

State Board of Education & Early Development
DRAFT Tentative Agenda
June 6, 2019
Anchorage School District Board Room
Address 5530 East Northern Lights Boulevard
Anchorage, AK 99504

Mission Statement: *An excellent education for every student every day.*

Board – Professional Development

June 6, 2019

10:00 AM

Call to Order James Fields, Chair

Pledge of Allegiance James Fields, Chair

10:15 AM

1. Board vision casting.....Dr. Michael Johnson, Commissioner
.....James Fields, Chair

11:00 AM

2. How to Travel well.....Dr. Michael Johnson, Commissioner
.....Karen Melin, Deputy Commissioner

11:30 AM

3. CTE Showcase Dr. Michael Johnson, Commissioner
..... Deb Riddle, Division Operations Manager

12:10 PM LUNCH

1:00 PM

4. Committee Meetings (Standards and Assessments, Tribal Compacting, Regulations, Funding Formula) Dr. Michael Johnson, Commissioner

4:15 PM BREAK

4:30 PM

5. Discussion of Proposed Legislation.....Dr. Michael Johnson, Commissioner
.....Brittany Hartmann, Chief of Staff

5:00 PM ADJOURN

State Board of Education & Early Development
DRAFT Tentative Agenda
June 7, 2019
Anchorage School District Board Room
Address 5530 East Northern Lights Boulevard
Anchorage, AK 99504

June 7, 2019

9:00 AM

Call to Order and Roll Call James Fields, Chair

Pledge of Allegiance James Fields, Chair

Adoption of Agenda for June 7, 2019.....James Fields, Chair

Disclosures of potential conflicts of interest.....James Fields, Chair

9:10 AM

Public Comment

Public comment is open on agenda and non-agenda items. Comment at this oral hearing is limited to three minutes per person and five minutes per group. The public comment period is an opportunity for the board to hear the public's concerns. The board will not engage in discussions with members of the public during the comment period.

Public comment can be made for this meeting, during this time only, by calling 1-844-586-9085 if you are outside of Juneau or Anchorage. For participation from Juneau, call 586-9085. For participation from Anchorage, call 563-9085. This meeting will be streamed through the Legislative Information Office over [AK Legislature TV](#) beginning at 9:00 am on June 7, 2019. Click on the meeting name to listen to the proceedings. When public comment is over, the meeting will continue to be broadcast at the above web site.

In the event there are more than two hours of public comment, the board may move to amend the agenda to extend the oral hearing to accommodate those present before 9:00 am who did not have an opportunity to comment. The board also reserves the right to adjourn at a later time.

Work Session

10:00 AM

1. Legislative Update Dr. Michael Johnson, Commissioner
.....Brittany Hartmann, Chief of Staff

10:15 AM

2. Budget Update Dr. Michael Johnson, Commissioner
.....Heidi Teshner, Director, Finance and Support Services

10:30 AM

3. Charter School Renewals
3A. Watershed Charter School Renewal Dr. Michael Johnson, Commissioner
.....Karen Melin, Deputy Commissioner
3B. Ayaprun Charter School Renewal Dr. Michael Johnson, Commissioner
.....Karen Melin, Deputy Commissioner

11:00 AM BREAK

11:15 AM

4. Mt. Edgecumbe High School Board Nominations Dr. Michael Johnson, Commissioner
.....Janelle Vanasse, Superintendent, Mt. Edgecumbe High School

11:30 AM

5. Adoption of Proposed Regulations Dr. Michael Johnson, Commissioner

5A. K-12 Science Standards.....Deb Riddle, Division Operations Manager
.....Susan Sonneborn, Assistant Attorney General

5B. Computer Science Standards.....Deb Riddle, Division Operations Manager
.....Susan Sonneborn, Assistant Attorney General

5C. Digital Literacy Standards.....Deb Riddle, Division Operations Manager
.....Susan Sonneborn, Assistant Attorney General

5D. AdvancED Standards.....Brad Billings, School Improvement Administrator
.....Susan Sonneborn, Assistant Attorney General

12:00 PM LUNCH

1:00 PM

6. State Board Of Education Committee Reports James Fields, Chair
 6A. Standards and Assessments Sally Stockhausen, Chair
 6B. Tribal Compacting Sandra Kowalski, Chair
 6C. Regulations Lorri Van Diest, Chair
 6D. Funding Formula Tiffany Scott, Chair

1:20 PM

7. NAEP Discussion from Member Bob Griffin James Fields, Chair
 Bob Griffin, SBOE Member

Business Meeting

1:30 PM

8. Adoption of Proposed Regulations Dr. Michael Johnson, Commissioner

 8A. K-12 Science Standards, Computer Science Standards, and Digital Literacy Standards
 Deb Riddle, Division Operations Manager
 Susan Sonneborn, Assistant Attorney General

 8B. AdvancED Standards Brad Billings, School Improvement Administrator
 Susan Sonneborn, Assistant Attorney General

1:45 PM

9. Charter School Renewal
 9A. Watershed Charter School Renewal Dr. Michael Johnson, Commissioner
 Karen Melin, Deputy Commissioner
 9B. Ayarun Charter School Renewal Dr. Michael Johnson, Commissioner
 Karen Melin, Deputy Commissioner

2:00 PM

10. Selection of Officers James Fields, Chair

2:15 PM

11. Subcommittee Appointments James Fields, Chair

2:30 PM

12. Selection of meeting dates, locations and topics James Fields, Chair

2:40 PM

13. Mt. Edgecumbe Advisory Board Appointments.....Dr. Michael Johnson, Commissioner
.....Janelle Vanasse, Superintendent

2:50 PM BREAK

3:00 PM

14. Questions Regarding Standing Reports James Fields, Chair

- 14A. Student Learning & Educator and School Excellence.....Tamara Van Wyhe, Director
- 14B. Mt. Edgecumbe High School Janelle Vanasse, Superintendent
- 14C. Libraries, Archives & Museums Patience Frederiksen, Director
- 14D. Attorney General Susan Sonneborn, Assistant Attorney General

3:15 PM

15. Commissioner's Report Dr. Michael Johnson, Commissioner

3:30 PM

16. Consent Agenda James Fields, Chair

- 16A. Approve the meeting minutes for the March 29, 2019 Board meeting
- 16B. Approve the meeting minutes for the April 24, 2019 Board work session

3:45 PM

17. Executive Session, Commissioner's Evaluation James Fields, Chair

4:45 PM

Board Comments

5:00 PM ADJOURN

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 1

◆ ISSUE

This is a standing report to the board regarding legislation.

◆ BACKGROUND

- The board will be briefed on current legislation for the 2019 legislative session that affects the department.
- Brittany Hartmann, Chief of Staff, will be present via teleconference to brief the board.

◆ OPTIONS

This is an information update. No action is required.

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 2

◆ ISSUE

This is a standing report to the board regarding the budget.

◆ BACKGROUND

- The board will be briefed on the status of the department's FY2020 operating and capital budgets, including any changes made to the budgets through the House and Senate Finance Subcommittees.
- Behind this cover memo are: 1) FY2020 Senate Finance Budget Subcommittee Narrative Report dated April 16, 2019.
- Heidi Teshner, Director of Finance and Support Services, will be present to brief the board.

◆ OPTIONS

This is an information update. No action is required.

ALASKA STATE SENATE

SENATOR LYMAN F. HOFFMAN
SENATE FINANCE SUB-COMMITTEE CHAIR

ALASKA STATE CAPITOL
ROOM 508
JUNEAU, ALASKA 99801-1182



MARIDON BOARIO, STAFF
(907)465-6887
FAX (907) 465-4523

SENATE FINANCE / DEPARTMENT OF EDUCATION & EARLY DEVELOPMENT

SUB-COMMITTEE MEMBERS: SENATOR STEVENS, SENATOR BIRCH, SENATOR BEGICH

NARRATIVE CLOSE-OUT REPORT

April 16, 2019

RECOMMENDATIONS:

The Senate Finance Subcommittee for the Department of Education & Early Development submits a recommended operating budget for FY2020 to the Senate Finance Committee as follows:

FUND SOURCE	FY19 Mgt Plan	FY20 Adj Base	FY20 House	FY20 Sen Sub	Chg-Adj Bs to Sen Over/(Under)
UGF	\$ 45,523.1	\$ 44,976.1	\$ 45,699.9	\$ 44,958.8	\$ (17.3)
DGF	26,091.2	26,091.2	25,058.9	24,997.3	(1,093.9)
Total GF	\$ 71,614.3	\$ 71,067.3	\$ 70,758.8	\$ 69,956.1	\$ (1,111.2)
Other	64,823.7	64,823.7	63,772.4	63,772.4	(1,051.3)
Federal	251,133.1	251,133.1	256,133.1	251,133.1	-
Total All Funds	\$ 387,571.1	\$ 387,024.1	\$ 390,664.3	\$ 384,861.6	\$ (2,162.5)

SALARY ADJUSTMENT FUND SOURCE - Informational Only

UGF	\$ 258.0
DGF	28.0
Total GF	\$ 286.0
Other	142.6
Federal	128.1
Total All Funds	\$ 556.7

POSITIONS

PFT	269
PPT	14
Temp	2

BUDGET ACTION:

The Senate Finance Budget Subcommittee for the Department of Education & Early Development held 3 meetings and analyzed all the Governor's budget transactions.

Following are budget highlights:

Governor's Amended Budget Request:

- Accepted the following items from the Governor's Amended Budget Request:
 - \$17.3 UGF decrement to the Special Education Service Agency Calculation
 - \$1,093.9 reduction for the School Broadband Access Grants
- The subcommittee did not accept the following decrements to the Governor's Amended Budget Requests:
 - \$1,200.0 UGF for Early Childhood Grants
 - \$6,853.0 UGF for Head Start Grants
 - \$474.7 UGF for Parents As Teachers
 - \$320.0 UGF for Best Beginnings
 - \$2,000.0 UGF for Pre-Kindergarten Grants
 - \$3,096.4 DGF for the WWAMI program
 - \$670.9 UGF for the OWL program
 - \$138.2 UGF for the Live Homework Help program
 - \$2,768.5 (all fund sources) to eliminate the Alaska State Council on the Arts
- Sub-Committee Additions, Reductions and Changes:
 - The subcommittee did not accept any of the Governor Amended Budget fund source changes
 - The subcommittee made a \$2,151.3 decrement to the amount of Public School Trust Fund appropriated for the Foundation Formula in order to accurately reflect the reduced amount available from the fund.
 - The subcommittee made a \$1,100.0 increment to Statutory Designated Program receipt authority for the Alaska State Council on the Arts so the council can accept additional private grant funding.

- Other Changes:
 - Salary Adjustment figures are informational only. Contracts are not finalized. The correct dollars will be added after close-out in the full Finance committee CS.

Organizational Changes

- There were no organizational changes.
- Intent Language
 - There was no intent language adopted.

The subcommittee recommends to continue full funding of the Base Student Allocation at five thousand nine hundred and thirty dollars.

ATTACHED REPORTS:

The Senate Finance Subcommittee for the Department of Education & Early Development adopts the attached reports:

- Agency Totals – FY2020 Operating Budget
- Transaction Comparison 1
- Transaction Comparison 2
- Transaction Comparison 3
- Wordage



Senator Lyman Hoffman, Chair

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Michael Johnson, Commissioner

Agenda Item: 3A

◆ **ISSUE**

The board is being asked to approve the Fairbanks North Star Borough School District's renewal application of Watershed Charter School for a period of ten years, terminating on July 1, 2029.

◆ **BACKGROUND**

- On January 15, 2019, the Fairbanks North Star Borough School District's Board of Education approved Watershed Charter School for a period of ten years.
- Behind this memo is an executive summary of the charter school application and the local board approval. DEED's review team found the application compliant with all state requirements.
- Karen Melin, Deputy Commissioner, will be present to brief the board.

◆ **OPTIONS**

This is a work session item. Action will take place under Agenda Item 9A.

Watershed Charter School – Renewal Application Summary

Fairbanks North Star Borough School District submitted the initial Watershed Charter School renewal application on February 12, 2019. The FNSBSD voted to approve the renewal application on January 15, 2019 for a period of 10 years (through the end of SY 2028-29). Watershed Charter School first opened for SY 2009-2010.

Watershed Charter School serves students in grades K-8. From SY2015-16 through SY2018-19 Watershed Charter school has had a total yearly enrollment ranging from 197 to 200 students. No students were waitlisted. Class sizes are capped at 22 students. The school is located at 4975 Decathlon Ave. Fairbanks, AK 99709. The building is 14,000 square feet and contains 9 classrooms, a SPED resource room, library, staff work room, multipurpose room, and offices. The space is leased from J&J Development, LLC. Watershed Charter School has an approved (estimated) budget of \$2,155,560 for SY2019-2020.

For the 2018-19 school year, Watershed Charter School had 21 staff. This included 9 teachers (K-8), a Special Education Teacher, Head Teacher, Counselor, 4 aides, 1 Library/Media/Study Hall staff, Custodian, and 2 Recess/Lunch Duty staff. Kindergarten students spend one year with a teacher, grades 1-6 use a looping model (2 years with the same teacher, then moving to the next “loop”), and grades 7-8 rotate between 2 teachers (Math/Science & ELA/Social Studies).

Watershed Charter School focuses on providing its students with a Place-Based Education, Outdoor Learning Experiences, increased Physical Activity, and thematically linking units across multiple content areas. In both 2017 and 2018, students at Watershed Charter School scored Proficient or Advanced (grades 3-8) at higher rates than both FNSBSD and the State of Alaska in ELA, Math, and Science (2017: 69.5%, 77.2%, 81% respectively; 2018: 73.9%, 70%, 84.1% respectively). In 2015, 69.3% of students “meet standards” in ELA and 66.9% “meet standards” on the AMP assessment (no 2016 results due to cancellation of AMP assessment).

Mission Statement of Watershed Charter School:

Watershed Charter School promotes the development of students with a strong sense of place who will be prepared to serve as stewards of their community. By gaining a working understanding of the history, government, people, places, and ecology of Alaska’s interior, students will be able to expand their competency to the rest of the world. We will teach each child with care, encouraging imaginative work and play, analytical and critical thinking skills, and a sense of social and ecological responsibility. At every opportunity, we will provide students with meaningful explorations and activities outside the classroom that will motivate the children towards academic excellence.

Goal of Watershed Charter School:

Watershed Charter School has made efforts to address school policies and goals including Improving Outreach and Increasing Accessibility, Improving APC Functionality, Fiscal Sustainability, Continued Review of Place-based and Outdoor Curriculum, and Academic Achievement as measured by Alaska Standardized Assessments.

Appendix A: FNSBSD Charter Approval

FAIRBANKS NORTH STAR BOROUGH SCHOOL DISTRICT BOARD OF EDUCATION

FAIRBANKS, ALASKA

Minutes of Board Action

The Fairbanks North Star Borough Board of Education took the following action at its January 15, 2019 Regular Meeting:

F. 1. Resolution 2019-15: Approving Watershed Charter School Renewal Application

Watershed Charter School has submitted a charter renewal application. The board held a work session with Watershed Charter School staff and district administration to review the charter school's renewal application on December 3, 2018. Resolution 2019-15: Approving Watershed Charter School Charter Renewal Application is now before the board for consideration.

Board Final Action:

MOVE TO APPROVE RESOLUTION 2019-15: APPROVING WATERSHED CHARTER SCHOOL CHARTER RENEWAL APPLICATION.

The above-listed action item passed unanimously by roll call vote with the following Board and Advisory Members present:

Board Member Votes:

7 AYES: Wendy Dominique, President
Timothy Doran, Vice President
Erin Morotti, Treasurer
Sharon McConnell, Clerk
Allyson Lambert, Member
Sean Rice, Member
Chrya Sanderson, Member

ABSENT FROM MEETING: None

Advisory Member Votes:

3 AYES: Colonel Chad BonDurant, Eielson Air Force Base Representative
Colonel Sean Fisher, Fort Wainwright Army Post Representative
Alden Jerome, Student Representative

ATTEST:


Sharon Tuttle
Executive Assistant to the Board of Education



FAIRBANKS NORTH STAR BOROUGH BOARD OF EDUCATION

RESOLUTION 2019-15:

APPROVING WATERSHED CHARTER SCHOOL RENEWAL APPLICATION

WHEREAS, the Fairbanks North Star Borough Board of Education believes charter schools provide an opportunity for innovation and diversity of educational services; and

WHEREAS, Watershed Charter School has worked with the Fairbanks North Star Borough School District during the past ten years to provide an educational option within the district; and

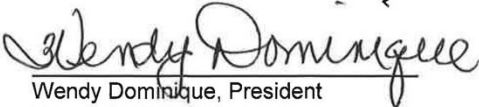
WHEREAS, the Fairbanks North Star Borough Board of Education supports the application of Watershed Charter School and finds the application meets the requirements of School Board Policy 935 and meets the application/renewal procedures developed by the school district;

NOW, THEREFORE, BE IT RESOLVED:

1. The Fairbanks North Star Borough Board of Education approves the Watershed Charter School Renewal Application and shall transmit that application to the State Board of Education with a recommendation for approval.
2. The school district will commit funding to the Watershed Charter School for 2019-2020 as follows:

Amounts generated by students enrolled using basic need calculation as provided by A.S. 14.17.410 (b) (1).

Passed and Approved: January 15, 2019


Wendy Dominique, President
Board of Education

ATTEST:


Sharon Tuttle
Executive Assistant to the Board of Education



Appendix B: Letter of Commitment and Charter Contract with FNSBSD



FAIRBANKS NORTH STAR BOROUGH SCHOOL DISTRICT

520 Fifth Avenue Fairbanks, Alaska 99701-4756 (907) 452-2000

www.k12northstar.org



February 12, 2019

Department of Education & Early Development
Attention: Charter School Program Manager
PO Box 110500
Juneau, Alaska 99811-0500

To Whom It May Concern:

Please be advised that the Fairbanks North Star Borough School District Board of Education has approved the renewal application for Watershed Charter School. The contract between the School District and the Charter School will commence upon approval of said renewal application by the Alaska State Board of Education.

Please feel free to contact my office if you have questions or require additional information.

Best Regards,

A handwritten signature in black ink, appearing to read "Andreau DeGraw".

Andreau DeGraw, Chief Operations Officer
Fairbanks North Star Borough School District

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Michael Johnson, Commissioner

Agenda Item: 3B

◆ **ISSUE**

The board is being asked to approve the Lower Kuskokwim School District's renewal application of Ayaprun Elitnaurvik for a period of ten years, terminating on July 1, 2029.

◆ **BACKGROUND**

- On January 24, 2019, the Lower Kuskokwim School District's Board of Education approved Ayaprun Elitnaurvik for a period of ten years.
- Behind this memo is an executive summary of the charter school application and the local board approval. DEED's review team found the application compliant with all state requirements.
- Karen Melin, Deputy Commissioner, will be present to brief the board.

◆ **OPTIONS**

This is a work session item. Action will take place under Agenda Item 9B.

Ayaprun Elitnaurvik – Renewal Application Summary

Lower Kuskokwim School District submitted the initial Ayaprun Elitnaurvik renewal application on February 22, 2019. The LKSD school board voted to approve the renewal application on January 24, 2019 for a period of 10 years (terminates June 30, 2029). Ayaprun Elitnaurvik first opened in 1999.

Ayaprun Elitnaurvik enrolls a minimum of 150 students and teacher to student ration of 1:20 (or less). In 2018-19, the school served 172 students with a waitlist of five (all grade K). The school serves students in grades K-6 with 12 instructional staff and a principal. Ayaprun Elitnaurvik is currently (temporarily – due to fire at original location) located in Bethel, AK at the intersection of Chief Eddie Hoffman Hwy and Old Hospital Rd. The current facility includes 50,700 square feet of space. Ayaprun Elitnaurvik has an FY19 operating budget of \$519,656.92.

Ayaprun Elitnaurvik is a Yugtun (Yup'ik) Immersion School with grades K-2 using Yugtun as the primary language of instruction, 75% Yugtun instruction in grade 3, and 50% Yugtun instruction in grades 4-6. In 2018, Ayaprun Elitnaurvik compared favorably to the district as whole on the PEAKS ELA assessment with 13.16% of students scoring Proficient or better (district: 7.59%), but compared less favorably to the State average (42.36%). This comparison held true with the Math assessment (Ayaprun: 23.68%, LKSD: 8.99%, State: 36.61%) and Science assessment (Ayaprun: 20%, LKSD: 13.75%, State: 47.15%). These numbers show considerable gains over the 2017 results.

Mission Statement of Ayaprun Elitnaurvik:

We, the community of Ayaprun Elitnaurvik, will strive to provide a high quality Yugtun immersion education: empowering our diverse students by strengthening their knowledge, use, and understanding of Yup'ik core values, language, and culture.

Goals of Ayaprun Elitnaurvik: To provide the benefits of proficiency in Yup'ik language and understanding of Yup'ik culture.

- To achieve academic growth and mastery of the regular subject area curricula.
- To provide students with communicative competence in speaking, reading, and writing in Yugtun as well as English, appropriate to their level of language development.
- To enable students to have expanded educational and career opportunities.
- To foster in students high levels of motivation, achievement, self-confidence and mutual respect.
 - To help preserve the Yugtun language

Information: B. M.E. School Report

Jazzmin LaValle, School Site Administrator presented the M.E. School report and answered questions of the board.

Information: C. Kuskokwim Learning Academy School Report

Walt Betz, Site Administrator, presented the KLA School Report and answered questions of the board.

Information: D. TAI / Media Center Report

Daryl Daugaard, Director, presented the TAI / Media Center Report and answered questions of the board.

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**Recessed at 6:44 PM and reconvened at 7:12 PM.**  
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Information: E. MOAs

The Administration presented the MOA report and answered questions of the board.

Information: F. Complaint Procedures

Carlton Kuhns, Assistant Superintendent presented the Complaint Procedures and answered questions of the board.

Information: G. Superintendent's Report

Daniel Walker, Superintendent, presented the Superintendent's report and answered questions of the board.

8. CONSENT AGENDA

Action (Consent): A. Personnel Actions

Moved to Approve Consent agenda as presented

Motion by John Mark, second by Michael D Husa.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action (Consent): B. Permission to Receive Grants and Funds

Moved to Approve Consent agenda as presented

Motion by John Mark, second by Michael D Husa.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action (Consent): C. Budget Revisions

Moved to Approve Consent agenda as presented

Motion by John Mark, second by Michael D Husa.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action (Consent): D. Vote on Consent Agenda

Resolution: Moved to Approve Consent agenda as presented

Moved to Approve Consent agenda as presented

Motion by John Mark, second by Michael D Husa.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

9. ACTION ITEMS

Action: A. MOA: iTutor for GEAR UP Grant

Move to enter into an MOA with iTutor to provide virtual tutoring services on a 1:3 teacher-to-student ratio in the amount not to exceed \$124,749.00 from January 2019 through December 2019.

Motion by Thor Williams, second by John Mark.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action: B. MOA: Yuut Elitnaurviat - KLA Student Lunch Program

Move to enter into an MOA with Yuut Elitnaurviat to provide lunch meals for KLA students at \$9.15/meal for lunch and \$1.70/meal for a salad bar, in an amount not to exceed \$76,275.50 from February 4, 2019 to May 31, 2019.

Motion by Deanna Latham, second by Richard L Long.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action: C. MOA: Yuut Elitnaurviat - Ready & KLA Dorm Meals

Move to enter into an MOA with Yuut Elitnaurviat to provide dinner meals for dorm students, daily snack service, and all weekend meals for dorm students in the READY and KLA programs for the second semester in an amount not to exceed \$98,347.50 from February 2, 2019 to May 31, 2019.

Motion by Deanna Latham, second by Thor Williams.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action: D. Consultant Award for Eek K-12 School Renovation/Addition Project

Move to award the GR-19-002 Eek K-12 School Renovation/Addition Project contract to BDS Architects for the professional design services in an amount not to exceed \$2,208,358.

Motion by Thor Williams, second by John Mark.

Final Resolution: Motion Carries

Yea: Wassilie Pleasant, Deanna Latham, Clarence Daniel, John Mark, Thor Williams, Felix Albert, Michael D Husa, Richard L Long, Bessie Weston

Action: E. Ayaprun Elitnaurvik Charter Renewal

Move to approve the Ayaprun Elitnaurvik Charter School renewal contract.

Motion by John Mark, second by Wassilie Pleasant.

Final Resolution: Motion Carries

**To: Members of the State Board of
Education and Early Development**

Date: June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 4

◆ ISSUE

The board is being asked to appoint two members to the Mt. Edgecumbe High School Advisory Board.

◆ BACKGROUND

- Mt. Edgecumbe High School has a cycle that opens two Advisory Board seats each year. This year, the Sitka Community Representative and a Parent Representative were open. Mt. Edgecumbe High School collected applications of interest and have made a recommendation for appointment.
- Mt. Edgecumbe High School received many qualified applications for the position of Parent Representative. The Mt. Edgecumbe Superintendent and administrative team has put forth the recommendation to appoint Janet Woods. Formally from the Yukon Flats School District, Janet not only has a background in education but also has served on many boards in the past. As stated in her application, she would like to be an active member on the board and she references her experience in providing board direction through planning, goal setting and evaluating progress toward achieving goals. Being from rural Interior, Janet Woods is from a region not currently represented on the board and her interest and skills in board planning will be welcome as Mt. Edgecumbe begins a new strategic planning cycle next year.
- Lois Rhodes has served on the Mt. Edgecumbe Advisory Board as the Sitka Community representative for many years. She was the only candidate, which is likely a result of the confidence the community has in her serving this role. She brings much appreciated insight and actively participates on subcommittees as needed. The Mt. Edgecumbe Superintendent and administrative team happily recommend her for continued service on the board.
- Behind this cover memo are the applications received by the Mt. Edgecumbe High School.
- Janelle Vanasse, Superintendent, will be present via teleconference to brief the board.

◆ OPTIONS

This is a work session item. Action will take place under Agenda Item 13.

Parent Representative:

Mt Edgecumbe High School (MEHS) received many qualified applications for the position of Parent Representative for the Advisory Board. After careful consideration, I would like to put forth the applicant Janet Woods. Formally from the Yukon Flats School District. She comes to us with not only a back ground in education, but has also served on other boards over the years. As she stated in her application, she would like to be a part of the board. That provides direction through planning, goal setting, and to be able to evaluate progress toward achieving goals. Academic school year 2019-2020 MEHS will be starting their new cycle Strategic Planning renewal, it is felt these are tools needed as we move forward with our Strategic Planning renewal and in the next three years of MEHS growth.

Community Representative:

Although MEHS did community wide announcement of the opening for Community Representative, Lois Rhodes currently serving on the board in this capacity was the only one to respond to the announcement. Ms. Rhodes has served in this role for more than one three year term. She has brought to the board much insight and has served on various subcommittees as needed. It is clear the community of Sitka is very happy with their representation of Ms. Rhodes by the fact no one else stepped forward and applied.

Lois Rhodes

Community Representative

Ms. Rhodes is from Petersburg, but has spent the last 48 years in Sitka. She has taught at MEHS for 20 years, with 8 of those years during its administration under the BIA. She believes that, by serving on the MEHS Advisory Board in the past, she possesses insight into the school that most community members of Sitka do not have. It has also given her an educational vision for the years to come. She wants to see it grow and continue being known as one of the best schools in the state. She believes MEHS provides an educational system that most rural school cannot, as well as a stable environment for student to live and learn.

Though she retired from MEHS, she did not leave education behind, as she became an Adjunct Assistant Professor from 1997 to 2008, in this time she was a coordinator/supervisor of the Sitka MAT program. This enabled her to be in both Sitka School District and MEHS classrooms.

Ms. Rhodes received her Bachelors in Elementary Education and a Masters in Library and Information Studies.

Since retiring in 2008 she has served on such boards as the MEHS Advisory Board, Sitka Community Hospital, Sitka Babies and Books (Treasurer), Sitka Cemetery Association (Vice President), and Sitka Lutheran Church Council member.

March 27, 2019

Ms. September Horton
Mt. Edgecumbe High School
1330 Seward Avenue
Sitka, Alaska 99835

Dear Ms. Horton,

I would like to apply for the Sitka Community Representative Position on the Mt. Edgecumbe High School Board. Enclosed is the completed Advisory Board application.

If you have any additional questions or need to talk with me, I can be reached at (907) 623-7271.

Thank you for your consideration of my application.

Sincerely,



Lois A. Rhodes
710 Lake Street
Sitka, AK 99835
lrhodes@gci.net

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

- ☐ **Parent Representative**
☒ **Community Representative**

Applicant's Name: _Lois A. Rhodes

What prompted you to consider applying for the vacant MEHS Advisory seat?

I have a long-time interest and attachment to MEHS having taught at MEHS for 20 years (8 years when it was a BIA school and 12 years as a State school). I feel I have valuable insight and understanding of MEHS and will use my experience and expertise for the good of the school. My experience of being on the board for 15 years should be useful, and I would like to work to see MEHS continue to be one of the best high schools in Alaska.

Are you or have ever been, directly associated with MEHS, if so what capacity?

Yes. I taught Developmental Reading at MEHS for 8 years when it was a BIA school. During this time, I also served as the coordinator for the Title I program. When MEHS re-opened in 1985, I was hired as half- time remedial math teacher and half- time librarian. After getting my Masters in Library Science at the request of teachers and administration, I became a full-time librarian. After retiring from MEHS, I worked part -time for UAS where I coordinated and supervised the MAT Program in Sitka. I had interns in schools throughout Sitka, so I was in classrooms in MEHS and Sitka High School several times a week.

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

MEHS plays an important role in the education of rural students, as it not only provides an educational system for students who don't have schools in their areas, but it also provides them with a stable alternative form of education and gives them educational opportunities not available in their villages. One only needs to look around the State and see all the leaders that attended or graduated from MEHS to see its importance.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

I have developed an understanding and appreciation for Alaska's students through my 20 years of teaching, 11 years of guiding MAT students to become great teachers, and 15 years serving on the MEHS Advisory Board. My interest in former students and extended family does not end at graduation, for I keep in contact with many students and share in their joys and sorrows. I am well known and respected throughout the State and was awarded the Alaska Association of School Librarians State Library of the Year Award while I was employed at MEHS. I also received the Soroptimist International Woman of Distinction Award for providing Outstanding volunteer Services to the community of Sitka. I was born and raised in Petersburg, Alaska, and have lived in Sitka for 48 years, so I feel I have a great appreciation for Alaska and its people. I am actively involved in community projects in Sitka and serve on several boards. I feel it is important to give something back to the community in which one lives.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

I have developed a genuine interest in MEHS and its success. I am a very positive person and will be looking out for the good of the school. Having served for 15 years on the Advisory Board, I feel I have grown in understanding the responsibility of my position on the Board and can add insight and expertise in a constructive manner. I keep in contact with my former students; my relationship doesn't end when they graduate. I had several former MEHS students in my MAT program. I have a positive relationship with the administration and faculty at MEHS both as a past employee, as the MAT supervisor/coordinator and as an MEHS Advisory Board member. My 20 years of teaching at MEHS along with my experience on the Advisory Board has given me a great deal of insight into the goals and visions of the school.

What other boards, commissions, etc. have you been appointed to? Are you currently active on any boards, commissions, CT.?

Inactive: Sitka Community Hospital Board
Active: Hospital Foundation-member
Sitka Babies and Books-Treasurer
Sitka Cemetery Association-Vice President
MEHS Advisory Board-member
Sitka Lutheran Church Council-member

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

Education:
Masters: Library and Information Studies
BA: Elementary Education

Credentials
State of Alaska Type A Elementary Ed-State of Alaska
Library-State of Alaska
State of California General Elementary Life Credential

Presently retired.

Last employment: University of Alaska Southeast; Adjunct Assistant Professor 1997-2008
Coordinator/Supervisor
Sitka MAT Program 2008

Mt. Edgecumbe High School	Teacher/Librarian	1985-1997

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

I am retired and have time to devote to this board.
I really care for these students that attend MEHS and for the MEHS tradition.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Hal Spackman_____ **Phone Number** (907) 738 3766

Name: Matt Hunter_____ **Phone Number** (907) 738 6851

Name: Valerie Nelson_____ **Phone Number** (907) 738 0027

Signature: Louis A. Rhodes

Date: 3/27/19

Janet Woods

Parent Representative

Janet Woods comes to us from Fairbanks/Rampart, and currently has a son, Quentin Woods, attending, as well as a daughter that graduated in May of 2014. As a board member, she wants to make sure we provide direction through planning, goal setting, and evaluating progress toward achieving the goals. She wants to ensure a clear, focused, attainable, and measurable progress for each student. Ms. Woods has always felt that MEHS is a fundamental step each student must successfully climb to ensure them to become responsible adults, and to further their education. Believing MEHS has an excellent education program due to its staff and faculty.

Ms. Woods brings to the board her experience in the classroom as a special ed. aid and teacher aid, working in the Yukon Flat School District. She believes in coming up with suggestions and problem solving ideas, as well as asking the tough questions and doing the research to make sure that her vote is an educated vote.

She has served on the Board of Fish Commission and as a Commissioner for the Interior Regional Housing Authority. She is 60 credits away from a BA in Rural Development. She has worked 11 years for the Yukon Flat School District, and for the last 19 years has worked for the Alyeska Pipeline Service Company as an office manager.

Mt. Edgecumbe High School
1330 Seward Ave
Sitka, Alaska 99835

March 20, 2019

Advisory Board Letter of Interest

To Whom It May Concern,

My name is Janet L Woods, from Fairbanks/Rampart and I am pleased to submit my application of interest for the School Advisory Board for Mt Edgecumbe High School.

Being a member of the School Advisory Board provides me with unique opportunity to:

- Contribute to the success of the school
- Make a positive impact as an Advisory Board Member
- Expand and broaden my network and to meet people and parents with similar interest for the betterment of Mt. Edgecumbe High School and students
- Focus on concerns and values that best support student achievement

As an Advisory Board member, I will keep in mind the big picture of the school, address issues of concern and possibly help develop strategies to address any concerns for issues if necessary. It is important to be able to voice at the local level and to provide input for the best interest of our students at Mt. Edgecumbe.

Mt. Edgecumbe is a wonderful school and needs the support and input of people and parents with my expertise, experience and insight.

Thank you for taking the time to read my letter of interest and reviewing my application. I am available to discuss any questions you may have. You can reach me at 907-322-1909 or email at: janetwoos03@gmail.com.

Sincerely,



Janet L Woods
5101 Electra Ave
Fairbanks, Alaska 99709

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

- ☒ **Parent Representative**
☐ **Community Representative**

Applicant's Name: Janet L Woods

What prompted you to consider applying for the vacant MEHS Advisory seat?

I have always been interested in this position. When my daughter Brittany Woods-Orrison was going to school at Mt. Edgecumbe I was interested at the time and did fill out an application of interest. Now that my son is now a student I am again submitting my application of interest as a parent.

Are you or have ever been, directly associated with MEHS, if so what capacity?

Not directly but indirectly as a parent of Quentin Woods a student of MEHS

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

As a Board Member I want to make sure we provide direction through planning and goal setting and able to evaluate progress toward achieving the goals. Make sure a clear, and focused, and attainable measurable progress for the outcomes of each student, and gains are achieved and are being made and met to insure their success.

I always felt that Mt Edgecumbe was a stepping stone or ladder each student successfully climbed that would insure them to become responsible adults, to further their education and not be a burden of the State of Alaska with social issues.

I believe Mt Edgecumbe has an excellent education program and students can be successful because of the educational staff! The staff also insure that each student is successful. I also believe the students must make the effort too and become responsible for their own education.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

I was currently involved in ESSA meeting in the Yukon Koyukuk School District for Manley school. I was involved in setting goals and brain storming to make sure the district was accomplishing in attaining measurable goals set for the success of each student.

I am passionate that each of our students are successful. I worked in the Yukon Flat School District for 11 ½ years as a Special ED Aid and Teacher Aid and was responsible for office duties and meeting all State required deadlines.

Board member for other small village boards and corporations so I understand the process and what it takes to be successful.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

With my experience in the classroom and sitting in school board room with other educators discussing education, coming up with suggestions and problem solving. What can we do better or what works when it comes to the educations of our students? I also have a voice and not afraid to speak-up and step-up to ask the tough questions. I am passionate about educations and able to use my voice for the disadvantage when I see fit to do so.

I can use two-way communicate to build trust and support for our board, superintendent, staff and students if necessary.

What other boards, commissions, ect., have you been appointed to? Are you currently active on any boards, commissions, ect.?

I was appointed to the Board of Fish commission during Sarah Palin's governorship. Currently not sitting on any boards or commissions.

Was a Commissioner for Interior Regional Housing Authority a nonprofit housing for Interior Villages for Alaskan Native and American Indians!

Education and Employment History: Please list your highest level of education and any professional certifications you may have eared, and recent employment history.

High School Education and less than 60 credits away from a BA in Rural Development.
11 ½ years working in Rampart for Yukon Flat School District
Currently 19 years & 3 months with Alyeska Pipeline Service Company as an office manager

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

It's always an undertaking when you put yourself out there to be a servant, but also my passion for children. I am accountable for myself, my job and my children I have at home. I will provide leadership. I am fair, and respectful to everyone's opinion. I will speak with one voice after reaching a decision. I am a hard worker on every board that I sat on and take it seriously. I will follow established procedures and policies, including the chain of command. I lead by example.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Georgianna Lincoln

Phone Number: ©907-317-3358

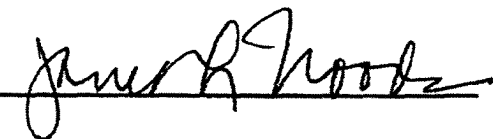
Name: Linda Evans

Phone Number: © 907-687-0135 (H) 907-358-31.

Name: Toni Mallott

Phone Number: © 907-321-2022

Signature:



Date:

3/20/19

Deana Bean-Heckman

Parent Representative

Deana Bean-Heckman comes to us from St. Mary's, and has a son, Arthur Heckman the III, who is a sophomore at MEHS. She herself is a 2000 graduate of MEHS. She decided to send her son to MEHS because of the diversity of students attending, as well as the school's reputation for excellence in learning, and the teachers the delivery that education. Deana believes MEHS has inspired and empowered her, and believes the school will do the same for her son.

She believes that a strong Advisory Board would enhance our knowledge of the needs of both students and families, and would better utilize the support that can be provided by a student's given community.

By being a graduate of 2000, and currently having a student at MEHS, she has an opportunity to bring a younger vision for the board and to keep up with current affairs affecting students today.

Ms. Dean-Heckman has received two bachelors degrees- one psychology and the other in education. She has earned a masters in counseling/psychology, and has licensing in social work. She is currently working as a behavioral health clinician for Yukon Kuskokwim Heath Corporation.

March 12, 2019

Deanna Bean-Heckman, MSCP, MSW

Behavioral Health Clinician

Yukon Kuskokwim Health Corporation

PO BOX 348

St. Mary's, Alaska 99658

907-444-5597

Dear Mr. /Ms.

I would like to take this opportunity to declare my interest in serving in the MEHS advisory board as a parent representative.

My name is Deanna Beans-Heckman graduate of MEHS in 2000. I graduated with honors, high GPA and served on the Nation Honors Society for 3 years as well as Future Teachers of Alaska committee for 3 years. I am currently a Behavioral Health Clinician for the Yukon Kuskokwim Health Corporation.

I am a graduate of Alaska Pacific University where I received my 3 degrees, 2 Bachelor's degrees in Psychology and Elementary Education and Masters in Counseling Psychology/Social Work where I also hold my MSW license.

I currently have a son Arthur Heckman III who is a sophomore at MEHS. Overall MEHS has been a great experience for my son and he is flourishing in ways I could never imagine for him, his horizons are brighter than ever. My son is receiving a superior education at MEHS and I would like to be a part of his positive education experience not only as a parent but as a parent representative for MEHS.

Thank you for your time,

Deanna Beans-Heckman

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

- ☒ **Parent Representative**
☐ **Community Representative**

Applicant's Name: Deanna Beans-Heckman _____

What prompted you to consider applying for the vacant MEHS Advisory seat?

I am a graduate of MEHS class of 2000 I held positions such as class president, was a part of NHS for 3 years. My son is a sophomore at MEHS currently.

Are you or have ever been, directly associated with MEHS, if so what capacity?

Yes graduate of 2000

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

MEHS is known for its diversity of children from all over Alaska and known for its excellence in teaching and learning. MEHS needs leaders not managers and I believe that MEHS does a very good job in that aspect. The teachers I have had at MEHS inspired, empowered, guided by a living breathing vision which developed and shaped who I am today and I would love to be apart of the larger picture.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

A strong advisory board always begins by developing shared personal and professional visions for the development of children and their families allowing to send their children to MEHS. I believe if given the opportunity together as a board we would be able to bring our capacities to the table to help increase the knowledge of students and families need's and utilize the communities resources to support the needs of the students of MEHS.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

I believe that giving the opportunity to develop a younger vision for the board to keep up with the hip modern new age.

What other boards, commissions, ect., have you been appointed to? Are you currently active on any boards, commissions, ect.?

Not apart of any boards.

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

I have 2 bachelors degrees in Psychology and Education, received a Masters in Counseling Psychology and have a license in Social Work.

I was on the National Deans list for 4 years in college.

I am currently a Behavioral Health Clinician for Yukon Kuskokwim Health Corporation.

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Veronia Babich

Phone Number: 907-438-3500

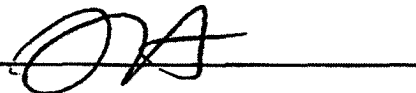
Name: Tasha Redfox

Phone Number: 907-591-6042

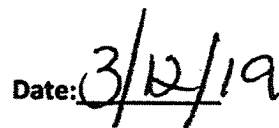
Name: Father Stanley Heckman

Phone Number: 907-543-6100

Signature:

A handwritten signature in black ink, appearing to be 'OA', written over a horizontal line.

Date:

A handwritten date '3/12/19' in black ink, written over a horizontal line.

Barbara Miranda

Parent Representative

Barbara Miranda has recently moved from Gustavus to Juneau, and is the mother of Cosley Bruno, a freshman at MEHS. Her strongest reason for sending her daughter to MEHS is the school's ability to provide a comprehensive education to students otherwise isolated in rural communities. She believes students here are provided a quality education while still honoring the cultural diversity. And though she just moved to Juneau, she truly understands the rural communities and their struggles as it fits in to where our students come from and how best MEHS can serve their needs, both educational and residential.

Ms. Miranda, has been involved with her child's education since preschool and wants to be able to continue. All through her career she has had to collaborative, and strategically work with teams to seek effective and creative solutions.

Ms. Miranda has served on such boards as the Midpines Community Advisory Committee from 2000 to 2002. She was also the president, treasurer and founder of Gustavus Community Preschool from 2006 to 2009, and the Mayor of Gustavus from 2017-2018.

Ms. Miranda has a Bachelor of Science in Forest Management and a Master in Public Administration. She is currently working as legislative specialist for the US Census Bureau.

Barbara Miranda
225 St. Anns Ave
Douglas, AK 99824
907.465-7485

March 28, 2019

Janelle Vanasse, Superintendent
Mt. Edgecumbe High School
1330 Seward Ave
Sitka, AK 99835

Dear Ms. Vanasse,

I am writing to express my interest in the position of Parent Representative on the Mt. Edgecumbe High School Advisory Council. I have a passion for being involved in community education, as demonstrated by role as founder, President and Treasurer of the Gustavus Community Preschool and my service on the Gustavus Advisory School Board. My recent move to Juneau and my federal position as a partnership and legislative specialist and my former role as the Mayor of Gustavus has already resulted in established quality working relationships with many of the legislators and staff in our state capital. I particularly enjoy working collaboratively and strategically with teams to seek effective and creative solutions to issues and problems. If selected, I would be honored to serve Mt. Edgecumbe High School.

Thank you for your consideration,

/s/ Barbara Miranda

Barbara Miranda

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

- ☒ **Parent Representative**
- ☐ **Community Representative**

Applicant's Name: Barbara Miranda

What prompted you to consider applying for the vacant MEHS Advisory seat?

I have always been an active community member and have been a member of the Advisory School Board in Gustavus, AK as well as President and Treasurer of the Gustavus Community Preschool. Now that my daughter attends Mt. Edgecumbe High School, I feel serving on the Advisory Board will allow me to continue to serve my child's educational institution as well as advocate for students and families across the state of Alaska.

Are you or have ever been, directly associated with MEHS, if so what capacity?

I am currently working with Social Studies Teacher Paul Fitzgibbon on 2020 Census Outreach Activities as part of my job as Partnership and Legislative Specialist for the US Census Bureau.

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

Alaska is geographically vast and culturally diverse. In order to serve the rural communities and allow equitable opportunities for students living in areas where high school education cannot adequately serve all student's needs, a residential boarding school like Mt. Edgecumbe High School is a vital component of an state-wide, K-12 education strategy.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

As a federal employee, serving in a state-wide outreach position as a Partnership and Legislative Specialist, I have an extensive network of contacts across the state in local and tribal governments, state government and federal offices. I am able to nimbly separate my official duties from my volunteer duties (so many Alaskans wear multiple hats!) and so think I can utilize this network to effectively benefit Mt. Edgecumbe High school when needed.

I'm also a proficient public speaker, and if given a task, I can be relied upon to complete it.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

My desire to be involved in Mt. Edgecumbe High School and make a positive difference in the school's ability to deliver high quality programs and education not just my child, but for children across this great state makes me a strong candidate. My recent move to Juneau and connections established via my current position as a congressional and legislative specialist for the US Census Bureau, affords me access to state representatives for advocacy efforts to benefit education funding and programs across the state, and specifically for Mt. Edgecumbe High School.

What other boards, commissions, etc., have you been appointed to? Are you currently active on any boards, commissions, etc.?

If referring to state boards or commissions, the answer is none.

I have served on the Midpines Community Advisory Committee 2000-2002

President and Treasurer and founder of Gustavus Community Preschool (2006-2009)

Gustavus Public School Advisory School Board (2010-2012)
Served as Gustavus City Council Member (January – June 2017)
Served as Gustavus Mayor (June 2017 – October 2018)

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

Masters in Public Administration – University of Alaska SE 2018
Bachelor of Science in Forest Management – Colorado State University 1991

Resume attached.

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

I would strongly encourage you to consider parent applicants from rural Alaska, as I recognize that my recent move to Juneau may not make me the best representative of families in our far-flung state. However, I am very interested in serving if asked.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Senator Jesse Kiehl Phone Number: 907-465-4947

Name: Mayor Calvin Casipit, City of Gustavus Phone Number: 907-697-2451

Name: Council Member Susan Warner Phone Number: 907-750-7846

Signature: /s/ *Barbara Miranda*

Date: March 28, 2019

BARBARA MIRANDA

P.O. Box 67, Gustavus, AK 99826 ✦ 907.465.7485 ✦ barbmmiranda@gmail.com

Innovative and results driven career professional who is entrepreneurial minded and has a successful background in Public Service, Partnership Development, and Grants and Agreements. Currently serve as Partnership and Legislative Specialist for the US Census Bureau.

Significant Skills and Abilities Include:

- Deep and rich knowledge of partnership and rural economic development; able to work collaboratively to enhance the resilience and sustainability of local governments and economies.
- Proven team leader, trainer, and facilitator; particularly excel in guiding interdisciplinary teams through a variety of planning and collaborative processes.
- Broad based background in natural resource management and planning, environmental compliance, development of educational programs, community organizing, partnership building, and communications (written and verbal).
- Strategic minded and multi-task oriented; readily embraces challenges and quickly resolves problems to meet all program/project specifications, timelines, and budgets.

Core Competencies

Program & Project Management – Human Resources – Strategic Planning – Community Liaison
Data Analysis – Event Planning & Management – Public Speaking – Written & Verbal Communications
Training & Instruction – Budget Administration – Financial Management – Consulting & Advising
Internal/External Customer Relations – Vendor Relations – Team Building & Leading
Staff Training & Development – Reviewing & Assessing – Tracking & Monitoring
Recording & Reporting – Grants and Agreements – Follow-Up & Problem Solving

Professional Experience

City of Gustavus – Mayor and City Council Member (2/2017-Present) **Municipal Government**

Serve as Chief Executive and Chief Administrative Officer for the city; administer and maintain state statutes, city laws, and ordinances. Plan and coordinate city functions; formulate annual operating and capital improvement budgets, and city's fiscal/budgeting processes. Record data; generate various management reports. Serve as city's personnel officer and administer a wide array of Human Resources functions, as well as oversee administrative, public service, maintenance, marine facility, and fire services. Communicate with city attorney on legal matters. Develop contracts and oversee contractual services. Uphold operational policies and procedures. Spearhead negotiations and planning with the State of Alaska, the Nature Conservancy, and adjacent private property owners to manage and develop high use beach tracts adjacent to the state ferry dock and city's marine facility.

- Work with neighboring communities on access and regional development interests.

- Successfully interact and negotiate with the State Regulatory Commission, the city's utility company, and four other Alaska cities to ensure electrical rates remain affordable for Gustavus citizens.
- Represent the city in pre-contract negotiations for the design and construction of a \$3M dollar electrical intertie between the National Park Service and the city's utility company that will result in effective use of the city's excess hydroelectric capacity and further reduction in electrical rates.
- Initiated dialogue between the Alaska State Troopers, the National Park Service, and the City of Gustavus to review the statewide mutual aid agreement and its applicability to law enforcement needs in Gustavus.
- Selected to be depicted in the Power in Place Project that is a web-based project highlighting portraits of women in politics, www.powerinplace.com.

Glacier Bay National Park & Preserve – Planner and Wilderness Coordinator (8/2010-12/2015)

National Park Service

Served as technical and policy advisor to senior management for recreation and environmental planning efforts at Glacier Bay National Park. Identified and evaluated trends that impacted park resources and visitor experience. Developed plans and strategies for park development, management, and operations. Compiled and analyzed census data and monitored for recreation impacts on Glacier Bay's shorelines. Participated in environmental compliance planning and contributed to commercial services documents and other matters as warranted. Stayed abreast of judicial, political, and stakeholder concerns that could affect park management and strategic planning.

BARBARA MIRANDA ~ PAGE TWO

- Created foundation for the park to embark on a Wilderness Stewardship Planning process that involved crafting a narrative, selecting indicators/measures, and finalizing a map of installations for cumulative impact assessments.
- Established strategy that allows off-vessel activities from tour vessels for improved service offerings.
- Served as Acting Alaska Region Wilderness Coordinator from October 2012-February 2013.
- Served on the Alaska Region Backcountry and Wilderness Advisory Group, a formal internal advisory group that makes planning and policy recommendations to the NPS Alaska Leadership Council.
- Chaired Glacier Bay National Park's Wilderness Science Team, an interdivisional group that evaluates all park research proposals.

Yosemite National Park – Interagency Wilderness Outreach Program Coordinator (11/1995-3/2006)

National Park Service

Developed, implemented, evaluated, and raised funds for targeted outreach programs. Met annually with Forest Supervisors, Park Superintendents, and BLM Area Supervisors to align programs and objectives with management priorities. Wrote outreach plans, journal articles, news releases, curriculum, newsletters, brochures, and other informative materials that educated the public on the many values of our wild lands and publicize/promoted the Wilderness Education Project programs. Drafted formal agreements with partner organizations and prepared annual reports of program and funding activities. Delivered numerous presentations and communicated with diverse user groups on the latest developments in wilderness management and science. Facilitated diversity outreach partnerships and supported website and video production. Produced several training videos for staff and volunteers. Supervised outreach staff and interns.

- Recipient of the Arthur Carhart National Wilderness Training Center Trapper's Lake Award in 2006.
- Selected as a Forest Service delegate to the 2001 World Wilderness Congress in South Africa.
- Received the USDA Forest Service National Wilderness Education and Leadership Award in 2002.
- Selected Speaker at numerous conferences and industry presentations.
- Recipient of National Outdoor Leadership School's Land Manager Stewardship Award, 1996.

EARLY ROLES as Administrator, Gustavus Visitors Association; Wilderness Program Coordinator, Washington Wilderness Coalition; Lead Wilderness Guard, Mt. Baker Snoqualmie National Forest; Public Relations Assistant, National Park Hochharz, Germany; Winter Ranger, Stanislaus National Forest; Forestry Technician, Stanislaus National Forest; and Forestry Technician, Sequoia National Forest and Bighorn National Forest.

Business Experience

Sunnyside Market, LLC, Gustavus, Alaska – Founder and Owner (1/2008-Present)

Health/Convenience Food Store and Deli

Supervise staff of 11 and provide operational oversight for optimal client relations and food service standards. Handle all business financials and accounting functions. Negotiate with vendors for cost-effective agreements on goods and services; manage supply logistics for shipments from vendors in lower 48 states to Alaska.

- Established and expanded a successful health food store and deli in rural Alaska; maintained cash flow, income, and distribution of goods since inception.

Education & Training

Master's in Public Administration; Concentration in Natural Resource Policy

University of Alaska Southeast (May, 2018 Graduation) (GPA 4.0)

Bachelor of Science in Forest Management, Colorado State University, Fort Collins, CO (GPA 3.6)

Professional Activities & Affiliations

- Member of Alaska Municipal League and Alaska Conference of Mayors
- Member, Merced Watershed Council Steering Committee and Education Sub-Committee, 2001-2007
- Gustavus Community Preschool Board President and Treasurer, 2007-2010
- Member Gustavus Advisory School Board 2010-2012
- Member Midpines Advisory Board – 2000-2002

Stacey Brux

Parent Reprehensive

Ms. Stacey Brux is from Dillingham, and is the mother of Jared Savo, a freshman at MEHS. Coming from a rural community, where she felt the school system was failing her son, was please to find a school like MEHS. She believes a student's individual ability to achieve, and strives to make them reach for their best they can be. Being a single Caucasian mother of an Alaska Native child has held some very eye opening experiences for her, as well as Jared. When Due to the stress she encountered learning in an extremely large school, Stacey is glad to see MEHS is not large, while still being very academically challenging. When touring the school, she was amazed at the environment MEHS offered the students.

Ms. Brux, working style is very reliable, dependable and focused on responsibility and gaining knowledge along the way. "I'm very vocal, like to get in figure something out, put a plan to paper and move on to the next task." This, along with her involvement with her son and the school, makes her a strong candidate

Ms. Brux, is 4 credits from an AA in business, and is currently working as business office manager at Bristol Bay Area Health Corp.

March 1, 2019

September Horton

Mt. Edgecumbe High School
1130 Seward Ave
Sitka, AK 99835

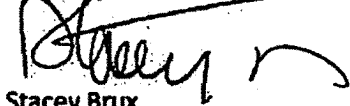
Dear Parent Review Board:

This is my letter of interest to be considered for the parent representative position advertised to parents of students who attend Mt. Edgecumbe.

I applied for this in hopes to be more active in the school by son attends. Having him away from home is an excellent opportunity for him, but I am missing out on my involvement.

Thank you for considering me, and if you have any question or would like to discuss this application, I can be reached at 907.842.9389 (work) or 907.843.0963 (cell).

Sincerely,

A handwritten signature in black ink, appearing to read 'Stacey Brux', with a long horizontal flourish extending to the right.

Stacey Brux
PO Box 1324
Dillingham, AK 99576

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

☒ **Parent Representative**

☐ **Community Representative**

Applicant's Name: Stacey Brux, Mother of freshman Jarad Savo

What prompted you to consider applying for the vacant MEHS Advisory seat?

I have had a lot of interaction with staff at MEHS trying to manage my child going to boarding school. I feel with helping him navigate, both successfully and not successfully, I have insight to bring to the table.

Are you or have ever been, directly associated with MEHS, if so what capacity?

I have not. The association I have is my freshman son is attending MEHS.

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

I am EXCITED by what MEHS has done and is doing for its students. Coming from a small rural Alaska community, the school system was failing Jarad and I was pleased to find an institution that truly believes in the kids and strives to make them the best they can be.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

I have been the manager in the business office in our community for years, beginning my position with BBAHC 26 years ago. I am very reliable, dependable. I worked my way up, gaining knowledge and responsibility. I'm very vocal, like to get in, figure something out. Put the plan to paper and move on to the next task.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

Being the single Caucasian mother of an Alaska Native child has held some very eye-opening experiences for Jarad and myself. I have attended very high stress, academically challenging large school systems. Jarad had not. Starting in head start, I was an advocate for Jarad's cultural upbringing. I was the loud voice he needed to succeed. I was head of his head start parent group, I was a leader in his grade school fund raising and activities calendars. I was very involved in his sports programs while in middle school, organizing and assigning tasks to ensure tournaments etc. went smoothly.

What other boards, commissions, etc., have you been appointed to? Are you currently active on any boards, commissions, etc.?

I am not

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

I am the business office manager at Bristol Bay Area Health Corp. I have been employed here for 28 years. I hold a certificate, CBCS, (Certified billing coding specialist) and have taken many college classes to better my education in healthcare. Sad to say, I am 4 credits shy of my AA in business.

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

I am unsure what else could be added.. I traveled to Sitka prior to enrolling Jarad into MEHS. I fell in love with the community. It's a great place. And amazing environment for students. So thankful you and your team exist for these students. I told Jarad while we were on tour, they need to have PTA so I can join long distance. Feel like I'm still involved with his schooling even though he is 800 miles away.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Alex Fox

Phone Number: 907.843.0828

Name: Kenny Rodgers

Phone Number: 907.227.1812

Name: Sara Fox

Phone Number: 907.843.1334

Signature: Stacey R

Date: 2/27/19

Jennifer Phillip

Parent Representative

Jennifer Phillip comes to us from Akiachak, and is the mother of Tyler Charles, a freshman MEHS. Ms. Phillip feels that MEHS provides a quality education that smaller schools cannot. It gives the student a better understand of what it is like to be away from home, and in doing so giving them a strong base for college and for the world. Ms. Phillip loves to learn, and is learning new things every day. Being on the MEHS Advisory Board would not only give her a chance to learn new things about the school, but to grow as parent and be a voice for many other parents that send their children to MEHS.

Ms. Phillips takes education very seriously not just for her child, but for every MEHS student. She believes she can be a strong voice for both students and parents, while still looking at the big picture.

Ms. Phillip serviced on the Migrant Parent advisory council in 2016 and is very active on the migrant PAC.

She is currently working for the Yupit School District, while also taking classed for pre-nursing.

March 12, 2019

To Whom It May Concern:

I am writing in regards to my interest in the advisory board for MEHS. I am interested in the advisory board because I would like to get to know more about MEHS and I also would like to be the voice for our parents and students. I think education is an important role in our lives without it where would we be. I always tell my children and other students in my village that in order to succeed you need to focus on what you want and pursue it. I think if you put your mind to something you will succeed. I want to be on the advisory board because I want to make a difference even if that difference is just a small increment. I thought that it would be a good opportunity for me to do something new and take a chance. At least, at the end of the day I know I have tried and accomplished something new. Quyana, for you time. I really appreciate it.

Sincerely,
Jennifer Phillip
Jennifer Phillip

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

☒ Parent Representative
☐ Community Representative

Applicant's Name: Jennifer Phillip

What prompted you to consider applying for the vacant MEHS Advisory seat?

MEHS advertised on their facebook page and I got an email from September Horton.

Are you or have ever been, directly associated with MEHS, if so what capacity?

NO I have not been associated with MEHS.

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

I think that MEHS provides quality education that the smaller districts can't fill. ~~and~~ It gives the students a better understanding of what it is like being away from home. and lets them learn first hand about being independent and MEHS gives support to the students who really need it.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

I am learning new things everyday and I love learning new things. So being on the advisory council. I want to learn more about being on the advisory council. I want to be the voice of many parents who send their children to MEHS, I can be shy at first but once I become familiar with things I can be outspoken. I might be one person but I can make a difference.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

I am a parent who takes education very seriously for my children. For my children I ~~am~~ ^{can be} the voice for their education.

What other boards, commissions, ect., have you been appointed to? Are you currently active on any boards, commissions, ect.?

I have been appointed to be on the Migrant Parent Advisory Council in 2016. So, currently I am ~~an~~ active on the migrant PAC.

I ~

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

I am currently taking classes for Pre-nursing. At one point I had my Certified Nursing Assistant Certificate, I am currently working at the Yupik School District.

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Jennifer Stackhouse

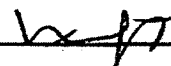
Phone Number: 907 825 2222

Name: Sharon Craft

Phone Number: 907 695 2121

Name: Cody Burnham

Phone Number: 907 815 7332

Signature: 

Date: 3/1/17

Carla Nanok

Parent Representative

Ms. Nanok comes to us from Goodnews Bay, and is the mother Kiersi Hammock, a freshman at MEHS. As a 2002 graduate of MEHS, and now having a daughter now attending, she feels it's time to give back to the MEHS community. She has a vision of how MEHS fits in the larger scheme of things and can create a bridge between the lifestyles of larger and smaller communities, so as to better shape the leaders of tomorrow. Describing herself as open-minded and a team player. Having lived in Sitka, Juneau, Dillingham, Tokiag and Twin Hills, she has been exposed to a broad range of people, theories, and cultures.

She is a 2002 graduate and is a child of a 1970 graduate of MEHS. She would hopes to continue this legacy by having her children graduate from MEHS.

Ms. Nanok has served on the LKSD School Board (Rocky Mountain School) and as a Parent Reprehensive for of Sitka's Head Start Program.

She feels by having such varied jobs- such as care giver, medical transcriptionist, and cab driver- she has become a very well rounded person.

Carla Nanok 11:16 AM (4 hours ago)

to me

Greetings Advisory Board Selection Committee:

I am a single/widowed mother of 4, soon to be 5, with my eldest attending Mt. Edgecumbe High School (MEHS) as a freshman this year (2018/2019). I am a 2002 graduate (salutatorian of my graduating class) of MEHS, as well as the child of a 1970 graduate of MEHS. It has been nearly 17 years since my graduation and I feel it is my time to give back to the students, staff and family of MEHS through the service of Parent Representative.

My personal vision of how MEHS fits in the larger scheme of things is that MEHS is the bridge between a smaller community lifestyle and a larger community lifestyle, as well as provides a personal experience for each attendee that shapes them to become apart of a growing family in the State of Alaska.

I believe I am talented in assisting people with personal growth. I am open-minded, a team player and excited to have this opportunity to apply to potentially be chosen as a Parent Representative. I am (a halfbreed) Yupik, from, and currently residing in, Goodnews Bay, Alaska, but have lived in Sitka, Juneau, Anchorage, Dillingham, Togiak and Twin Hills. These experiences have exposed me to a broad range of people, theories, cultures and lifestyles. I feel I have a unique perspective, as well as love to learn.

I have prior experience as a school board member for LKSD Rocky Mountain School, Parent Representative for Head Start in Sitka, Alaska, and a volunteer for Girl Scouts of America. I currently have 50+ college credit hours, previously employed as a taxi driver, medical transcriptionist and respite care provider.

I believe I am a well-rounded, open-minded and outspoken individual who challenged my own beliefs, as well as the beliefs of others. I am kind and enjoy learning. I feel this is a great fit to add to the current board at MEHS.

Thank you for your consideration. If you have any questions, please feel free to ask.

Quyana,

Carla Nanok

References:

Ronald Bowers: 907-528-3711

Chasady Didrickson: 907-738-5280

Ellen Frankenstein: 907-747-3399

Mt. Edgecumbe High School
Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

- ☒ Parent Representative
☐ Community Representative

Applicant's Name: Carla Nanok

What prompted you to consider applying for the vacant MEHS Advisory seat?

I would like to give back to the students, staff and educators through the service as a parent representative

Are you or have ever been, directly associated with MEHS, if so what capacity?

Yes, mother of freshman (2018/2019), graduate of class of 2002 and child of graduating class of 1970.

fits in the larger educational scheme for the State of Alaska?

Bridge between smaller & larger
communities & opportunities for growth.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

Enjoy learning; challenging beliefs &
accepting & contributing to growth.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

Served on Parent Policy Council, as well as
School board; lived in different communities
and exposed to people & cultures.

What other boards, commissions, ect., have you been appointed to? Are you currently active on any boards, commissions, ect.?

Not currently, but previously served.

Education and Employment History: Please list your highest level of education and any professional certifications you may have earned, and recent employment history.

Medical Transcriptionist; taxi cab driver;
patient respite provider

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

Unique perspective

Please list three references of people who can speak to your ability to serve MEHS.

Name: Ronald Bowers

Phone Number: 907 528 3711

Name: Ellen Frankenstein

Phone Number: 907 747 3394

Name: Charady Didrickson

Phone Number: 907 738 5288

Signature: Coreanano

Date: 4/1/2019

Clay Beck

Parent Representative

Clay Beck comes to us from Kenai, and is the father of Marysue Beck, a freshman at MEHS. Former board member Margie Ubben told him how enjoyable her experience as an MEHS Advisory Board member was to her, which prompted him to take the opportunity when it arose. Mr. Beck is familiar with the history of MEHS, and it's role as educating Alaska Natives early on for the benefit of both local communities and statewide issues. He believes the role of MEHS has remained unchanged, but faces a whole new set of issues with the passage of time. Being a teacher in rural Alaska for 16 years, he has tried to stay in touch with his former students, many who have attended MEHS. Spending 13 years teaching in Kotzebue has given him the insight concerning academic and social challenges students are facing.

Mr. Beck, has been involved in education for 16 years in the state and has experienced shifts in classroom methodology and teaching philosophies. Mr. Beck also brings his real classroom experiences to the board.

Mr. Beck received a Bachelor's of Science in teaching. He is a certified English Teacher for grades 7-12. He taught various subjects and ages in Kotzebue from 2002 to 2013 and is now teaching 9th grade language arts in Kenai Central High School since 2015.

March 28, 2019

To Whom it may concern:

I would like to express my interest in the vacant parent seat on the MEHS Advisory Board. My daughter Marysue Beck is a freshman at MEHS this year. I have been very impressed with the school and opportunities it gives to students. I have been familiar with MEHS for years. As a teacher in Kotzebue from 2002-2013 many of my pupils went to MEHS and I had the good fortune of making friends of co-workers who had graduated from MEHS. I am very excited my daughter is in Sitka attending MEHS and I hope to be as involved as I can as a parent. I view serving on the advisory board as something I can do and bring insight and knowledge of schools and philosophies to the board from my experiences. I also believe that this is an excellent chance to learn more about Mt. Edgecumbe and everything that it offers.

Thank you for your time and consideration.

A handwritten signature in black ink, appearing to read "Clay Beck". The signature is fluid and cursive, with a long horizontal stroke extending from the left side.

Clay Beck

Mt. Edgecumbe High School Advisory Board-Application Questionnaire

The Alaska Department of Education is pleased that you are potentially willing to serve on the Mt. Edgecumbe High School (MEHS) Advisory Board. In an effort to assist the MEHS in making the best selection possible for the vacant seat or seats, we are encouraging you to complete the following questionnaire and return it with your letter of interest and detailed resume. Please attach additional sheet as needed.

Position:

Please Check Box

☐ Parent Representative

☐ Community Representative

Applicant's Name: _____ Clay Beck _____

What prompted you to consider applying for the vacant MEHS Advisory seat?

Former MEHS Advisory member, Margie Ubben, told me about her experiences as a board member this summer. She said it was an enjoyable experience and prompted me to take the opportunity if it arose. I have always been impressed with MEHS and the education and opportunities that it allows students to experience. Finally, I have always tried to be active in my daughter's education, and see this opportunity as a chance to participate in a positive way.

Are you or have ever been, directly associated with MEHS, if so what capacity?

I have only been associated with former students who went to MEHS. I have written several letters of recommendation for students to include in their applications.

What is your vision of the role of MEHS and how a public supported residential high school fits in the larger educational scheme for the State of Alaska?

I envision MEHS as an opportunity for students to access opportunities- both academic and cultural- that they wouldn't experience at schools in their home towns. MEHS served as a networking catalyst in its early days that helped Alaskan Native Leaders from across the state meet and recognize issues that affected them all. This motivated these leaders to pass important legislation such as ANCSA and improve the lives of their people. Today in Alaska we are facing many issues from our climate to social problems. MEHS is the place where Alaska's future leaders are going to meet and join together to solve the problems facing Alaska.

I also believe that because of the state of affairs regarding Alaska's budget MEHS is going to be looked at as a model for other potential residential schools in our state. It's my opinion that MEHS has set a high bar and should be looked at as the model other residential schools should follow.

In your opinion, what special interest, talents and/or capacities could you bring to the Advisory's Board?

Besides the interest of my own daughter's education, I have had numerous students that have attended MEHS over the course of my 16 years of teaching in Alaska. I try to stay in touch with former students and listen to how they feel they were prepared for life after high school. I use these conversations to improve what I can for current students so they get the most they can out of their time in school.

I spent 13 years teaching in Kotzebue. I believe that I have an insight from within the rural education system many applicants do not have. I know the academic and social challenges many students face.

In your opinion, what makes you uniquely qualified for the vacant seat for which you are making application?

I have been involved in education for a number of years and have experienced different movements and philosophies that have been implemented in Alaskan schools. I believe that I can bring real classroom experiences to discussions with the board that would be beneficial.

What other boards, commissions, ect., have you been appointed to? Are you currently active on any boards, commissions, ect.?

I have never sat on any board or commission.

Education and Employment History: Please list your highest level of education and any professional certifications you may have eared, and recent employment history.

I have a bachelors of science in teaching that I received from Chadron State College in Chadron, Nebraska. I am a certified English Teacher for grades 7-12. I taught various subjects and ages during my career in Kotzebue, AK (2002-2013). I took one year off teaching and managed/operated a new gas station/fuel delivery business owned by Vitus Energy. In 2014 I moved from Kotzebue to Kenai and served as a substitute teacher in various schools until I received a full-time position at Kenai Central HS teaching 9th grade language arts beginning in 2015 to present.

If interested, please provide any additional information that you believe might be helpful to reviewers of your application.

I love spending time in the outdoors and participating in subsistence activities. I feel that these kind of activities should be practiced by the youth of our state because it is an important component of culture.

Please list three references of people who can speak to your ability to serve MEHS.

Name: Rod Nutting

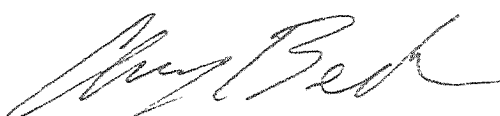
Phone Number: (907) 738-0502

Name: Robin Gage

Phone Number: (907) 412-1979

Name: Margie Ubben

Phone Number (406) 531-8088

Signature: 

Date: 3/29/2019

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 5A

◆ **ISSUE**

The board is being asked to adopt the proposed amendments to regulation 4 AAC 04.140 Content Standards. The amendments remove the science content and performance standards from the *Alaska Standards: Content and Performance Standards for Alaska Students (2016)* and publish them separately as the *Science Standards for Alaska*.

BACKGROUND

- The last time science standards were reviewed was in 2006. To meet the demands of postsecondary education and the requirements for challenging standards for science (Every Student Succeeds Act), a committee of educators reviewed and revised the science standards.
- Proposed amendments to 4 AAC 04.140 update science content standards for use by school districts in Alaska.
- Process for developing draft science standards:
 - In April 2018, a committee of volunteer stakeholders was recruited by DEED to develop draft standards appropriate for Alaska. Committee members represented urban and rural schools districts, education partners, and industry. Volunteers were divided into writing and reading committees that worked over the subsequent seven months to write and refine the draft standards.
 - The draft standards were developed by reviewing adopted standards from other states, the *Framework for K-12 Science Education*, *Next Generation Science Standards*, and science standards recently adopted by districts in Alaska.
- Behind this cover memo are the proposed *Science Standards for Alaska*.
- Deb Riddle, Division Operations Manager, will be present via teleconference to brief the board.

◆ **OPTIONS**

This is a work session item. Action will take place under agenda item 8A.

Science Standards for Alaska

Proposed Draft Standards

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Science Standards for Alaska

Proposed November 2, 2018

Introduction

Science and technology have been essential to the people for Alaska in its past, its present, and will be increasingly important in the future. Providing a firm foundation in science education for all students in Alaska is a bright opportunity and essential challenge. The State's science content standards provide the foundation for defining what students should know and be able to do in terms of scientific knowledge and skills.

Development Process

In October of 2017, the Alaska Department of Education and Early Development (DEED) began a statewide application process to identify teachers, principals, curriculum directors, science specialists, and other qualified individuals to serve as writers and reviewers and aid in the creation of new science content standards for the State of Alaska.

Out of the pool of applicants, 15 diverse professionals were selected based upon merit, to serve on the science content standards Writing Committee. An additional 15 individuals were chosen to review the writing committee's recommendations.

The Writing Committee was provided with the following charge:

- The Writing Committee will identify and review influential sets of science content standards (e.g., *Next Generation Science Standards*; standards for the NAEP, PISA, and TIMSS assessments; science standards from College Board and ACT; standards from other leading states; science standards from leading textbook publishers; and past science standards such as AAAS' *Project 2061*).
- The Writing Committee will identify, modify, write, and compile a recommended set of science content standards drawing on its members' expertise and review of relevant materials. Ideally, the Writing Committee will produce a set of content standards to guide curriculum and instruction in the state. In addition, the Writing Committee will provide recommendations regarding the state summative assessment in science.
- The Writing Committee will receive feedback from the Review Committee. Following review, the Writing Committee will make appropriate changes. The Writing Committee will send its recommended set of science content standards to the Alaska Department of Education and Early Development, which will review and send to the State Board.

In April of 2018, the first meeting of the Writing Committee was held in Anchorage. From this review, the team decided to use the *Next Generation Science Standards* (NGSS) as a basis for Alaska Science Standards due to its three-dimensional design, and focus on science for all

students. The three-dimensional design provides students with a context for the content of science, how science knowledge is acquired and understood, and how the individual sciences are connected through concepts that have universal meaning across disciplines.

It was the committee's decision to shape the Alaska Science Standards around the NGSS, with a strong focus on relevance to Alaskan students and allow educators the flexibility to determine the best way to help students meet the standards, based on local needs.

Following the first meeting, Writing Committee suggestions were sent to Reviewers for questions and comments. The Writing Committee met again in June of 2018 to discuss reviewers' input and revise the standards based on the feedback received.

Subsequently the Writing Committee's revisions went back to the Review Committee for a second round of review. The Reviewers' comments were again presented to the Writing Committee in October of 2018.

In October of 2018, the Writing Committee met again, reviewed comments of the Review Team, and finalized recommendations regarding the Alaska Science Standards, to be submitted to the Alaska Board of Education for review and adoption.

Relation of the Science Content Standards for Alaska and the NGSS

The Science Content Standards for Alaska are largely the same as the NGSS. The Writing Committee strongly supported the general architecture and approach of the NGSS, and made no changes to the scientific content. The revisions made by the Writing Committee included:

- Adding many examples of how the standards could be made more relevant for students in Alaska by showing applications of scientific principles and skills in an Alaskan context
- Rephrasing several content standards statements to make them clearer and/or more age-appropriate
- Fewer than a handful of NGSS content standards were combined, moved to a different grade, or deleted.

The Science Content Standards for Alaska contain two main parts: Performance Expectations and Foundational Statements. These are also found in the NGSS. In addition, the NGSS content standards have a third part, called "Connections" that provide information for how the science content standards are related to each other and to other widely-used content standards in reading, writing, and mathematics. The Writing Committee recommended not incorporating the Connections information as a part of the state-adopted science content standards because such connections are likely to change more rapidly than the science content standards. The Writing Committee endorsed DEED providing such information, along with other support materials as supplemental to the actual state science content standards.

How to Read the Science Content Standards for Alaska¹

The Science Content Standards for Alaska are distinct from prior science standards in three essential ways.

- 1) **Performance.** Prior standards documents listed what students should “know” or “understand.” These ideas needed to be translated into performances that could be assessed to determine whether or not students met the standard. Different interpretations sometimes resulted in assessments that were not aligned with curriculum and instruction. The Science Content Standards for Alaska has avoided this difficulty by developing performance expectations that state what students should be able to do in order to demonstrate that they have met the standard, thus providing the same clear and specific targets for curriculum, instruction, and assessment.
- 2) **Foundations.** Each performance expectation incorporates all three dimensions from the Framework— a science or engineering practice, a core disciplinary idea, and a crosscutting concept.
- 3) **Coherence.** Each set of performance expectations lists connections to other ideas within the disciplines of science and engineering, and with Common Core State Standards in Mathematics and English Language Arts.

This chapter describes how these three unique characteristics are embodied in the format of the standards, beginning with the “system architecture.”

¹ This section paraphrases and quotes extensively from NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

System Architecture

As shown in the illustration at right, each set of performance expectations has a title. Below the title is a box containing the performance expectations. Below that are three foundation boxes, which list (from left to right) the specific science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) that were combined to produce the performance expectations (PEs) above. These sections are described in further detail below.

Performance Expectations

Performance expectations are the assessable statements of what students should know and be able to do. All students should be held accountable for demonstrating their achievement of all PEs, which are written to allow for multiple means of assessment.

The NGSS writers initially attempted to include all of the disciplinary core ideas (DCIs) verbatim from the Framework in the performance expectations, but found that the resulting statements were bulky and reduced readers' comprehension of the standards. Instead, the performance expectations were written to communicate a "big idea" that combined content from the three foundation boxes. In the final phase of development NGSS writers further limited the number of performance expectations with input from the NGSS state teams, to ensure that this set of PEs is achievable at some reasonable level of proficiency by the vast majority of students.

The Science Content Standards for Alaska are for all students, and all students are expected to achieve proficiency with respect to all of the performance expectations in the Alaska standards.

A second essential point is that the Science Content Standards for Alaska should not limit the curriculum. Students interested in pursuing science further (through Advanced Placement or other advanced courses) should have the opportunity to do so. The Science Content Standards for Alaska provide a foundation for rigorous advanced courses in science or engineering that some students may choose to take.

A third point is that the Science Content Standards for Alaska are not a set of instructional or assessment tasks. They are statements of what students should be able to do after instruction. Decisions on how best to help students meet these PEs are left to states, districts, and teachers.

In the example below, notice how the performance expectation combines the skills and ideas that students need to learn, while it suggests ways of assessing whether or not third graders have the capabilities and understandings specified in the three foundation boxes.

3. Interdependent Relationships in Ecosystems:
Environmental Impacts on Organisms



3-PS2-1

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.

Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	PS2.A: Forces and Motion Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.	Cause and Effect Cause and effect relationships are routinely identified.

As in this example, statements where the performance expectation is followed by an asterisk * indicate content standards especially appropriate to make connections with engineering and technology.

As shown in the example, most of the performance expectations are followed by one or two additional statements in smaller type. These include clarification statements, which supply examples or additional clarification to the performance expectations; and assessment boundary statements, which specify the limits to large scale assessment.

The codes for the performance expectations were derived from the Framework. As with the titles, the first digit indicates a grade K-5, or specifies MS (middle school) or HS (high school). The next alpha-numeric code specifies the discipline, core idea and sub-idea. All of these codes are shown in the table below, derived from the Framework. Finally, the number at the end of each code indicates the order in which that statement appeared as a DCI in the Framework.

Physical Science	Life Science	Earth and Space Science
PS1 Matter and Its Interactions	LS1 From Molecules to Organisms: Structures and Processes	ESS1 Earth's Place in the Universe
PS1A Structure and Properties of matter	LS1A Structure and Function	ESS1A The Universe and Its Stars
PS1B Chemical Reactions	LS1B Growth and Development of Organisms	ESS1B Earth and the Solar System
PS1C Nuclear Processes	LS1C Organization for Matter and Energy Flow in Organisms	ESS1C The History of Planet Earth
PS2 Motion and Stability: Forces and Interactions	LS1D Information Processing	ESS2 Earth's Systems
		ESS2A Earth Materials and Systems

Physical Science	Life Science	Earth and Space Science
PS2A Forces and Motion PS2B Types of Interactions	LS2 Ecosystems: Interactions, Energy, and Dynamics	ESS2B Plate Tectonics and Large-Scale System Interactions
PS2C Stability and Instability in Physical Systems	LS2A Interdependent Relationships in Ecosystems	ESS2C The Roles of Water in Earth's Surface Processes
PS3 Energy	LS2B Cycles of Matter and Energy Transfer in Ecosystems	ESS2D Weather and Climate
PS3A Definitions of Energy	LS2C Ecosystem Dynamics, Functioning, and Resilience	ESS2E Biogeology
PS3B Conservation of Energy and Energy Transfer	LS2D Social Interactions and Group Behavior	ESS3 Earth and Human Activity
PS3C Relationship Between Energy and Forces	LS3 Heredity: Inheritance and Variation of Traits	ESS3A Natural Resources ESS3B Natural Hazards
PS3D Energy and Chemical Processes in Everyday Life	LS3A Inheritance of Traits	ESS3C Human Impacts on Earth Systems
PS4 Waves and Their Applications in Technologies for Information Transfer	LS3B Variation of Traits	ESS3D Global Climate Change
PS4 Waves and Their Applications in Technologies for Information Transfer	LS4 Biological Evolution: Unity and Diversity	
PS4A Wave Properties	LS4A Evidence of Common Ancestry	
PS4B Electromagnetic Radiation	LS4B Natural Selection	
PS4C Information Technologies and Instrumentation	LS4C Adaptation	
	LS4D Biodiversity and Humans	

Foundation Boxes

While the performance expectations can stand alone, a more coherent and complete view of what students should be able to do comes when the performance expectations are viewed in tandem with the contents of the foundation boxes that lie just below the performance expectations. These three boxes include the practices, core disciplinary ideas, and crosscutting concepts, derived from the Framework, that were used to construct this set of performance expectations.

Disciplinary Core Ideas (DCIs). The orange box in the middle includes statements that are taken from the Framework about the most essential ideas in the major science disciplines that all students should understand during 13 years of school. Including these detailed statements was very helpful to the NGSS writing team as they analyzed and “unpacked” the disciplinary core ideas and sub-ideas to reach a level that is helpful in describing what each student should understand about each sub-idea at the end of grades 2, 5, 8, and 12. Although they appear in paragraph form in the Framework, here they are bulleted to be certain that each statement is distinct.

Science and Engineering Practices (SEPs). The blue box on the left includes just the science and engineering practices used to construct the performance expectations in the box above. These statements are derived from and grouped by the eight categories detailed in the Framework to further explain the science and engineering practices important to emphasize in each grade band. Most sets of performance expectations emphasize only a few of the practice categories; however, all practices are emphasized within a grade band. Teachers should be encouraged to utilize several practices in any instruction, and need not be limited by the performance expectation, which is only intended to guide assessment. The SEPs are discussed more in Appendix A.

Crosscutting Concepts (CCCs). The green box on the right includes statements derived from the Framework’s list of crosscutting concepts, which apply to one or more of the performance expectations in the box above. Most sets of PEs limit the number of crosscutting concepts so as focus on those that are readily apparent when considering the DCIs. However, all are emphasized within a grade band. Again, the list is not exhaustive nor is it intended to limit instruction. The CCCs are discussed more in Appendix B.

Title. The organization of the Science Content Standards for Alaska is based on the core ideas in the major fields of natural science from A Framework for K-12 Science Education (NRC 2012), plus one set of PEs for engineering. For the elementary level, from Kindergarten to grade five, sets of performance expectations are assigned to specific grades. A numeral at the start of a title indicates the grade level; so the title in the example above identifies a content standard for grade 3. Titles for middle school (grades 6-8) standards begin with “MS” and those for high school standards (grades 9-12) begin with “HS.”

The titles also reveal the organization of the standards, which is based on the core ideas in the disciplines from the Framework. The Framework lists 11 core ideas, four in life science, four in physical science, and three in Earth and Space Science. The core ideas are divided into a total of 39 sub-ideas, and each sub-idea is elaborated in a list of what students should understand about that sub-idea at the end of grades 2, 5, 8, and 12. We have called these grade-specific statements Disciplinary Core Ideas (DCIs).

At the beginning of the process, the NGSS writers examined all of the DCIs in the Framework to eliminate redundant statements, find natural connections among DCIs, and develop PEs that were appropriate for the different grade levels. The result was a topical clustering of DCIs that usually, but did not always correspond to the core ideas identified in the Framework. This structure provided the original basis of the standards and has continued through the process. The Science Content Standards for Alaska have been presented in this topic organization.

KINDERGARTEN

The performance expectations in kindergarten help students formulate answers to questions such as: “What happens if you push or pull an object harder? Where do animals live and why do they live there? What is the weather like today and how is it different from yesterday?”

Kindergarten performance expectations include PS2, PS3, LS1, ESS2, ESS3, and ETS1

Disciplinary Core Ideas from the NRC Framework. Students are expected to develop understanding of patterns and variations in local weather and the purpose of weather forecasting to prepare for, and respond to, severe weather. Students are able to apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution. Students are also expected to develop understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live.

The crosscutting concepts of patterns; cause and effect; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

K. Forces and Interactions: Pushes and Pulls

Students who demonstrate understanding can:

- K-PS2-1 Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.** [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]
- K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*.** [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.]

K-PS2-1

Students who demonstrate mastery can:

Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.

Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations With guidance, plan and conduct an investigation in collaboration with peers.	PS2.A: Forces and Motion - Pushes and pulls can have different strengths and directions. - Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. PS2.B: Types of Interactions - When objects touch or collide, they push on one another and can change motion. PS3.C: Relationship Between Energy and Forces - A bigger push or pull makes things speed up or slow down more quickly. (<i>secondary</i>)	Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.

K-PS2-2

Students who demonstrate understanding can:

Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*

Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.

Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data from tests of an object or tool to determine if it works as intended.	PS2.A: Forces and Motion - Pushes and pulls can have different strengths and directions. - Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. ETS1.A: Defining Engineering Problems - A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. <i>(secondary)</i>	Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.

K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment

Students who demonstrate understanding can:

- K-LS1-1 Use observations to describe patterns of what plants and animals (including humans) need to survive.** [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]
- K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.** [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete, or local plant and animal observations.]
- K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.** [Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system. Explain the characteristics of the model and the relationships.]
- K-ESS3-3 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*** [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]

K-LS1-1

Students who demonstrate mastery can:

Use observations to describe patterns of what plants and animals (including humans) need to survive.

Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence • Scientists look for patterns and order when making observations about the world	LS1.C: Organization for Matter and Energy Flow in Organisms • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.	Patterns • Patterns in the natural and human designed world can be observed and used as evidence.

K-ESS2-2

Students who demonstrate understanding can:

Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete, or local plant and animal observations.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an argument with evidence to support a claim.	ESS2.E: Biogeology - Plants and animals can change their environment. ESS3.C: Human Impacts on Earth Systems - Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. <i>(secondary)</i>	Systems and System Models Systems in the natural and designed world have parts that work together.

K-ESS3-1

Students who demonstrate understanding can:

Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system. Explain the characteristics of the model and the relationships.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model to represent relationships in the natural world.	ESS3.A: Natural Resources Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.	Systems and System Models Systems in the natural and designed world have parts that work together.

K-ESS3-3

Students who demonstrate understanding can:

Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*

Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.	ESS3.C: Human Impacts on Earth Systems - Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. ETS1.B: Developing Possible Solutions - Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. <i>(secondary)</i>	Cause and Effect Events have causes that generate observable patterns.

K. Weather and Climate

Students who demonstrate understanding can:

- K-PS3-1** **Make observations to determine the effect of sunlight on Earth's surface.** [Clarification Statement: Local observation of duration of sunlight. Examples of Earth's surface could include sand, soil, rocks, and water.] *[Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]*
- K-PS3-2** **Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.*** [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun. Explain the characteristics of the structure and their effect on the temperature.]
- K-ESS2-1** **Use and share observations of local weather conditions to describe patterns over time.** [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] *[Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.]*
- K-ESS3-2** **Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.*** [Clarification Statement: Emphasis is on local forms of severe weather.]

K-PS3-1

Students who demonstrate understanding can:

Make observations to determine the effect of sunlight on Earth's surface.

Clarification Statement: Local observation of duration of sunlight. Examples of Earth's surface could include sand, soil, rocks, and water.

Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations - Make observations (firsthand or from media) to collect data that can be used to make comparisons. Connections to Nature of Science Scientific Investigations Use a Variety of Methods - Scientists use different ways to study the world.	PS3.B: Conservation of Energy and Energy Transfer Sunlight warms Earth's surface.	Cause and Effect Events have causes that generate observable patterns.

K-PS3-2

Students who demonstrates understanding can:

Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.*

Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun. Explain the characteristics of the structure and their effect on the temperature.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem.	PS3.B: Conservation of Energy and Energy Transfer Sunlight warms Earth's surface.	Cause and Effect Events have causes that generate observable patterns.

K-ESS2-1

Students who demonstrate understanding can:

Use and share observations of local weather conditions to describe patterns over time.

Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.

Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. Connections to Nature of Science Science Knowledge is Based on Empirical Evidence - Scientists look for patterns and order when making observations about the world.	ESS2.D: Weather and Climate Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.	Patterns Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

K-ESS3-2

Students who demonstrate understanding can:

Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.*

Clarification Statement: Emphasis is on local forms of severe weather.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems - Ask questions based on observations to find more information about the designed world. Obtaining, Evaluating, and Communicating Information - Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world.	ESS3.B: Natural Hazards - Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. ETS1.A: Defining and Delimiting an Engineering Problem - Asking questions, making observations, and gathering information are helpful in thinking about problems. <i>(secondary)</i>	Cause and Effect - Events have causes that generate observable patterns. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - People encounter questions about the natural world every day. Influence of Engineering, Technology, and Science on Society and the Natural World - People depend on various technologies in their lives; human life would be very different without technology.

K-2.Engineering Design

Students who demonstrate understanding can:

- K-2-ETS1-1** **Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**

- K-2-ETS1-2** **Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.** [Clarifying Statement: Explain how the model functions to solve the problem.]

- K-2-ETS1-3** **Analyze and discuss data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

K-2-ETS1-1

Students who demonstrate understanding can:

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems - Ask questions based on observations to find more information about the natural and/or designed world(s). - Define a simple problem that can be solved through the development of a new or improved object or tool.	ETS1.A: Defining and Delimiting Engineering Problems - A situation that people want to change or create can be approached as a problem to be solved through engineering. - Asking questions, making observations, and gathering information are helpful in thinking about problems. - Before beginning to design a solution, it is important to clearly understand the problem.	

K-2-ETS1-2

Students who demonstrate understanding can:

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Clarifying Statement: Explain how the model functions to solve the problem.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a simple model based on evidence to represent a proposed object or tool.	ETS1.B: Developing Possible Solutions Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	Structure and Function The shape and stability of structures of natural and designed objects are related to their function(s).

K-2-ETS1-3

Students who demonstrate understanding can:

Analyze and discuss data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data from tests of an object or tool to determine if it works as intended.	ETS1.C: Optimizing the Design Solution Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	

FIRST GRADE

The performance expectations in first grade help students formulate answers to questions such as: “What happens when materials vibrate? What happens when there is no light? What are some ways plants and animals meet their needs so that they can survive and grow? How are parents and their children similar and different? What objects are in the sky and how do they seem to move?” First grade performance expectations include PS4, LS1, LS3, and ESS1

Disciplinary Core Ideas from the NRC Framework. Students are expected to develop understanding of the relationship between sound and vibrating materials as well as between the availability of light and ability to see objects. The idea that light travels from place to place can be understood by students at this level through determining the effect of placing objects made with different materials in the path of a beam of light. Students are also expected to develop understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs as well as how behaviors of parents and offspring help the offspring survive. The understanding is developed that young plants and animals are like, but not exactly the same as, their parents. Students are able to observe, describe, and predict some patterns of the movement of objects in the sky.

The crosscutting concepts of patterns; cause and effect; structure and function; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the first grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

1. Waves: Light and Sound

Students who demonstrate understanding can:

- 1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.** [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork or a person making a hunting call.]
- 1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.** [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]
- 1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.** [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [*Assessment Boundary: Assessment does not include the speed of light.*]
- 1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.*** [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats. Explain how the device works.] [*Assessment Boundary: Assessment does not include technological details for how communication devices work.*]

1-PS4-1

Students who demonstrate understanding can:

Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork or a person making a hunting call.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations - Plan and conduct investigations collaboratively to produce evidence to answer a question. Connections to Nature of Science Scientific Investigations Use a Variety of Methods - Science investigations begin with a question. - Scientists use different ways to study the world.	PS4.A: Wave Properties Sound can make matter vibrate, and vibrating matter can make sound.	Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.

1-PS4-2

Students who demonstrate understanding can:

Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.

Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.	PS4.B: Electromagnetic Radiation Objects can be seen if light is available to illuminate them or if they give off their own light.	Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.

1-PS4-3

Students who demonstrate understanding can:

Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).

Assessment Boundary: Assessment does not include the speed of light.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct investigations collaboratively to produce evidence to answer a question.	PS4.B: Electromagnetic Radiation Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)	Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.

1-PS4-4

Students who demonstrate understanding can:

Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.*

Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones,” and a pattern of drum beats. Explain how the device works.

Assessment Boundary: Assessment does not include technological details for how communication devices work.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use tools and materials provided to design a device that solves a specific problem.	PS4.C: Information Technologies and Instrumentation People also use a variety of devices to communicate (send and receive information) over long distances.	Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science, on Society and the Natural World People depend on various technologies in their lives; human life would be very different without technology.

1. Structure, Function, and Information Processing

Students who demonstrate understanding can:

- 1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*** [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells (e.g., protective helmets), acorn shells, mollusks, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; detecting intruders by mimicking eyes and ears; use of camouflage, or tools such as snowshoes. Explain how the solution solves the problem described.]
- 1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.** [Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).]
- 1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.** [Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.] [Assessment Boundary: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.]

1-LS1-1

Students who demonstrate understanding can:

Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*

Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells (e.g., protective helmets), acorn shells, mollusks, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; detecting intruders by mimicking eyes and ears; use of camouflage, or tools such as snowshoes. Explain how the solution solves the problem described.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use materials to design a device that solves a specific problem or a solution to a specific problem.	LS1.A: Structure and Function - All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. LS1.D: Information Processing - Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.	Structure and Function - The shape and stability of structures of natural and designed objects are related to their function(s). Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering and Technology on Society and the Natural World - Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

1-LS1-2

Students who demonstrate understanding can:

Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information - Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Scientists look for patterns and order when making observations about the world.	LS1.B: Growth and Development of Organisms Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.	Patterns Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

1-LS3-1

Students who demonstrate understanding can:

Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.

Assessment Boundary: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.	LS3.A: Inheritance of Traits - Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. LS3.B: Variation of Traits - Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.	Patterns Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

1. Space Systems: Patterns and Cycles

Students who demonstrate understanding can:

- 1-ESS1-1 Use observations of the sun, moon, stars, and tides to describe patterns that can be predicted.** [Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day. Students not required to know the mechanisms that control tides]
- 1-ESS1-2 Make and graph observations at different times of year to relate the amount of daylight to the time of year, and graph findings.** [Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.] [Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]

1-ESS1-1

Students who demonstrate understanding can:

Use observations of the sun, moon, stars, and tides to describe patterns that can be predicted.

Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.

Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day. Students not required to know the mechanisms that control tides.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.	ESS1.A: The Universe and its Stars Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.	Patterns - Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes natural events happen today as they happened in the past. - Many events are repeated.

1-ESS1-2

Students who demonstrate understanding can:

Make and graph observations at different times of year to relate the amount of daylight to the time of year, and graph findings.

Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.

Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Make observations (firsthand or from media) to collect data that can be used to make comparisons.	ESS1.B: Earth and the Solar System Seasonal patterns of sunrise and sunset can be observed, described, and predicted.	Patterns Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

SECOND GRADE

The performance expectations in second grade help students formulate answers to questions such as: “How does land change and what are some things that cause it to change? What are the different kinds of land and bodies of water? How are materials similar and different from one another, and how do the properties of the materials relate to their use? What do plants need to grow? How many types of living things live in a place?” Second grade performance expectations include PS1, LS2, LS4, ESS1, ESS2, and ETS1

Disciplinary Core Ideas from the NRC Framework. Students are expected to develop an understanding of what plants need to grow and how plants depend on animals for seed dispersal and pollination. Students are also expected to compare the diversity of life in different habitats. An understanding of observable properties of materials is developed by students at this level through analysis and classification of different materials. Students are able to apply their understanding of the idea that wind and water can change the shape of the land to compare design solutions to slow or prevent such change. Students are able to use information and models to identify and represent the shapes and kinds of land and bodies of water in an area and where water is found on Earth.

The crosscutting concepts of patterns; cause and effect; energy and matter; structure and function; stability and change; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the second grade performance expectations, students are expected to demonstrate grade- appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

2. Structure and Properties of Matter

Students who demonstrate understanding can:

- 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.** [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]
- 2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]
- 2-PS1-3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]
- 2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning wood.]

2-PS1-1

Students who demonstrate understanding can:

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.	PS1.A: Structure and Properties of Matter Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.	Patterns Patterns in the natural and human designed world can be observed.

2-PS1-2

Students who demonstrate understanding can:

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*

Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.

Assessment Boundary: Assessment of quantitative measurements is limited to length.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data from tests of an object or tool to determine if it works as intended.	PS1.A: Structure and Properties of Matter Different properties are suited to different purposes.	Cause and Effect - Simple tests can be designed to gather evidence to support or refute student ideas about causes. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science, on Society and the Natural World - Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

2-PS1-3

Students who demonstrate understanding can:

Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.	PS1.A: Structure and Properties of Matter - Different properties are suited to different purposes. - A great variety of objects can be built up from a small set of pieces.	Energy and Matter Objects may break into smaller pieces and be put together into larger pieces, or change shapes.

2-PS1-4

Students who demonstrate understanding can:

Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and burning wood.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence - Construct an argument with evidence to support a claim. Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - Science searches for cause and effect relationships to explain natural events.	PS1.B: Chemical Reactions Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.	Cause and Effect Events have causes that generate observable patterns.

2. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

- 2-LS2-1** **Plan and conduct an investigation to determine if plants need sunlight and water to grow.** [*Assessment Boundary: Assessment is limited to testing one variable at a time.*]

- 2-LS2-2** **Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*.** [Clarification Statement: Examples can include those components that mimic the natural structure of an animal that helps it disperse seeds (e.g., hair that snares seeds, squirrel cheek pouches that transport seeds) or that mimic the natural structure of an animal that helps it pollinate plants (e.g., bees have fuzzy bodies to which pollen sticks, hummingbirds have bills that transport pollen). Explain how the model disperses seeds or pollinates plants.]

- 2-LS4-1** **Make observations of plants and animals to compare the diversity of life in different habitats.** [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [*Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.*]

2-LS2-1

Students who demonstrate understanding can:

Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Assessment Boundary: Assessment is limited to testing one variable at a time.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.	LS2.A: Interdependent Relationships in Ecosystems Plants depend on water and light to grow.	Cause and Effect Events have causes that generate observable patterns.

2-LS2-2

Students who demonstrate understanding can:

Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*.

Clarification Statement: Examples can include those components that mimic the natural structure of an animal that helps it disperse seeds (e.g., hair that snares seeds, squirrel cheek pouches that transport seeds) or that mimic the natural structure of an animal that helps it pollinate plants (e.g., bees have fuzzy bodies to which pollen sticks, hummingbirds have bills that transport pollen). Explain how the model disperses seeds or pollinates plants.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a simple model based on evidence to represent a proposed object or tool.	LS2.A: Interdependent Relationships in Ecosystems - Plants depend on animals for pollination or to move their seeds around. ETS1.B: Developing Possible Solutions - Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. <i>(secondary)</i>	Structure and Function The shape and stability of structures of natural and designed objects are related to their function(s).

2-LS4-1

Students who demonstrate understanding can:

Make observations of plants and animals to compare the diversity of life in different habitats.

Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.

Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations - Make observations (firsthand or from media) to collect data which can be used to make comparisons. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Scientists look for patterns and order when making observations about the world.	LS4.D: Biodiversity and Humans There are many different kinds of living things in any area, and they exist in different places on land and in water.	

2. Earth's Systems: Processes that Shape the Earth

Students who demonstrate understanding can:

- 2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions, earthquakes, tsunamis, avalanches, and landslides, which happen quickly and events such as erosion of rocks and movement of glaciers, which occur slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]
- 2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land. Discuss the solutions for controlling erosion.]
- 2-ESS2-2 Develop a model to represent the shapes and kinds of land and bodies of water in an area.** [Clarifying Statement: Discuss the features of the models.] [Assessment Boundary: Assessment does not include quantitative scaling in models.]
- 2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.**

2-ESS1-1

Students who demonstrate understanding can:

Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Clarification Statement: Examples of events and timescales could include volcanic explosions, earthquakes, tsunamis, avalanches, and landslides, which happen quickly and events such as erosion of rocks and movement of glaciers, which occur slowly.

Assessment Boundary: Assessment does not include quantitative measurements of timescales.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Make observations from several sources to construct an evidence-based account for natural phenomena.	ESS1.C: The History of Planet Earth Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.	Stability and Change Things may change slowly or rapidly.

2-ESS2-1

Students who demonstrate understanding can:

Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*

Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land. Discuss the solutions for controlling erosion.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Compare multiple solutions to a problem.	ESS2.A: Earth Materials and Systems - Wind and water can change the shape of the land. ETS1.C: Optimizing the Design Solution - Because there is always more than one possible solution to a problem, it is useful to compare and test designs. <i>(secondary)</i>	Stability and Change - Things may change slowly or rapidly. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Developing and using technology has impacts on the natural world. Connections to Nature of Science Science Addresses Questions About the Natural and Material World - Scientists study the natural and material world.

2-ESS2-2

Develop a model to represent the shapes and kinds of land and bodies of water in an area. [Clarifying Statement: Discuss the features of the models.] [Assessment Boundary: Assessment does not include quantitative scaling in models.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to represent patterns in the natural world.	ESS2.B: Plate Tectonics and Large-Scale System Interactions Maps show where things are located. One can map the shapes and kinds of land and water in any area.	Patterns Patterns in the natural world can be observed.

2-ESS2-3

Obtain information to identify where water is found on Earth and that it can be solid or liquid.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question.	ESS2.C: The Roles of Water in Earth's Surface Processes Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	Patterns Patterns in the natural world can be observed.

THIRD GRADE

The performance expectations in third grade help students formulate answers to questions such as: “What is typical weather in different parts of the world and during different times of the year? How can the impact of weather-related hazards be reduced? How do organisms vary in their traits? How are plants, animals, and environments of the past similar or different from current plants, animals, and environments? What happens to organisms when their environment changes? How do equal and unequal forces on an object affect the object? How can magnets be used?”

Third grade performance expectations include PS2, LS1, LS2, LS3, LS4, ESS2, and ESS3

Disciplinary Core Ideas from the NRC Framework. Students are able to organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. Students are expected to develop an understanding of the similarities and differences of organisms’ life cycles. An understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops, is acquired by students at this level. In addition, students are able to construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Students are expected to develop an understanding of types of organisms that lived long ago and also about the nature of their environments. Third graders are expected to develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. Students are able to determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. They are then able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the third grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems; developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

3. Forces and Interactions

Students who demonstrate understanding can:

- 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]
- 3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]
- 3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]
- 3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

3-PS2-1

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.

Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	PS2.A: Forces and Motion Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) PS2.B: Types of Interactions Objects in contact exert forces on each other.	Cause and Effect Cause and effect relationships are routinely identified.

3-PS2-2

Students who demonstrate understanding can:

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Clarification Statement:

Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.

Assessment Boundary:

Assessment does not include technical terms such as period and frequency.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	PS2.A: Forces and Motion The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)	Patterns Patterns of change can be used to make predictions.

3-PS2-3

Students who demonstrate understanding can:

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Clarification Statement:

Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.

Assessment Boundary:

Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Ask questions that can be investigated based on patterns such as cause and effect relationships.	PS2.B: Types of Interactions Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.

3-PS2-4

Students who demonstrate understanding can:

Define a simple design problem that can be solved by applying scientific ideas about magnets.*

Clarification Statement:

Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	PS1.C: Nuclear Processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.	Energy and Matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.

3. Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms

Students who demonstrate understanding can:

- 3-LS2-1** **Construct an argument that some animals form groups that help members survive.** [Clarification Statement: Alaska examples may include wolves, musk ox, caribou, and schools of fish.]
- 3-LS4-1** **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]
- 3-LS4-3** **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]
- 3-LS4-4** **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms. Solution may be created or provided. Students evaluate the solution to the problem to determine the merit of the solution. Students describe how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

3-LS2-1

Students who demonstrate understanding can:

Construct an argument that some animals form groups that help members survive.

Clarification Statement:

Alaska examples may include wolves, musk ox, caribou, and schools of fish.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an argument with evidence, data, and/or a model.	LS2.D: Social Interactions and Group Behavior Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size (<i>Note: Moved from K-2</i>).	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

3-LS4-1

Students who demonstrate understanding can:

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.

Assessment Boundary:

Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to make sense of phenomena using logical reasoning.	LS4.A: Evidence of Common Ancestry and Diversity Some kinds of plants and animals that once lived on Earth are no longer found anywhere. <i>(Note: moved from K-2)</i> Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.	Scale, Proportion, and Quantity Observable phenomena exist from very short to very long time periods.

3-LS4-3

Students who demonstrate understanding can:

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Clarification Statement:

Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an argument with evidence.	LS4.C: Adaptation For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

3-LS4-4

Students who demonstrate understanding can:

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*

Clarification Statement:

Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms. Solution may be created or provided. Students evaluate the solution to the problem to determine the merit of the solution. Students describe how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system.

Assessment Boundary:

Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. <i>(secondary)</i> LS4.D: Biodiversity and Humans Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	Systems and System Models A system can be described in terms of its components and their interactions.

3. Inheritance and Variation of Traits: Life Cycles and Traits

Students who demonstrate understanding can:

- 3-LS1-1** **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.** [Clarification Statement: Changes organisms, such as salmon, woolly bear caterpillar, frogs, go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]
- 3-LS3-1** **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]
- 3-LS3-2** **Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; a pet dog that is given too much food and little exercise may become overweight; and, comparison of plants and animals in Arctic regions versus non-Arctic regions.]
- 3-LS4-2** **Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.** [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

3-LS1-1

Students who demonstrate understanding can:

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Clarification Statement:

Changes organisms, such as salmon, woolly bear caterpillar, frogs, go through during their life form a pattern.

Assessment Boundary:

Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop models to describe phenomena.	LS1.B: Growth and Development of Organisms Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	Patterns Patterns of change can be used to make predictions.

3-LS3-1

Students who demonstrate understanding can:

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

Clarification Statement:

Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.

Assessment Boundary:

Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to make sense of phenomena using logical reasoning.	LS3.A: Inheritance of Traits Many characteristics of organisms are inherited from their parents. LS3.B: Variation of Traits Different organisms vary in how they look and function because they have different inherited information.	Patterns Similarities and differences in patterns can be used to sort and classify natural phenomena.

3-LS3-2

Students who demonstrate understanding can:

Use evidence to support the explanation that traits can be influenced by the environment.

Clarification Statement:

Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; a pet dog that is given too much food and little exercise may become overweight; and, comparison of plants and animals in Arctic regions versus non-Arctic regions

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use evidence (e.g., observations, patterns) to support an explanation.	LS3.A: Inheritance of Traits Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. LS3.B: Variation of Traits The environment also affects the traits that an organism develops.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

3-LS4-2

Students who demonstrate understanding can:

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use evidence (e.g., observations, patterns) to construct an explanation.	LS4.B: Natural Selection Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

3. Weather and Climate

Students who demonstrate understanding can:

- 3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data at this grade level could include student-generated graphs of average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]
- 3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.**
- 3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent storm erosion or flooding (e.g., from storm surges), or buildup of snow drifts; wind resistant roofs, lightning rods, and other weather hazards such as white-out conditions.]

3-ESS2-1

Students who demonstrate understanding can:

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Clarification Statement:

Examples of data at this grade level could include student-generated graphs of average temperature, precipitation, and wind direction.

Assessment Boundary:

Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.	ESS2.D: Weather and Climate Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	Patterns Patterns of change can be used to make predictions.

3-ESS2-2

Students who demonstrate understanding can:

Obtain and combine information to describe climates in different regions of the world.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtain and combine information from books and other reliable media to explain phenomena.	ESS2.D: Weather and Climate Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.	Patterns Patterns of change can be used to make predictions.

3-ESS3-1

Students who demonstrate understanding can:

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*

Clarification Statement:

Examples of design solutions to weather-related hazards could include barriers to prevent storm erosion or flooding (e.g., from storm surges), or buildup of snow drifts; wind resistant roofs, lightning rods, and other weather hazards such as white-out conditions.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	ESS3.B: Natural Hazards A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. <i>(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)</i>	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.

3-5.Engineering Design

Students who demonstrate understanding can:

- 3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

FOURTH GRADE

The performance expectations in fourth grade help students formulate answers to questions such as: “What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth’s features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?” Fourth grade performance expectations include PS3, PS4, LS1, ESS1, ESS2, ESS3, and ETS1

Disciplinary Core Ideas from the NRC Framework. Students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth’s features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another.

The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

4. Energy

Students who demonstrate understanding can:

- 4-PS3-1** **Use evidence to construct an explanation relating the speed of an object to the energy of that object.** *[Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.]*
- 4-PS3-2** **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** *[Assessment Boundary: Assessment does not include quantitative measurements of energy.]*
- 4-PS3-3** **Ask questions and predict outcomes about the changes in energy that occur when objects collide.** *[Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. Examples may be at different scales, such as bouncing balls, car crashes, and plate tectonics (e.g., collisions of land to land, ice to ice, and ice to land).]*
[Assessment Boundary: Assessment does not include quantitative measurements of energy.]
- 4-PS3-4** **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*** *[Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.]* *[Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]*
- 4-ESS3-1** **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.** *[Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, tidal, geothermal, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]*

4-PS3-1

Students who demonstrate understanding can:

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Use evidence (e.g., measurements, observations, patterns) to construct an explanation.	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses.	Energy and Matter Energy can be transferred in various ways and between objects.

4-PS3-2

Students who demonstrate understanding can:

Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Assessment Boundary:

Assessment does not include quantitative measurements of energy.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	PS3.A: Definitions of Energy Energy can be moved from place to place by moving objects or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.	Energy and Matter Energy can be transferred in various ways and between objects.

4-PS3-3

Students who demonstrate understanding can:

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement:

Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. Examples may be at different scales, such as bouncing balls, car crashes, and plate tectonics (e.g., collisions of land to land, ice to ice, and ice to land).

Assessment Boundary:

Assessment does not include quantitative measurements of energy.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	PS3.A: Definitions of Energy Energy can be moved from place to place by moving objects or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. PS3.C: Relationship Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the objects' motions.	Energy and Matter Energy can be transferred in various ways and between objects.

4-PS3-4

Students who demonstrate understanding can:

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*

Clarification Statement:

Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.

Assessment Boundary:

Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific ideas to solve design problems.	PS3.B: Conservation of Energy and Energy Transfer Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. PS3.D: Energy in Chemical Processes and Everyday Life The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. ETS1.A: Defining Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. <i>(secondary)</i>	Energy and Matter Energy can be transferred in various ways and between objects.

4-ESS3-1

Students who demonstrate understanding can:

Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Clarification Statement:

Examples of renewable energy resources could include wind energy, water behind dams, tidal, geothermal, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtain and combine information from books and other reliable media to explain phenomena.	ESS3.A: Natural Resources Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

4. Waves

Students who demonstrate understanding can:

- 4-PS4-1** **Develop and use a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.** [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]
- 4-PS4-3** **Generate and compare multiple solutions that use patterns to transfer information.*** [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

4-PS4-1

Students who demonstrate understanding can:

Develop and use a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Clarification Statement:

Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.

Assessment Boundary:

Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model using an analogy, example, or abstract representation to describe a scientific principle.	PS4.A: Wave Properties Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. <i>(Note: This grade band endpoint was moved from K–2.)</i> Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).	Patterns Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.

4-PS4-3

Students who demonstrate understanding can:

Generate and compare multiple solutions that use patterns to transfer information.*

Clarification Statement:

Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	PS4.C: Information Technologies and Instrumentation Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. ETS1.C: Optimizing The Design Solution Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. <i>(secondary)</i>	Patterns Similarities and differences in patterns can be used to sort and classify designed products.

4. Structure, Function, and Information Processing

Students who demonstrate understanding can:

- 4-PS4-2** **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.** *[Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]*

- 4-LS1-1** **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** *[Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, skin, gills, scales, and bones.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]*

- 4-LS1-2** **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** *[Clarification Statement: Emphasis is on systems of information transfer. Examples may include salmon homing, responses of marine invertebrates to sound and smell, and sonar communication among whales and other marine mammals.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]*

4-PS4-2

Students who demonstrate understanding can:

Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Clarification Statement:

Assessment Boundary:

Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to describe phenomena.	PS4.B: Electromagnetic Radiation An object can be seen when light reflected from its surface enters the eyes.	Cause and Effect Cause and effect relationships are routinely identified.

4-LS1-1

Students who demonstrate understanding can:

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Clarification Statement:

Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, skin, gills, scales, and bones.

Assessment Boundary:

Assessment is limited to macroscopic structures within plant and animal systems.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an argument with evidence, data, and/or a model.	LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	Systems and System Models A system can be described in terms of its components and their interactions.

4-LS1-2

Students who demonstrate understanding can:

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Clarification Statement:

Emphasis is on systems of information transfer. Examples may include salmon homing, responses of marine invertebrates to sound and smell, and sonar communication among whales and other marine mammals.

Assessment Boundary:

Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model to test interactions concerning the functioning of a natural system.	LS1.D: Information Processing Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.	Systems and System Models A system can be described in terms of its components and their interactions.

4. Earth's Systems: Processes that Shape the Earth

Students who demonstrate understanding can:

- 4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.** [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]
- 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.** [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]
- 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.** [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]
- 4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*** [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

4-ESS1-1

Students who demonstrate understanding can:

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Clarification Statement:

Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

Assessment Boundary:

Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Identify the evidence that supports particular points in an explanation.	ESS1.C: The History of Planet Earth Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	Patterns Patterns can be used as evidence to support an explanation.

4-ESS2-1

Students who demonstrate understanding can:

Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Clarification Statement:

Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.

Assessment Boundary:

Assessment is limited to a single form of weathering or erosion.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	ESS2.A: Earth Materials and Systems Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ESS2.E: Biogeology Living things affect the physical characteristics of their regions.	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.

4-ESS2-2

Students who demonstrate understanding can:

Analyze and interpret data from maps to describe patterns of Earth's features.

Clarification Statement:

Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to make sense of phenomena using logical reasoning.	ESS2.B: Plate Tectonics and Large-Scale System Interactions The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.	Patterns Patterns can be used as evidence to support an explanation.

4-ESS3-2

Students who demonstrate understanding can:

Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*.

Clarification Statement:

Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.

Assessment Boundary:

Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.	ESS3.B: Natural Hazards A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. <i>(Note: This Disciplinary Core Idea can also be found in 3.WC.)</i> ETS1.B: Designing Solutions to Engineering Problems Testing a solution involves investigating how well it performs under a range of likely conditions. <i>(secondary)</i>	Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.

FIFTH GRADE

The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?” Fifth grade performance expectations include PS1, PS2, PS3, LS1, LS2, ESS1, ESS2, and ESS3

Disciplinary Core Ideas from the NRC Framework. Students are able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun. Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas. In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.

5. Structure and Properties of Matter

Students who demonstrate understanding can:

- 5-PS1-1** **Develop and use a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
- 5-PS1-2** **Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]
- 5-PS1-3** **Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]
- 5-PS1-4** **Conduct an investigation to determine whether the mixing of two or more substances results in new substances.** [Clarifying Statement: Share finding from the investigation.]

5-PS1-1

Students who demonstrate understanding can:

Develop and use a model to describe that matter is made of particles too small to be seen.

Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.

Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use models to describe phenomena.	PS1.A: Structure and Properties of Matter Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.	Scale, Proportion, and Quantity Natural objects exist from the very small to the immensely large.

5-PS1-2

Students who demonstrate understanding can:

Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.

Assessment Boundary: Assessment does not include distinguishing mass and weight.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Measure and graph quantities such as weight to address scientific and engineering questions and problems.	PS1.A: Structure and Properties of Matter - The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. PS1.B: Chemical Reactions - No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)	Scale, Proportion, and Quantity - Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. <i>Connections to Nature of Science</i> Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes consistent patterns in natural systems.

5-PS1-3

Students who demonstrate understanding can:

Make observations and measurements to identify materials based on their properties.

Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.

Assessment Boundary: Assessment does not include density or distinguishing mass and weight.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	PS1.A: Structure and Properties of Matter Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)	Scale, Proportion, and Quantity Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

5-PS1-4

Students who demonstrate understanding can:

Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Clarifying Statement: Share finding from the investigation.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	PS1.B: Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

5. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

- 5-PS3-1** **Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]
- 5-LS1-1** **Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]
- 5-LS2-1** **Develop and describe a model that describes the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.]
[Assessment Boundary: Assessment does not include molecular explanations.]

5-PS3-1

Students who demonstrate understanding can:

Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

Clarification Statement: Examples of models could include diagrams, and flow charts.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use models to describe phenomena.	PS3.D: Energy in Chemical Processes and Everyday Life - The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). LS1.C: Organization for Matter and Energy Flow in Organisms - Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. <i>(secondary)</i>	Energy and Matter Energy can be transferred in various ways and between objects.

5-LS1-1

Students who demonstrate understanding can:

Support an argument that plants get the materials they need for growth chiefly from air and water.

Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Support an argument with evidence, data, or a model.	LS1.C: Organization for Matter and Energy Flow in Organisms Plants acquire their material for growth chiefly from air and water.	Energy and Matter Matter is transported into, out of, and within systems.

5-LS2-1

Students who demonstrate understanding can:

Develop and describe a model that describes the movement of matter among plants, animals, decomposers, and the environment.

Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.

Assessment Boundary: Assessment does not include molecular explanations.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models - Develop a model to describe phenomena. Connections to the Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - Science explanations describe the mechanisms for natural events.	LS2.A: Interdependent Relationships in Ecosystems The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.	Systems and System Models A system can be described in terms of its components and their interactions.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.	

5. Earth's Systems

Students who demonstrate understanding can:

- 5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere (water), cryosphere (ice), and/or atmosphere interact.** [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, cryosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
- 5-ESS2-2 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** [Classification Statement: Examples could include lakes, rivers, glaciers, sea ice, oceans, groundwater, and polar ice caps. Represent and interpret the data represented by the graphical displays.] [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]
- 5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.**

5-ESS2-1

Students who demonstrate understanding can:

Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere (water), cryosphere (ice), and/or atmosphere interact.

Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, cryosphere, atmosphere, and biosphere are each a system.

Assessment Boundary: Assessment is limited to the interactions of two systems at a time.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model using an example to describe a scientific principle.	ESS2.A: Earth Materials and Systems Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.	Systems and System Models A system can be described in terms of its components and their interactions.

5-ESS2-2

Students who demonstrate understanding can:

Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Classification Statement: Examples could include lakes, rivers, glaciers, sea ice, oceans, groundwater, and polar ice caps. Represent and interpret the data represented by the graphical displays.

Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Describe and graph quantities such as area and volume to address scientific questions.	ESS2.C: The Roles of Water in Earth's Surface Processes Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	Scale, Proportion, and Quantity Standard units are used to measure and describe physical quantities such as weight and volume.

5-ESS3-1

Students who demonstrate understanding can:

Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.	ESS3.C: Human Impacts on Earth Systems Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments.	Systems and System Models - A system can be described in terms of its components and their interactions. Connections to Nature of Science Science Addresses Questions About the Natural and Material World. - Science findings are limited to questions that can be answered with empirical evidence.

5. Space Systems: Stars and the Solar System

Students who demonstrate understanding can:

- 5-PS2-1** **Support an argument that the gravitational force exerted by Earth on objects is directed toward the center of the Earth.**
[Clarification Statement: “Down” is a local description of the direction that points toward the center of the spherical Earth.]
[Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]
- 5-ESS1-1** **Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.** [Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, and stage).]
- 5-ESS1-2** **Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, daily appearance of the moon, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]

5-PS2-1

Students who demonstrate understanding can:

Support an argument that the gravitational force exerted by Earth on objects is directed toward the center of the Earth.

Clarification Statement: “Down” is a local description of the direction that points toward the center of the spherical Earth.

Assessment Boundary: Assessment does not include mathematical representation of gravitational force.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Support an argument with evidence, data, or a model.	PS2.B: Types of Interactions The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

5-ESS1-1

Students who demonstrate understanding can:

Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.

Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, and stage).

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Support an argument with evidence, data, or a model.	ESS1.A: The Universe and its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.	Scale, Proportion, and Quantity Natural objects exist from the very small to the immensely large.

5-ESS1-2

Students who demonstrate understanding can:

Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, daily appearance of the moon, and the seasonal appearance of some stars in the night sky.

Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.

Assessment Boundary: Assessment does not include causes of seasons.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.	ESS1.B: Earth and the Solar System The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.	Patterns Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

MIDDLE SCHOOL PHYSICAL SCIENCES

Students in middle school continue to develop understanding of four core ideas in the physical sciences. The middle school performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. In the physical sciences, performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.

The performance expectations in the topic **Structure and Properties of Matter** help students to formulate an answer to the questions: “How can particles combine to produce a substance with different properties? How does thermal energy affect particles?” by building understanding of what occurs at the atomic and molecular scale. By the end of middle school, students will be able to apply understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They will be able to provide molecular level accounts to explain states of matters and changes between states. The crosscutting concepts of cause and effect; scale, proportion and quantity; structure and function; interdependence of science, engineering, and technology; and influence of science, engineering and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in developing and using models, and obtaining, evaluating, and communicating information. Students use these scientific and engineering practices to demonstrate understanding of the core ideas.

The performance expectations in the topic **Chemical Reactions** help students to formulate an answer to the questions: “What happens when new materials are formed? What stays the same and what changes?” by building understanding of what occurs at the atomic and molecular scale during chemical reactions. By the end of middle school, students will be able to provide molecular level accounts to explain that chemical reactions involve regrouping of atoms to form new substances, and that atoms rearrange during chemical reactions. Students are also able to apply an understanding of the design and the process of optimization in engineering to chemical reaction systems. The crosscutting concepts of patterns and energy and matter are called out as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in developing and using models, analyzing and interpreting data, and designing solutions. Students use these scientific and engineering practices to demonstrate understanding of the core ideas.

The performance expectations in the topic **Forces and Interactions** focus on helping students understand ideas related to why some objects will keep moving, why objects fall to the ground and why some materials are attracted to each other while others are not. Students answer the

question, “How can one describe physical interactions between objects and within systems of objects?” At the middle school level, the PS2 Disciplinary Core Idea from the NRC Framework is broken down into two sub-ideas: Forces and Motion and Types of interactions. By the end of September 2017 ©2013 Achieve, Inc. All rights reserved. 33 of 102 middle school, students will be able to apply Newton’s Third Law of Motion to relate forces to explain the motion of objects. Students also apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while other repel. In particular, students will develop understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are also able to apply an engineering practice and concept to solve a problem caused when objects collide. The crosscutting concepts of cause and effect; system and system models; stability and change; and the influence of science, engineering, and technology on society and the natural world serve as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, and designing solutions, and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

The performance expectations in the topic **Energy** help students formulate an answer to the question, “How can energy be transferred from one object or system to another?” At the middle school level, the PS3 Disciplinary Core Idea from the NRC Framework is broken down into four sub-core ideas: Definitions of Energy, Conservation of Energy and Energy Transfer, the Relationship between Energy and Forces, and Energy in Chemical Process and Everyday Life. Students develop their understanding of important qualitative ideas about energy including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students will also come to know the difference between energy and temperature, and begin to develop an understanding of the relationship between force and energy. Students are also able to apply an understanding of design to the process of energy transfer. The crosscutting concepts of scale, proportion, and quantity; systems and system models; and energy are called out as organizing concepts for these disciplinary core ideas. These performance expectations expect students to demonstrate proficiency in developing and using models, planning investigations, analyzing and interpreting data, and designing solutions, and engaging in argument from evidence; and to use these practices to demonstrate understanding of the core ideas in PS3.

The performance expectations in the topic **Waves and Electromagnetic Radiation** help students formulate an answer to the question, “What are the characteristic properties of waves and how can they be used?” At the middle school level, the PS4 Disciplinary Core Idea from the NRC Framework is broken down into Wave Properties, Electromagnetic Radiation, and Information Technologies and Instrumentation. Students are able to describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means to send digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these disciplinary core ideas. These performance expectations focus on students demonstrating proficiency in

developing and using models, using mathematical thinking, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.

MS. Structure and Properties of Matter

Students who demonstrate understanding can:

- MS-PS1-1** **Develop models to describe the atomic composition of simple molecules and extended structures.** [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]
- MS-PS1-3** **Collect information that supports the idea that synthetic materials come from the use of natural resources, and analyze the positive and negative effects of use and development of synthetics on society.** [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]
- MS-PS1-4** **Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.** [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

MS-PS1-1

Students who demonstrate understanding can:

Develop models to describe the atomic composition of simple molecules and extended structures.

Clarification Statement:

Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.

Assessment Boundary:

Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to predict and/or describe phenomena.	PS1.A: Structure and Properties of Matter - Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. - Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).	Scale, Proportion, and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

MS-PS1-3

Students who demonstrate understanding can:

Collect information that supports the idea that synthetic materials come from the use of natural resources, and analyze the positive and negative effects of use and development of synthetics on society.

Clarification Statement:

Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)	PS1.B: Chemical Reactions Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants	Structure and Function - Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. Influence of Science, Engineering and Technology on Society and the Natural World - The uses of technologies and any limitation on their use are driven by individual or societal needs, desires, and values; by the findings of scientific

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
		research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)

MS-PS1-4

Students who demonstrate understanding can:

Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Clarification Statement:

Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Develop a model to predict and/or describe phenomena.	PS1.A: Structure and Properties of Matter - Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. - In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. - The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. PS3.A: Definitions of Energy - The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material.	

MS. Chemical Reactions

Students who demonstrate understanding can:

- MS-PS1-2** **Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.** [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]
- MS-PS1-5** **Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.** [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]
- MS-PS1-6** **Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.** [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of chemical process designs could involve dissolving ammonium chloride or calcium chloride and chemical heat packs. Examples of physical process designs could involve a plastic bag and hot water. Alaskan physical examples could include: countercurrent exchange in the limbs and surfaces of Arctic animals and the DIFFERENCE IN THE albedo effect of open ocean water vs. sea ice.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]

MS-PS1-2

Students who demonstrate understanding can:

Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Clarification Statement:

Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.

Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings. Connections to Nature of Science Scientific Knowledge is based on Empirical Evidence - Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)	PS1.A: Structure and Properties of Matter - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. PS1.B: Chemical Reactions - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants	Patterns Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

MS-PS-5

Students who demonstrate understanding can:

Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

Clarification Statement:

Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.

Assessment Boundary:

Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models - Develop a model to describe unobservable mechanisms Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - Laws are regularities or mathematical descriptions of natural phenomena.	PS1.B: Chemical Reactions - Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. - The total number of each type of atom is conserved, and thus the mass does not change.	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

MS-PS-6

Students who demonstrate understanding can:

Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

Clarification Statement:

Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of chemical process designs could involve dissolving ammonium chloride or calcium chloride and chemical heat packs. Examples of physical process designs could involve a plastic bag and hot water. Alaskan physical examples could include: countercurrent exchange in the limbs and surfaces of Arctic animals and the DIFFERENCE IN THE albedo effect of open ocean water vs. sea ice.

Assessment Boundary:

Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.	PS1.B: Chemical Reactions - Some chemical reactions release energy, others store energy. ETS1.B: Developing Possible Solutions - A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. ETS1.C: Optimizing the Design Solution - Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. - The iterative process of testing the most promising solutions and modifying what is	Energy and Matter The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	

MS. Forces and Interactions

Students who demonstrate understanding can:

- MS-PS2-1** **Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.*** [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]
- MS-PS2-2** **Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.** [Clarification Statement: Emphasis is on balanced (Newton’s First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton’s Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]
- MS-PS2-3** **Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, the effect of increasing the number or strength of magnets on the speed of an electric motor, or a change in the range and intensity of the aurora over time.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]
- MS-PS2-4** **Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.** [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton’s Law of Gravitation or Kepler’s Laws.]
- MS-PS2-5** **Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.** [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]

MS-PS2-1

Students who demonstrate understanding can:

Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.

Clarification Statement:

Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.

Assessment Boundary:

Assessment is limited to vertical or horizontal interactions in one dimension.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	PS2.A: Forces and Motion For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton’s third law).	Systems and System Models - Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

MS-PS2-2

Students who demonstrate understanding can:

Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Clarification Statement:

Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.

Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	PS2.A: Forces and Motion - The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. - All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.	Stability and Change Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.

MS-PS2-3

Students who demonstrate understanding can:

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Clarification Statement:

Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, the effect of increasing the number or strength of magnets on the speed of an electric motor, or a change in the range and intensity of the aurora over time.

Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	PS2.B: Types of Interactions Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.

MS-PS2-4

Students who demonstrate understanding can:

Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Clarification Statement:

Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.

Assessment Boundary: Assessment does not include Newton’s Law of Gravitation or Kepler’s Laws.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	PS2.B: Types of Interactions Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).	Systems and System Models Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.

MS-PS2-5

Students who demonstrate understanding can:

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Clarification Statement:

Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.

Assessment Boundary:

Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.	PS2.B: Types of Interactions Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.

MS. Energy

Students who demonstrate understanding can:

- MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.** [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]
- MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.** [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]
- MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, a Styrofoam cup, or traditional seasonal clothing or dwellings.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
- MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.** [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
- MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.** [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]

MS-PS3-1

Student who demonstrate understanding:

Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Clarification Statement:

Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Construct and interpret graphical displays of data to identify linear and nonlinear relationships.	PS3.A: Definitions of Energy Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.	Scale, Proportion, and Quantity Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.

MS-PS3-2

Students who demonstrate understanding:

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

Clarification Statement:

Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.

Assessment Boundary:

Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to describe unobservable mechanisms.	PS3.A: Definitions of Energy - A system of objects may also contain stored (potential) energy, depending on their relative positions. PS3.C: Relationship Between Energy and Forces - When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.	Systems and System Models Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.

MS-PS3-3

Students who demonstrate understanding:

Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Clarification Statement: Examples of devices could include an insulated box, a solar cooker, a Styrofoam cup, or traditional seasonal clothing or dwellings.

Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)	PS3.A: Definitions of Energy - Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. - Energy is spontaneously transferred out of hotter regions or objects and into colder ones. ETS1.A: Defining and Delimiting an Engineering Problem - The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3) ETS1.B: Developing Possible Solutions	Scale, Proportion, and Quantity - Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. Energy and Matter - The transfer of energy can be tracked as energy flows through a designed or natural system.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (secondary to MS-PS3-3)	

MS-PS3-4

Students who demonstrate understanding:

Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.

Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	PS3.A: Definitions of Energy - Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. PS3.B: Conservation of Energy and Energy Transfer - The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.	Scale, Proportion, and Quantity Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes

MS-PS3-5

Students who demonstrate understanding:

Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.

Assessment Boundary: Assessment does not include calculations of energy.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)	PS3.B: Conservation of Energy and Energy Transfer <i>When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)</i>	Energy and Matter Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion).

MS. Waves and Electromagnetic Radiation

Students who demonstrate understanding can:

- MS-PS4-1** Qualitatively and quantitatively describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Examples can include waves modeled with a jump rope, slinky, water, seismic activity, and sound.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]
- MS-PS4-2** **Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.** [Clarification Statement: Emphasis is on both light and mechanical waves (including sound). Examples of models could include drawings, simulations, and written descriptions. Alaskan examples include whale echolocation, or use of sonar projection of the sea floor and fish populations.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
- MS-PS4-3** Integrated with HS PS4-2

MS-PS4-1

Students who demonstrate understanding:

Qualitatively and quantitatively describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

Clarification Statement: Examples can include waves modeled with a jump rope, slinky, water, seismic activity, and sound.

Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking - Use mathematical representations to describe and/or support scientific conclusions and design solutions. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Science knowledge is based upon logical and conceptual connections between evidence and explanations.	PS4.A: Wave Properties A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.	Patterns Graphs and charts can be used to identify patterns in data.

MS-PS4-2

Students who demonstrate understanding:

Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Clarification Statement: Emphasis is on both light and mechanical waves (including sound). Examples of models could include drawings, simulations, and written descriptions. Alaskan examples include whale echolocation, or use of sonar projection of the sea floor and fish populations.

Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe a phenomena	PS4.A: Wave Properties - A sound wave needs a medium through which it is transmitted. PS4.B: Electromagnetic Radiation - When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. - The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. - A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. - However, because light can travel through space, it cannot be a matter wave, like sound or water waves.	Structure and Function Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

MS-PS4-3

Integrated with HS PS4-2

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Obtaining, Evaluating, and Communicating Information Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)	PS4.C: Information Technologies and Instrumentation Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)	Structure and Function - Structures can be designed to serve particular functions. (MS-PS4-3) Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3) Connections to Nature of Science Science is a Human Endeavor - Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

MIDDLE SCHOOL LIFE SCIENCES

Students in middle school develop understanding of key concepts to help them make sense of the life sciences. These ideas build upon students' science understanding from earlier grades and from the disciplinary core ideas, science and engineering practices, and crosscutting concepts of other experiences with physical and earth sciences. There are five life science topics in middle school: 1) Structure, Function, and Information Processing, 2) Growth, Development, and Reproduction of Organisms, 3) Matter and Energy in Organisms and Ecosystems, 4) Interdependent Relationships in Ecosystems, and 5) Natural Selection and Adaptations. The performance expectations in middle school blend core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge across the science disciplines. While the performance expectations in middle school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many science and engineering practices integrated in the performance expectations. The concepts and practices in the performance expectations are based on the grade-band endpoints described in A Framework for K-12 Science Education (NRC, 2012).

The Performance Expectations in **Structure, Function, and Information Processing** help students formulate an answer to the question, "How do the structures of organisms contribute to life's functions?" Middle school students can plan and carry out investigations to develop evidence that living organisms are made of cells and to determine the relationship of organisms to the environment. Students can use understanding of cell theory to develop physical and conceptual models of cells. They can construct explanations for the interactions of systems in cells and organisms and how organisms gather and use information from the environment. By the end of their studies, students understand that all organisms are made of cells, that special structures are responsible for particular functions in organisms, and that for many organisms the body is a system of multiple interacting subsystems that form a hierarchy from cells to the body. Crosscutting concepts of cause and effect, structure and function, and matter and energy are called out as organizing concepts for these core ideas.

The Performance Expectations in **Growth, Development, and Reproduction of Organisms** help students formulate an answer to the question, "How do organisms grow, develop, and reproduce?" Students understand how the environment and genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications for sexual and asexual reproduction. Students can develop evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. They have a beginning understanding of the ways humans can select for specific traits, the role of technology, genetic modification, and the nature of ethical responsibilities related to selective breeding. At the end of middle school, students can explain how selected structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. Students can use the practices of analyzing and interpreting data, using models, conducting investigations and communicating information. Crosscutting concepts of structure and function, change and stability, and matter and energy flow in organisms support understanding across this topic.

The Performance Expectations in **Matter and Energy in Organisms and Ecosystems** help students formulate answers to the questions: “How do organisms obtain and use matter and energy? How do matter and energy move through an ecosystem?” Middle school students can use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They can construct explanations for the cycling of matter in organisms and the interactions of organisms to obtain the matter and energy from the ecosystem to survive and grow. Students have a grade-appropriate understanding and use of the practices of investigations, constructing arguments based on evidence, and oral and written communication. They understand that sustaining life requires substantial energy and matter inputs and the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. Adding to these crosscutting concepts is a deeper understanding of systems and system models that ties the performances expectations in this topic together.

The Performance Expectations in **Interdependent Relationships in Ecosystems** help students formulate an answer to the question, “How do organisms interact with other organisms in the physical environment to obtain matter and energy? To answer the question, middle school students construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students can use models, construct evidence-based explanations, and use argumentation from evidence. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. Crosscutting concepts of matter and energy, systems and system models, and cause and effect are used by students to support understanding the phenomena they study.

The Performance Expectations in **Natural Selection and Adaptations** help students formulate answers to the questions: “How does genetic variation among organisms in a species affect survival and reproduction? How does the environment influence genetic traits in populations over multiple generations?” Middle school students can analyze data from the fossil record to describe evidence of the history of life on Earth and can construct explanations for similarities in organisms. They have a beginning understanding of the role of variation in natural selection and how this leads to speciation. They have a grade-appropriate understanding and use of the practices of analyzing graphical displays; using mathematical models; and gathering, reading, and communicating information. The crosscutting concept of cause and effect is central to this topic.

MS. Structure, Function, and Information Processing

Students who demonstrate understanding can:

- MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.** [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]
- MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.** [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]
- MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]
- MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.** [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

MS-LS1-1

Students who demonstrate understanding can:

Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.	LS1.A: Structure and Function All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	Scale, Proportion, and Quantity - Phenomena that can be observed at one scale may not be observable at another scale. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.

MS-LS1-2

Students who demonstrate understanding can:

Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.

Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	LS1.A: Structure and Function Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	Structure and Function Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function.

MS-LS1-3

Students who demonstrate understanding can:

Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.

Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.	In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.	Systems and System Models - Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Connections to Engineering, Technology, and Applications of Science Science is a Human Endeavor - Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

MS-LS1-8

Students who demonstrate understanding can:

Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.	LS1.D: Information Processing Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

MS. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

- MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.** [Clarification Statement: Emphasis is on tracing the role of vegetation in movement of matter and flow of energy. Alaskan examples include: caribou eating lichen through the winter, forests and other ecosystems thriving with contribution of decaying salmon, and phytoplankton and seaweed in marine food chain.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]
- MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.** [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources. This emphasis should include local ecosystem processes and traditional native ways of knowing.]
- MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. Examples should include: food web, energy pyramid, cycles of water, oxygen, nitrogen, and carbon. Alaska references could include animal droppings contributing nutrients to tundra and other ecosystems.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** [Clarification Statement: Emphasis is on recognizing patterns in data, evaluating the validity of and analyzing the evidence, and making logical inferences that explain or predict changes in population based on physical or biological changes.]

MS-LS1-6

Students who demonstrate understanding can:

Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Clarification Statement: Emphasis is on tracing the role of vegetation in movement of matter and flow of energy. Alaskan examples include: caribou eating lichen through the winter, forests and other ecosystems thriving with contribution of decaying salmon, and phytoplankton and seaweed in marine food chain.

Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical connections between evidence and explanations.	LS1.C: Organization for Matter and Energy Flow in Organisms - Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. PS3.D: Energy in Chemical Processes and Everyday Life - The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)	Energy and Matter Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

MS-LS1-7

Students who demonstrate understanding can:

Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.

Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to describe unobservable mechanisms. (MS-LS1-7)	LS1.C: Organization for Matter and Energy Flow in Organisms - Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) PS3.D: Energy in Chemical Processes and Everyday Life - Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)	Cause and Effect - Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1) Energy and Matter - Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

MS-LS2-1

Students that demonstrate understanding can:

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources. This emphasis should include local ecosystem processes and traditional native ways of knowing.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) - Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)	LS2.A: Interdependent Relationships in Ecosystems - Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) - In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) - Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

MS-LS2-3

Students who demonstrate understanding can:

Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. Examples should include: food web, energy pyramid, cycles of water, oxygen, nitrogen, and carbon.

Alaska references could include animal droppings contributing nutrients to tundra and other ecosystems.

Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to describe phenomena. (MS-LS2-3)	LS2.B: Cycle of Matter and Energy Transfer in Ecosystems Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)	Energy and Matter - The transfer of energy can be tracked as energy flows through a natural system. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

MS-LS2-4

Students who demonstrate understanding can:

Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Clarification Statement: Emphasis is on recognizing patterns in data, evaluating the validity of and analyzing the evidence, and making logical inferences that explain or predict changes in population based on physical or biological changes.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science disciplines share common rules of obtaining and evaluating empirical evidence.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	Stability and Change Small changes in one part of a system might cause large changes in another part.

MS. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

- MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
- MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

MS-LS2-2

Students who demonstrate understanding can:

Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.	LS2.A: Interdependent Relationships in Ecosystems Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	Patterns Patterns can be used to identify cause and effect relationships.

MS-LS2-5

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience - Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (MS-LS2-5) LS4.D Biodiversity and Humans - Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (MS-LS2-5) ETS1.B: Developing Possible Solutions - There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	Stability and Change - Small changes in one part of a system might cause large changes in another part.(MS-LS2-5) Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) Connections to Nature of Science Science Addresses Questions About the Natural and Material World - Scientific knowledge can describes consequence of actions but does not make the decisions that society takes. (MS-LS2-5)

MS. Growth, Development, and Reproduction of Organisms

Students who demonstrate understanding can:

- MS-LS1-4. Use an evidence-based argument to support an explanation for how characteristic behaviors and/or structures of organisms affect the probability of their successful reproduction.** [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building and burrowing to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollinators, and hard shells on nuts that squirrels bury.]
- MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.** [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds. Alaskan examples include fish sizes/population in fresh vs. salt water or of varying water temperatures, deer size and color (Sitka blacktail deer), bear size and color.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]
- MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.** [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins and that the changes can have far-reaching effects.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]
- MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.** [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]
- MS-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.** [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]

MS-LS1-4

Students who demonstrate understanding can:

Use an evidence-based argument to support an explanation for how characteristic behaviors and/or structures of organisms affect the probability of their successful reproduction.

Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building and burrowing to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollinators, and hard shells on nuts that squirrels bury.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4)	LS1.B: Growth and Development of Organisms - Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) - Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)	Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MS-LS1-5),(MS-LS4-5)

MS-LS1-5

Students who demonstrate understanding can:

Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms.

Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds. Alaskan examples include fish sizes/population in fresh vs. salt water or of varying water temperatures, deer size and color (Sitka blacktail deer), bear size and color.

Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	LS1.B: Growth and Development of Organisms Genetic factors as well as local conditions affect the growth of the adult plant.	Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

MS-LS3-1

Students who demonstrate understanding can:

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins and that the changes can have far-reaching effects.

Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	LS3.A: Inheritance of Traits - Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. LS3.B: Variation of Traits - In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	Structure and Function Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function.

MS-LS3-2

Students who demonstrate understanding can:

Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [

Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena. (MS- LS3-1),(MS-LS3-2)	LS1.B: Growth and Development of Organisms - Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2) LS3.A: Inheritance of Traits - Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. LS3.B: Variation of Traits - In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural systems.

MS-LS4-5

Students who demonstrate understanding can:

Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)	LS4.B: Natural Selection In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)	Cause and Effect - Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5) Connections to Nature of Science Science Addresses Questions About the

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
		Natural and Material World Science knowledge can describe consequences of actions but does not make the decisions that society takes.

MS. Natural Selection and Adaptations

Students who demonstrate understanding can:

- MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.** [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]
- MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.** [Clarification Statement: Emphasis is on comparing anatomical differences, such as field experiences using dichotomous and other types of keys, in order to explain evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]
- MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.** [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]
- MS-LS4-4. Construct and present an evidence-based explanation of how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.** [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]
- MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

MS-LS4-1

Students who demonstrate understanding can:

Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.

Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Analyze and interpret data to determine similarities and differences in findings. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Science knowledge is based upon logical and conceptual connections between evidence and explanations.	4.A: Evidence of Common Ancestry and Diversity The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.	Patterns - Graphs, charts, and images can be used to identify patterns in data. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

MS-LS4-2

Students who demonstrate understanding can:

Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

Clarification Statement: Emphasis is on comparing anatomical differences, such as field experiences using dichotomous and other types of keys, in order to explain evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events.	LS4.A: Evidence of Common Ancestry and Diversity Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.	Patterns - Patterns can be used to identify cause and effect relationships. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

MS-LS4-3

Students who demonstrate understanding can:

Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.

Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze displays of data to identify linear and nonlinear relationships.	LS4.A: Evidence of Common Ancestry and Diversity Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.	Patterns Graphs, charts, and images can be used to identify patterns in data.

MS-LS4-4

Students who demonstrate understanding can:

Construct and present an evidence-based explanation of how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.	LS4.B: Natural Selection Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

MS-LS4-6

Students who demonstrate understanding can:

Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.

Assessment Boundary: Assessment does not include Hardy Weinberg calculations.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations to support scientific conclusions and design solutions.	LS4.C: Adaptation Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	Cause and Effect Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

MIDDLE SCHOOL EARTH AND SPACE SCIENCES

Students in middle school develop understanding of a wide range of topics in Earth and space science (ESS) that build upon science concepts from elementary school through more advanced content, practice, and crosscutting themes. There are six ESS standard topics in middle school: Space Systems, History of Earth, Earth's Interior Systems, Earth's Surface Systems, Weather and Climate, and Human Impacts. The content of the performance expectations are based on current community-based geoscience literacy efforts such as the Earth Science Literacy Principles (Wyssession et al., 2012), and is presented with a greater emphasis on an Earth Systems Science approach. The performance expectations strongly reflect the many societally relevant aspects of ESS (resources, hazards, environmental impacts) as well as related connections to engineering and technology.

Space Systems: Middle school students can examine the Earth's place in relation to the solar system, Milky Way galaxy, and universe. There is a strong emphasis on a systems approach, using models of the solar system to explain astronomical and other observations of the cyclic patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories that explain the formation and evolution of the universe.

History of Earth: Students can examine geoscience data in order to understand the processes and events in Earth's history. Important concepts in this topic are "Scale, Proportion, and Quantity" and "Stability and Change," in relation to the different ways geologic processes operate over the long expanse of geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems.

Earth's Systems: Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students can investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Of special importance in both topics are the ways that geoscience processes provide resources needed by society but also cause natural hazards that present risks to society; both involve technological challenges, for the identification and development of resources and for the mitigation of hazards.

Weather and Climate: Students can analyze data, including maps, and construct and use models to develop understanding of the factors that control weather and climate. A systems approach is also important here, examining the feedbacks between systems as energy from the sun is transferred between systems and circulates through the ocean and atmosphere.

Human Impacts: Students understand the ways that human activities impacts Earth's other systems. Students can use many different practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development.

MS. Space Systems

Students who demonstrate understanding can:

- MS-ESS1-1a** **Develop and use a model to explain how the positions of the Earth-Sun-Moon in a system and the cyclic patterns of each cause lunar phases and eclipses of the sun and moon.** [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]
- MS-ESS1-1b** **Develop and use a model to explain how the seasons occur.** [Clarification statement: Reference Alaskan community latitudes and how position on the Earth affects the severity of the seasons for the different regions of AK. Compare and describe the seasons of the northern hemisphere and the southern hemisphere.] [Assessment Boundary: Assessment limited to qualitative and spatial explanations for seasons.]
- MS-ESS1-2** **Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.** [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state.)) [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]
- MS-ESS1-3** **Analyze data to determine scale properties of objects in the solar system.** [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

MS-ESS1-1a

Students who demonstrate understanding can:

Develop and use a model to explain how the positions of the Earth-Sun-Moon in a system and the cyclic patterns of each cause lunar phases and eclipses of the sun and moon.

Clarification Statement: Examples of models can be physical, graphical, or conceptual.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	ESS1.A The Universe and its Stars - Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. ESS1.B: Earth and the Solar System - This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short- term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.	Patterns - Patterns can be used to identify cause and effect relationships. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

MS-ESS1-1b

Students who demonstrate understanding can:

Develop and use a model to explain how the seasons occur.

Clarification statement: Reference Alaskan community latitudes and how position on the Earth affects the severity of the seasons for the different regions of AK. Compare and describe the seasons of the northern hemisphere and the southern hemisphere.

Assessment Boundary: Assessment limited to qualitative and spatial explanations for seasons.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	ESS1.A The Universe and its Stars - Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. ESS1.B: Earth and the Solar System - This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short- term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.	Patterns - Patterns can be used to identify cause and effect relationships. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

MS-ESS1-2

Students who demonstrate understanding can:

Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state.)

Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	ESS1.A The Universe and its Stars - Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. ESS1.B: Earth and the Solar System - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them - The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	Systems and System Models - Models can be used to represent systems and their interactions. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

MS-ESS1-3

Students who demonstrate understanding can:

Analyze data to determine scale properties of objects in the solar system.

Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.

Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to determine similarities and differences in findings.	ESS1.B: Earth and the Solar System The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	Scale, Proportion, and Quantity - Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.

MS. History of Earth

Students who demonstrate understanding can:

- MS-ESS1-4 Construct and explain, using evidence from rock strata, how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.** [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]
- MS-ESS2-2 Construct and present an evidence-based explanation of how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate. Alaskan examples should include locally significant landforms including coastal or ocean sea floor structures.]
- MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.** [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

MS-ESS1-4

Students who demonstrate understanding can:

Construct and explain, using evidence from rock strata, how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.

Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	ESS1.C: The History of Planet Earth - The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. ESS2.B: Plate Tectonics and Large-Scale System Interactions - Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	Scale Proportion and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

MS-ESS2-2

Students who demonstrate understanding can:

Construct and present an evidence-based explanation of how geoscience processes have changed Earth's surface at varying time and spatial scales.

Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate. Alaskan examples should include locally significant landforms including coastal or ocean sea floor structures.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	ESS2.A: Earth's Materials and Systems - The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future ESS2.C: The Roles of Water in Earth's Surface Processes - Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.	Scale Proportion and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

MS-ESS2-3

Students who demonstrate understanding can:

Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).

Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) Connections to Nature of Science Scientific Knowledge is Open to Revision in Light of New Evidence - Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)	ESS1.C: The History of Planet Earth - Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE)(secondary to MS-ESS2-3) ESS2.B: Plate Tectonics and Large-Scale System Interactions - Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)	Patterns Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. (MS-ESS2-3)

MS. Earth's Systems

Students who demonstrate understanding can:

- MS-ESS2-1** **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]
- MS-ESS2-4** **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
- MS-ESS3-1** **Construct an evidence-based explanation for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

MS-ESS2-1

Students who demonstrate understanding can:

Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.

Assessment Boundary: Assessment does not include the identification and naming of minerals.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena. (MS- ESS2-1)	ESS2.A: Earth's Materials and Systems All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)	Stability and Change Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS- ESS2-1)

MS-ESS2-4

Students who demonstrate understanding can:

Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle.

Examples of models can be conceptual or physical.

Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model to describe unobservable mechanisms. (MS-ESS2-4)	ESS2.C: The Roles of Water in Earth's Surface Processes - Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) - Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)	Energy and Matter Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

MS-ESS3-1

Students who demonstrate understanding can:

Construct an evidence-based explanation for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)	ESS3.A: Natural Resources Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)	Cause and Effect - Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1) Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - All human activity draws on natural resources and has both short and long- term consequences, positive as well a negative, for the health of people and the natural environment. (MS-ESS3-1)

MS. Weather and Climate

Students who demonstrate understanding can:

- MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] *[Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]*
- MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] *[Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]*
- MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures and chemistry (both ocean and land surface), sea ice cover, permafrost, glacial change, atmospheric levels of gases such as carbon dioxide and methane, food availability locally and worldwide, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

MS-ESS2-5

Students who demonstrate understanding can:

Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation)..

Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems - Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5) Planning and Carrying Out Investigations - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)	ESS2.C: The Roles of Water in Earth's Surface Processes - The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate - Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) - The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6) ESS3.D: Global Climate Change	Cause and Effect - Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5) Stability and Change - Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	

MS-ESS2-6

Students who demonstrate understanding can:

Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model to describe phenomena.	ESS2.C: The Roles of Water in Earth's Surface Processes - Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. ESS2.D: Weather and Climate - Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. - The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.	Systems and System Models Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.

MS-ESS3-5

Students who demonstrate understanding can:

Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures and chemistry (both ocean and land surface), sea ice cover, permafrost, glacial change, atmospheric levels of gases such as carbon dioxide and methane, food availability locally and worldwide, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Ask questions to identify and clarify evidence of an argument.	ESS3.D: Global Climate Change Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	Stability and Change Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

MS. Human Impacts

Students who demonstrate understanding can:

- MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts). Alaskan examples should include but are not limited to tsunamis, storm surges, landslides, and earthquakes.]
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.***[Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.** [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

MS-ESS3-2

Students who demonstrate understanding can:

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts). Alaskan examples should include but are not limited to tsunamis, storm surges, landslides, and earthquakes.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze and interpret data to determine similarities and differences in findings.	ESS3.B: Natural Hazards Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.	Patterns - Graphs, charts, and images can be used to identify patterns in data. Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - The uses of technologies and limitations on their use are driven by people's needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

MS-ESS3-3

Students who demonstrate understanding can:

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific principles to design an object, tool, process or system.	ESS3.C: Human Impacts on Earth Systems - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. - Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	Cause and Effect - Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. - The uses of technologies and limitations on their use are driven by people's needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

MS-ESS3-4

Students who demonstrate understanding can:

Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	ESS3.C: Human Impacts on Earth Systems Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	Cause and Effect - Cause and effect relationships may be used to predict phenomena in natural or designed systems. Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. Connections to Nature of Science Science Addresses Questions About the Natural and Material World - Science knowledge can describe consequences of actions but does not make the decisions that society takes.

MS. Engineering Design

Students who demonstrate understanding can:

- MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4** Develop a model to generate data for repetitive testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

HIGH SCHOOL PHYSICAL SCIENCES

Students in high school continue to develop their understanding of the four core ideas in the physical sciences. These ideas include the most fundamental concepts from chemistry and physics, but are intended to leave room for expanded study in upper-level high school courses. The high school performance expectations in Physical Science build on the middle school ideas and skills and allow high school students to explain more in-depth phenomena central not only to the physical sciences, but to life and earth and space sciences as well. These performance expectations blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain ideas across the science disciplines. In the physical science performance expectations at the high school level, there is a focus on several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several engineering practices, including design and evaluation.

The performance expectations in the topic **Structure and Properties of Matter** help students formulate an answer to the question, “How can one explain the structure and properties of matter?” Two sub-ideas from the *NRC Framework* are addressed in these performance expectations: the structure and properties of matter, and nuclear processes. Students are expected to develop understanding of the substructure of atoms and provide more mechanistic explanations of the properties of substances. Students are able to use the periodic table as a tool to explain and predict the properties of elements. Phenomena involving nuclei are also important to understand, as they explain the formation and abundance of the elements, radioactivity, the release of energy from the sun and other stars, and the generation of nuclear power. The crosscutting concepts of patterns, energy and matter, and structure and function are called out as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in developing and using models, planning and conducting investigations, and communicating scientific and technical information; and to use these practices to demonstrate understanding of the core ideas.

The performance expectations in the topic **Chemical Reactions** help students formulate an answer to the questions: “How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?” Chemical reactions, including rates of reactions and energy changes, can be understood by students at this level in terms of the collisions of molecules and the rearrangements of atoms. Using this expanded knowledge of chemical reactions, students are able to explain important biological and geophysical phenomena. Students are also able to apply an understanding of the process of optimization in engineering design to chemical reaction systems. The crosscutting concepts of patterns, energy and matter, and stability and change are called out as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in developing

and using models, using mathematical thinking, constructing explanations, and designing solutions; and to use these practices to demonstrate understanding of the core ideas.

The Performance Expectations associated with the topic **Forces and Interactions** supports students' understanding of ideas related to why some objects will keep moving, why objects fall to the ground, and why some materials are attracted to each other while others are not. Students should be able to answer the question, "How can one explain and predict interactions between objects and within systems of objects?" The disciplinary core idea expressed in the Framework for PS2 is broken down into the sub ideas of Forces and Motion and Types of Interactions. The performance expectations in PS2 focus on students building understanding of forces and interactions and Newton's Second Law. Students also develop understanding that the total momentum of a system of objects is conserved when there is no net force on the system. Students are able to use Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. Students are able to apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. The crosscutting concepts of patterns, cause and effect, and systems and system models are called out as organizing concepts for these disciplinary core ideas. In the PS2 performance expectations, students are expected to demonstrate proficiency in planning and conducting investigations, analyzing data and using math to support claims, and applying scientific ideas to solve design problems; and to use these practices to demonstrate understanding of the core ideas.

The Performance Expectations associated with the topic **Energy** help students formulate an answer to the question, "How is energy transferred and conserved?" The disciplinary core idea expressed in the Framework for PS3 is broken down into four sub-core ideas: Definitions of Energy, Conservation of Energy and Energy Transfer, the Relationship between Energy and Forces, and Energy in Chemical Process and Everyday Life. Energy is understood as quantitative property of a system that depends on the motion and interactions of matter and radiation within that system, and the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students develop an understanding that energy at both the macroscopic and the atomic scale can be accounted for as either motions of particles or energy associated with the configuration (relative positions) of particles. In some cases, the energy associated with the configuration of particles can be thought of as stored in fields. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of cause and effect; systems and system models; energy and matter; and the influence of science, engineering, and technology on society and the natural world are further developed in the performance expectations associated with PS3. In these performance expectations, students are expected to demonstrate proficiency in developing and using models, planning and carry out investigations, using computational thinking, and designing solutions; and to use these practices to demonstrate understanding of the core ideas.

The Performance Expectations associated with the topic **Waves and Electromagnetic Radiation** are critical to understand how many new technologies work. As such, this disciplinary core idea helps students answer the question, "How are waves used to transfer energy and send and store information?" The disciplinary core idea in PS4 is broken down into Wave Properties, Electromagnetic Radiation, and Information

Technologies and Instrumentation. Students are able to apply understanding of how wave properties and the interactions of electromagnetic radiation with matter can transfer information across long distances, store information, and investigate nature on many scales. Models of electromagnetic radiation as either a wave of changing electric and magnetic fields or as particles are developed and used. Students understand that combining waves of different frequencies can make a wide variety of patterns and thereby encode and transmit information. Students also demonstrate their understanding of engineering ideas by presenting information about how technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. The crosscutting concepts of cause and effect; systems and system models; stability and change; interdependence of science, engineering, and technology; and the influence of engineering, technology, and science on society and the natural world are highlighted as organizing concepts for these disciplinary core ideas. In the PS3 performance expectations, students are expected to demonstrate proficiency in asking questions, using mathematical thinking, engaging in argument from evidence, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.

HS. Structure and Properties of Matter

Students who demonstrate understanding can:

- HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (valence electrons).** [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]
- HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.** [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.]
- HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.** [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations. Example applications include dating of rocks, carbon dating of artifacts, paleoclimate studies, medical imaging, tracking animal migrations via diet, age dating meteorites, tracking ground water flow.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]
- HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of natural and designed materials.** [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]

HS-PS1-1

Students who demonstrate understanding can:

Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (valence electrons).

Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.

Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model to predict the relationships between systems or between components of a system.	PS1.A: Structure and Properties of Matter - Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. - The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

HS-PS1-3

Students who demonstrate understanding can:

Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.

Assessment Boundary: *Assessment does not include Raoult's law calculations of vapor pressure.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations - Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	PS1.A: Structure and Properties of Matter - The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. PS2.B: Types of Interactions - Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. <i>(secondary)</i>	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

HS-PS1-8

Students who demonstrate understanding can:

Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations. Example applications include dating of rocks, carbon dating of artifacts, paleoclimate studies, medical imaging, tracking animal migrations via diet, age dating meteorites, tracking ground water flow.

Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	PS1.C: Nuclear Processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.	Energy and Matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.

HS-PS2-6

Students who demonstrate understanding can:

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of natural and designed materials.

Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.

Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	PS2.B: Types of Interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.	Structure and Function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

HS. Chemical Reactions

Students who demonstrate understanding can:

- HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.** [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]
- HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.** [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.]
- HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.** [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.]
- HS-PS1-6. Make arguments based on kinetic molecular theory to explain how altering conditions affects the forward and reverse rates of a reaction at equilibrium.** [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.]
- HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.** [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.]

HS-PS1-2

Students who demonstrate understanding can:

Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.

Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	PS1.C: Nuclear Processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.	Energy and Matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.

HS-PS1-4

Students who demonstrate understanding can:

Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.

Assessment Boundary: *Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	PS1.A: Structure and Properties of Matter - A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. PS1.B: Chemical Reactions - Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	Energy and Matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.

HS-PS1-5

Students who demonstrate understanding can:

Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.

Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.	PS1.B: Chemical Reactions Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

HS-PS1-6

Students who demonstrate understanding can:

Make arguments based on kinetic molecular theory to explain how altering conditions affects the forward and reverse rates of a reaction at equilibrium.

Clarification Statement: Emphasis is on the application of Le Chatelier’s Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.

Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	PS1.B: Chemical Reactions - In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. ETS1.C: Optimizing the Design Solution - Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. <i>(secondary)</i>	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.

HS-PS1-7

Students who demonstrate understanding can:

Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.

Assessment Boundary: Assessment does not include complex chemical reactions.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations of phenomena to_	PS1.B: Chemical Reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	Energy and Matter The total amount of energy and matter in closed systems is conserved.

HS. Forces and Interactions

Students who demonstrate understanding can:

- HS-PS2-1. Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.** [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled by a constant force.] [Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.]
- HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.** [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]
- HS-PS2-3. Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*** [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]
- HS-PS2-4. Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.** [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]
- HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.** [Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.]

HS-PS2-1

Students who demonstrate understanding can:

Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled by a constant force.

Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	PS2.A: Forces and Motion Newton's second law accurately predicts changes in the motion of macroscopic objects.	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-PS2-2

Students who demonstrate understanding can:

Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.

Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations of phenomena to describe explanations.	PS2.A: Forces and Motion Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.	Systems and System Models When investigating or describing a system, the boundaries and initial conditions of the system need to be defined.

HS-PS2-3

Students who demonstrate understanding can:

Apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.

Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.	PS2.A: Forces and Motion If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. ETS1.A: Defining and Delimiting an Engineering Problem Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. <i>(secondary)</i> ETS1.C: Optimizing the Design Solution Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. <i>(secondary)</i>	Cause and Effect Systems can be designed to cause a desired effect.

HS-PS2-4

Students who demonstrate understanding can:

Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.

Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.

Assessment Boundary: *Assessment is limited to systems with two objects.*

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations of phenomena to describe explanations.	PS2.B: Types of Interactions - Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. - Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

HS-PS2-5

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

Assessment Boundary: *Assessment is limited to designing and conducting investigations with provided materials and tools.*

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	PS2.B: Types of Interactions - Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) - Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. PS3.A: Definitions of Energy “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. (<i>secondary</i>)	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS. Energy

Students who demonstrate understanding can:

- HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.** [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model. Examples of models could include different insulation types or windows.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]
- HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).** [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.]
- HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*** [Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.]
- HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).** [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.] [Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students.]
- HS-PS3-5 Develop and use a model of two objects interacting through electrical or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction (Coulomb's Law).** [Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.] [Assessment Boundary: Assessment is limited to systems containing two objects.]

HS-PS3-1

Students who demonstrate understanding can:

Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.

Assessment Boundary: *Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Create a computational model or simulation of a phenomenon, designed device, process, or system.	PS3.A: Definitions of Energy - Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. PS3.B: Conservation of Energy and Energy Transfer - Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. - Energy cannot be created or destroyed, but it can be transported from one place	Systems and System Models - Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes the universe is a vast single system in which basic laws are consistent.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system.	

HS-PS3-2

Students who demonstrate understanding can:

Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative positions of particles (objects).

Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	PS3.A: Definitions of Energy - Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. - At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. - These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the	Energy and Matter Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.	

HS-PS3-3

Students who demonstrate understanding can:

Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*

Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.

Assessment Boundary: *Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	PS3.A: Definitions of Energy - At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. PS3.D: Energy in Chemical Processes - Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. ETS1.A: Defining and Delimiting Engineering Problems - Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a	Energy and Matter - Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World - Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	way that one can tell if a given design meets them.	

HS-PS3-4

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.

Assessment Boundary: *Assessment is limited to investigations based on materials and tools provided to students.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	PS3.B: Conservation of Energy and Energy Transfer - Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. - Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). PS3.D: Energy in Chemical Processes - Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.	Systems and System Models When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.

HS-PS3-5

Students who demonstrate understanding can:

Develop and use a model of two objects interacting through electrical or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction (Coulomb's Law).

Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.

Assessment Boundary: *Assessment is limited to systems containing two objects.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	PS3.C: Relationship Between Energy and Forces When two objects interacting through a field change relative position, the energy stored in the field is changed.	Cause and Effect Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

HS. Waves and Electromagnetic Radiation

Students who demonstrate understanding can:

- HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.** [Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.] [Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.]
- HS-PS4-2. Evaluate questions about the advantages and disadvantages of using digital transmission and storage of information with respect to that of forms other than digital, including analog.** [Clarification Statement: Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.]
- HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.** [Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.] [Assessment Boundary: Assessment does not include using quantum theory.]
- HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** [Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is limited to qualitative descriptions.]
- HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*** [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.]

HS-PS4-1

Students who demonstrate understanding can:

Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.

Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations.	PS4.A: Wave Properties The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-PS4-2

Students who demonstrate understanding can:

Evaluate questions about the advantages and disadvantages of using digital transmission and storage of information with respect to that of forms other than digital, including analog.

Clarification Statement: Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.	PS4.A: Wave Properties Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses.	Stability and Change Systems can be designed for greater or lesser stability.

HS-PS4-3

Students who demonstrate understanding can:

Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.

Assessment Boundary: Assessment does not include using quantum theory.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	PS4.A: Wave Properties [From the 3–5 grade band endpoints] Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Boundary: The discussion at this grade level is qualitative only; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) PS4.B: Electromagnetic Radiation - Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.	Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

HS-PS4-4

Students who demonstrate understanding can:

Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.

Assessment Boundary: Assessment is limited to qualitative descriptions.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.	PS4.B: Electromagnetic Radiation When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells.	Cause and Effect Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.

HS-PS4-5

Students who demonstrate understanding can:

Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.

Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	PS3.D: Energy in Chemical Processes - Solar cells are human-made devices that likewise capture the sun’s energy and produce electrical energy. (<i>secondary</i>) PS4.A: Wave Properties - Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. PS4.B: Electromagnetic Radiation - Photoelectric materials emit electrons when they absorb light of a high-enough frequency. - PS4.C: Information Technologies and Instrumentation - Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern	Cause and Effect Systems can be designed to cause a desired effect.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.	

HIGH SCHOOL LIFE SCIENCES

Students in high school develop understanding of key concepts that help them make sense of life science. The ideas are building upon students' science understanding of disciplinary core ideas, science and engineering practices, and crosscutting concepts from earlier grades. There are five life science topics in high school: 1) *Structure and Function*, 2) *Inheritance and Variation of Traits*, 3) *Matter and Energy in Organisms and Ecosystems*, 4) *Interdependent Relationships in Ecosystems*, and 5) *Natural Selection and Evolution*. The performance expectations for high school life science blend core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge that can be applied across the science disciplines. While the performance expectations in high school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices underlying the performance expectations. The performance expectations are based on the grade-band endpoints described in *A Framework for K-12 Science Education* (NRC, 2012).

The performance expectations in the topic **Structure and Function** help students formulate an answer to the question: "How do the structures of organisms enable life's functions?" High school students are able to investigate explanations for the structure and function of cells as the basic units of life, the hierarchical systems of organisms, and the role of specialized cells for maintenance and growth. Students demonstrate understanding of how systems of cells function together to support the life processes. Students demonstrate their understanding through critical reading, using models, and conducting investigations. The crosscutting concepts of structure and function, matter and energy, and systems and system models in organisms are called out as organizing concepts.

The performance expectations in the topic **Inheritance and Variation of Traits** help students in pursuing an answer to the question: "How are the characteristics from one generation related to the previous generation?" High school students demonstrate understanding of the relationship of DNA and chromosomes in the processes of cellular division that pass traits from one generation to the next. Students can determine why individuals of the same species vary in how they look, function, and behave. Students can develop conceptual models for the role of DNA in the unity of life on Earth and use statistical models to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science can be described. Students can explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expression. Crosscutting concepts of structure and function, patterns, and cause and effect developed in this topic help students to generalize understanding of inheritance of traits to other applications in science.

The performance expectations in the topic **Matter and Energy in Organisms and Ecosystems** help students answer the questions: "How do organisms obtain and use energy they need to live and grow? How do matter and energy move through ecosystems?" High school students can construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. They can apply mathematical concepts to develop evidence to support explanations of the interactions of photosynthesis and cellular respiration and develop models to communicate

these explanations. They can relate the nature of science to how explanations may change in light of new evidence and the implications for our understanding of the tentative nature of science. Students understand organisms' interactions with each other and their physical environment, how organisms obtain resources, change the environment, and how these changes affect both organisms and ecosystems. In addition, students can utilize the crosscutting concepts of matter and energy and Systems and system models to make sense of ecosystem dynamics.

The performance expectations in the topic **Interdependent Relationships in Ecosystems** help students answer the question, "How do organisms interact with the living and non-living environment to obtain matter and energy?" This topic builds on the other topics as high school students demonstrate an ability to investigate the role of biodiversity in ecosystems and the role of animal behavior on survival of individuals and species. Students have increased understanding of interactions among organisms and how those interactions influence the dynamics of ecosystems. Students can generate mathematical comparisons, conduct investigations, use models, and apply scientific reasoning to link evidence to explanations about interactions and changes within ecosystems.

The performance expectations in the topic **Natural Selection and Evolution** help students answer the questions: "How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? How does biodiversity affect humans?" High school students can investigate patterns to find the relationship between the environment and natural selection. Students demonstrate understanding of the factors causing natural selection and the process of evolution of species over time. They demonstrate understanding of how multiple lines of evidence contribute to the strength of scientific theories of natural selection and evolution. **Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution.** Students can use models, apply statistics, analyze data, and produce scientific communications about evolution. Understanding of the crosscutting concepts of patterns, scale, structure and function, and cause and effect supports the development of a deeper understanding of this topic.

HS. Structure and Function

Students who demonstrate understanding can:

- HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.** *[Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]*
- HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** *[Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]*
- HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** *[Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]*

HS-LS1-1

Students who demonstrate understanding can: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.

Clarification Statement:

Assessment Boundary: *Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life. - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.	Structure and Function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

HS-LS1-2

Students who demonstrate understanding can: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.

Assessment Boundary: *Assessment does not include interactions and functions at the molecular or chemical reaction level.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	LS1.A: Structure and Function Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

HS-LS1-3

Students who demonstrate understanding can: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.

Assessment Boundary: *Assessment does not include interactions and functions at the molecular or chemical reaction level.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. Connections to Nature of Science Scientific Investigations Use a Variety of Methods - Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.	LS1.A: Structure and Function Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.	Stability and Change Feedback (negative or positive) can stabilize or destabilize a system.

HS. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

- HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.** [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]
- HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.** [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]
- HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.** [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]
- HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.** [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]
- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]
- HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** [Clarification Statement: Examples of models could include simulations and

mathematical models.] *[Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]*

HS-LS1-5

Students who demonstrate understanding can: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.

Assessment Boundary: *Assessment does not include specific biochemical steps.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model based on evidence to illustrate the relationships between systems or between components of a system.	LS1.C: Organization for Matter and Energy Flow in Organisms The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.	Energy and Matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.

HS-LS1-6

Students who demonstrate understanding can: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.

Assessment Boundary: *Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	LS1.C: Organization for Matter and Energy Flow in Organisms - The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. - As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.	Energy and Matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.

HS-LS1-7

Students who demonstrate understanding can: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.

Assessment Boundary: *Assessment should not include identification of the steps or specific processes involved in cellular respiration.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model based on evidence to illustrate the relationships between systems or between components of a system.	LS1.C: Organization for Matter and Energy Flow in Organisms - As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. - As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.	Energy and Matter Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.

HS-LS2-3

Students who demonstrate understanding can: Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.

Assessment Boundary: *Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions - Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. Connections to Nature of Science Scientific Knowledge is Open to Revision in Light of New Evidence - Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.	Energy and Matter Energy drives the cycling of matter within and between systems.

HS-LS2-4

Students who demonstrate understanding can: Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.

Assessment Boundary: *Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical representations of phenomena or design solutions to support claims.	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.	Energy and Matter Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.

HS-LS2-5

Students who demonstrate understanding can: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Clarification Statement: Examples of models could include simulations and mathematical models.

Assessment Boundary: *Assessment does not include the specific chemical steps of photosynthesis and respiration.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or components of a system.	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems - Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. PS3.D: Energy in Chemical Processes - The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.	Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

HS. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

- HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]
- HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]
- HS-LS2-6. Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.** [Clarification Statement: Examples of changes in ecosystem conditions could include hunting and fishing harvests, predation, flooding, sea ice variation, erosion, volcanic eruptions, land level changes due to earthquakes, tsunamis, changes in ocean current patterns or ocean chemistry, or sea-level rise.]
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*** [Clarification Statement: Examples of human activities can include urbanization, pollution, building dams and roads, and dissemination of invasive species. Example lessons can include applications of Tragedy of the Commons.]
- HS-LS2-8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.** [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]
- HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*** [Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

HS-LS2-1

Students who demonstrate understanding can: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.

Assessment Boundary: *Assessment does not include deriving mathematical equations to make comparisons.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use mathematical and/or computational representations of phenomena or design solutions to support explanations.	LS2.A: Interdependent Relationships in Ecosystems Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.	Scale, Proportion, and Quantity The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

HS-LS2-2

Students who demonstrate understanding can: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.

Assessment Boundary: *Assessment is limited to provided data.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking - Use mathematical representations of phenomena or design solutions to support and revise explanations. Connections to Nature of Science Scientific Knowledge is Open to Revision in Light of New Evidence - Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.	LS2.A: Interdependent Relationships in Ecosystems - Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. LS2.C: Ecosystem Dynamics, Functioning, and Resilience - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant	Scale, Proportion, and Quantity Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.	

HS-LS2-6

Students who demonstrate understanding can: Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Clarification Statement: Examples of changes in ecosystem conditions could include hunting and fishing harvests, predation, flooding, sea ice variation, erosion, volcanic eruptions, land level changes due to earthquakes, tsunamis, changes in ocean current patterns or ocean chemistry, or sea-level rise.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence - Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. Connections to Nature of Science Scientific Knowledge is Open to Revision in Light of New Evidence - Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.

HS-LS2-7

Students who demonstrate understanding can: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

Clarification Statement: Examples of human activities can include urbanization, pollution, building dams and roads, and dissemination of invasive species. Example lessons can include applications of Tragedy of the Commons.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience - Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. LS4.D: Biodiversity and Humans - Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. ETS1.B: Developing Possible Solutions When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	

HS-LS2-8

Students who demonstrate understanding can: Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence - Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. Connections to Nature of Science Scientific Knowledge is Open to Revision in Light of New Evidence - Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation.	LS2.D: Social Interactions and Group Behavior Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-LS4-6

Students who demonstrate understanding can: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Create or revise a simulation of a phenomenon, designed device, process, or system.	LS4.C: Adaptation - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. LS4.D: Biodiversity and Humans - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. ETS1.B: Developing Possible Solutions • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs	

HS. Inheritance and Variation of Traits

Students who demonstrate understanding can:

- HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** *[Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.]*
- HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.** *[Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]*
- HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.** *[Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]*
- HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.** *[Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]*

HS-LS1-4

Students who demonstrate understanding can: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Clarification Statement:

Assessment Boundary: *Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Use a model based on evidence to illustrate the relationships between systems or between components of a system.	LS1.B: Growth and Development of Organisms In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.	Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

HS-LS3-1

Students who demonstrate understanding can: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Clarification Statement:

Assessment Boundary: *Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Asking Questions and Defining Problems Ask questions that arise from examining models or a theory to clarify relationships.	LS1.A: Structure and Function - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. LS3.A: Inheritance of Traits - Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-LS3-2

Students who demonstrate understanding can: Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.

Assessment Boundary: *Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.	LS3.B: Variation of Traits - In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. - Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-LS3-3

Students who demonstrate understanding can: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.

Assessment Boundary: *Assessment does not include Hardy-Weinberg calculations.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	LS3.B: Variation of Traits Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.	Scale, Proportion, and Quantity - Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). Connections to Nature of Science Science is a Human Endeavor - Technological advances have influenced the progress of science and science has influenced advances in technology. - Science and engineering are influenced by society and society is influenced by science and engineering.

HS. Natural Selection and Evolution

Students who demonstrate understanding can:

- HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.** [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]
- HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.** [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.]
- HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.** [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]
- HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]
- HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.** [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, pollution, erosion, permafrost thawing, changes in sea ice, invasive species, land level changes due to earthquakes, changes

in ocean chemistry, sea level change, volcanic eruptions, drought, flood and the rate of change of the environment affect the distribution or disappearance of traits in species.]

HS-LS4-1

Students who demonstrate understanding can: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information - Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	LS4.A: Evidence of Common Ancestry and Diversity Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.	Patterns - Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future.

HS-LS4-2

Students who demonstrate understanding can: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.

Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	LS4.B: Natural Selection - Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. LS4.C: Adaptation - Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-LS4-3

Students who demonstrate understanding can: Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.

Assessment Boundary: *Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	LS4.B: Natural Selection - Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. - The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. LS4.C: Adaptation - Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. Adaptation also means that the distribution of traits in a population can change when conditions change.	

HS-LS4-4

Students who demonstrate understanding can: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	LS4.C: Adaptation Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.	Cause and Effect - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future.

HS-LS4-5

Students who demonstrate understanding can: Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, pollution, erosion, permafrost thawing, changes in sea ice, invasive species, land level changes due to earthquakes, changes in ocean chemistry, sea level change, volcanic eruptions, drought, flood and the rate of change of the environment affect the distribution or disappearance of traits in species.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	LS4.C: Adaptation - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. - Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HIGH SCHOOL EARTH AND SPACE SCIENCES

Students in high school develop understanding of a wide range of topics in Earth and space science (ESS) that build upon science concepts from middle school through more advanced content, practice, and crosscutting themes. There are five ESS standard topics in middle school: Space Systems, History of Earth, Earth's Systems, Weather and Climate, and Human Sustainability. The content of the performance expectations are based on current community-based geoscience literacy efforts such as the Earth Science Literacy Principles (Wyssession et al., 2012), and is presented with a greater emphasis on an Earth Systems Science approach. There are strong connections to mathematical practices of analyzing and interpreting data. The performance expectations strongly reflect the many societally relevant aspects of ESS (resources, hazards, environmental impacts) with an emphasis on using engineering and technology concepts to design solutions to challenges facing human society.

Space Systems: High school students can examine the processes governing the formation, evolution, and workings of the solar system and universe. Some concepts studied are fundamental to science, such as understanding how the matter of our world formed during the Big Bang and within the cores of stars. Others concepts are practical, such as understanding how short-term changes in the behavior of our sun directly affect humans. Engineering and technology play a large role here in obtaining and analyzing the data that support the theories of the formation of the solar system and universe.

History of Earth: Students can construct explanations for the scales of time over which Earth processes operate. An important aspect of Earth and space science involves making inferences about events in Earth's history based on a data record that is increasingly incomplete that farther you go back in time. A mathematical analysis of radiometric dating is used to comprehend how absolute ages are obtained for the geologic record. A key to Earth's history is the coevolution of the biosphere with Earth's other systems, not only in the ways that climate and environmental changes have shaped the course of evolution but also in how emerging life forms have been responsible for changing Earth.

Earth's Systems: Students can develop models and explanations for the ways that feedbacks between different Earth systems control the appearance of Earth's surface. Central to this is the tension between internal systems, which are largely responsible for creating land at Earth's surface (e.g., volcanism and mountain building), and the sun-driven surface systems that tear down the land through weathering and erosion. Students understand the role that water plays in affecting weather. Students understand chemical cycles such as the carbon cycle. Students can examine the ways that human activities cause feedbacks that create changes to other systems.

Weather and Climate: Students understand the system interactions that control weather and climate, with a major emphasis on the mechanisms and implications of climate change. Students understand the analysis and interpretation of different kinds of geoscience data allow students to construct explanations for the many factors that drive climate change over a wide range of time scales.

Human Impacts: Students understand the complex and significant interdependencies between humans and the rest of Earth's systems through the impacts of natural hazards, our dependencies on natural resources, and the environmental impacts of human activities.

HS. Space Systems

Students who demonstrate understanding can:

- HS-ESS1-1. Develop a model based on evidence to illustrate that the life span of the Sun is a function of nuclear fusion in its core, and that stars, through nuclear fusion over their life cycle, produce elements and release energy that eventually reaches Earth in the form of radiation.** [Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime. Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Example applications include solar flares, auroras, the 11-year sunspot cycle and non-cyclic variations over centuries.] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with nuclear fusion, or details of the many different nucleosynthesis pathways for stars of differing masses.]
- HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.** [Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).]
- HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.** [Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.] [Assessment Boundary: Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.]

HS-ESS1-1

Students who demonstrate understanding can: Develop a model based on evidence to illustrate that the life span of the Sun is a function of nuclear fusion in its core, and that stars, through nuclear fusion over their life cycle, produce elements and release energy that eventually reaches Earth in the form of radiation.

Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime. Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Example applications include solar flares, auroras, the 11-year sunspot cycle and non-cyclic variations over centuries.

Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with nuclear fusion, or details of the many different nucleosynthesis pathways for stars of differing masses.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models - Develop a model based on evidence to illustrate the relationships between systems or components of a system. Obtaining, Evaluating, and Communicating Information - Communicate scientific ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	ESS1.A: The Universe and Its Stars - The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. - The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. - Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. PS3.D: Energy in Chemical Processes and Everyday Life - Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.	Scale, Proportion, and Quantity - The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. Energy and Matter - In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.

HS-ESS1-2

Students who demonstrate understanding can: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions - Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through	ESS1.A: The Universe and Its Stars - The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. - The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. - Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements	Energy and Matter - Energy cannot be created or destroyed—only moved between one place and another place, between objects and/or fields, or between systems. Connection to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. Connection to Nature of Science

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence.	are produced when certain massive stars achieve a supernova stage and explode. PS4.B Electromagnetic Radiation Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.	Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. - Science assumes the universe is a vast single system in which basic laws are consistent.

HS-ESS1-4

Students who demonstrate understanding can: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.

Assessment Boundary: *Mathematical representations for the gravitational attraction of bodies and Kepler’s Laws of orbital motions should not deal with more than two bodies, nor involve calculus.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematical and Computational Thinking Use mathematical or computational representations of phenomena to describe explanations.	ESS1.B: Earth and the Solar System Kepler’s laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	Scale, Proportion, and Quantity - Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). Connection to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

HS. History of Earth

Students who demonstrate understanding can:

- HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.** [Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate (a result of past plate interactions).]
- HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.** [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]
- HS-ESS2-1. Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.** [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]

HS-ESS1-5

Students who demonstrate understanding can: Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages of oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust decreasing with distance away from a central ancient core of the continental plate (a result of past plate interactions).

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.	ESS1.C: The History of Planet Earth - Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. ESS2.B: Plate Tectonics and Large-Scale System Interactions - Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. PS1.C: Nuclear Processes - Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.	Patterns Empirical evidence is needed to identify patterns.

HS-ESS1-6

Students who demonstrate understanding can: Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.

Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth’s oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions - Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. - Models, mechanisms, and explanations collectively serve as tools in the development of a scientific theory.	ESS1.C: The History of Planet Earth - Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth’s formation and early history. PS1.C: Nuclear Processes - Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.

HS-ESS2-1

Students who demonstrate understanding can: Develop a model to illustrate how Earth’s internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).

Assessment Boundary: *Assessment does not include memorization of the details of the formation of specific geographic features of Earth’s surface.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	ESS2.A: Earth Materials and Systems - Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. A deep knowledge of how feedbacks work within and among Earth’s systems is still lacking, thus limiting scientists’ ability to predict some changes and their impacts. ESS2.B: Plate Tectonics and Large-Scale System Interactions - Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth’s surface and provides a framework for understanding its geologic history. - Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth’s crust.	Stability and Change Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

HS. Earth's Systems

Students who demonstrate understanding can:

- HS-ESS2-2. Analyze geoscience data to evaluate claims that one change to Earth's surface creates feedbacks that cause changes to other Earth systems.** [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperature that melts glacial and sea ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as feedbacks due to the effects of permafrost thawing; how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge and decrease sediment transport, and how the loss of wetlands causes a decrease in local humidity that further reduces wetland extent.]
- HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.** [Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.** [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide evidence for the connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, beach erosion and deposition patterns in relation to substrate type and size, erosion using variations in soil moisture content, and frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering, and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]
- HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.** [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, permafrost, and biosphere (including humans), providing the foundation for living organisms.]

HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

[Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.] [*Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.*]

HS-ESS2-2

Students who demonstrate understanding can: Analyze geoscience data to evaluate claims that one change to Earth’s surface creates feedbacks that cause changes to other Earth systems.

Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperature that melts glacial and sea ice, which reduces the amount of sunlight reflected from Earth’s surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as feedbacks due to the effects of permafrost thawing; how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge and decrease sediment transport, and how the loss of wetlands causes a decrease in local humidity that further reduces wetland extent.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	ESS2.A: Earth Materials and Systems - Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ESS2.D: Weather and Climate - The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space.	Stability and Change - Feedback (negative or positive) can stabilize or destabilize a system. Connections to Engineering, Technology and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.

HS-ESS2-3

Students who demonstrate understanding can: Develop a model based on evidence of Earth’s interior to describe the cycling of matter by thermal convection.

Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth’s three-dimensional structure obtained from seismic waves, records of the rate of change of Earth’s magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth’s layers from high-pressure laboratory experiments.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models - Develop a model based on evidence to illustrate the relationships between systems or between components of a system. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Science knowledge is based on empirical evidence. - Science disciplines share common rules of evidence used to evaluate explanations about natural systems. - Science includes the process of coordinating patterns of evidence with current theory.	ESS2.A: Earth Materials and Systems - Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth’s surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth’s interior and gravitational movement of denser materials toward the interior. ESS2.B: Plate Tectonics and Large-Scale System Interactions - The radioactive decay of unstable isotopes continually generates new energy within Earth’s crust and mantle, providing the primary source of the heat that drives mantle convection. Plate	Energy and Matter - Energy drives the cycling of matter within and between systems. Connections to Engineering, Technology and Applications of Science Interdependence of Science, Engineering, and Technology - Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	tectonics can be viewed as the surface expression of mantle convection. PS4.A: Wave Properties Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet.	

HS-ESS2-5

Students who demonstrate understanding can: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide evidence for the connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, beach erosion and deposition patterns in relation to substrate type and size, erosion using variations in soil moisture content, and frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering, and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Planning and Carrying Out Investigations Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	ESS2.C: The Roles of Water in Earth's Surface Processes The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	Structure and Function The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

HS-ESS2-6

Students who demonstrate understanding can: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, permafrost, and biosphere (including humans), providing the foundation for living organisms.

Assessment Boundary:

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	ESS2.D: Weather and Climate - Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. - Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.	Energy and Matter The total amount of energy and matter in closed systems is conserved.

HS-ESS2-7

Students who demonstrate understanding can: Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.

Assessment Boundary: *Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Construct an oral and written argument or counter-arguments based on data and evidence.	ESS2.D: Weather and Climate - Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ESS2.E: Biogeology - The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co- evolution of Earth's surface and the life that exists on it.	Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.

HS. Weather and Climate

Students who demonstrate understanding can:

- HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.** [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]
- HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.** [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, and physical and chemical characteristics of atmosphere and ocean.) [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]

HS-ESS2-4

Students who demonstrate understanding can: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.

Assessment Boundary: *Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Developing and Using Models - Use a model to provide mechanistic accounts of phenomena. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence - Science arguments are strengthened by multiple lines of evidence supporting a single explanation.	ESS1.B: Earth and the Solar System - Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. ESS2.A: Earth Materials and Systems - The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden	Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
	(e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. ESS2.D: Weather and Climate - The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space. ESS2.D: Weather and Climate - Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.	

HS-ESS3-5

Students who demonstrate understanding can: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, and physical and chemical characteristics of atmosphere and ocean).

Assessment Boundary: *Assessment is limited to one example of a climate change and its associated impacts.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Analyzing and Interpreting Data - Analyze data using computational models in order to make valid and reliable scientific claims. Connections to Nature of Science Scientific Investigations Use a Variety of Methods - Science investigations use diverse methods and do not always use the same set of procedures to obtain data. - New technologies advance scientific knowledge. Scientific Knowledge is Based on Empirical Evidence - Science knowledge is based on empirical evidence. - Science arguments are strengthened by multiple lines of evidence supporting a single explanation.	ESS3.D: Global Climate Change Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.	Stability and Change Change and rates of change can be quantified and modeled over very short or very long period of time. Some system changes are irreversible.

HS. Human Sustainability

Students who demonstrate understanding can:

- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals, wildlife, fish, trees, and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, storm surge, lightning strike fires, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, changes in stream or ocean water temperatures and/or chemistry, and the types of food that can be raised, hunted, fished, harvested, or gathered.]
- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*** [Clarification Statement: Emphasis is on the conservation, recycling and reuse of resources (such as minerals and metals) where possible and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, all types of mining, extracting of fossil fuels, and collecting renewable resources. Scientific knowledge indicates what can happen in natural systems--not what should happen.]
- HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [*Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*]

HS-ESS3-1

Students who demonstrate understanding can: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals, wildlife, fish, trees, and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, storm surge, lightning strike fires, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, changes in stream or ocean water temperatures and/or chemistry, and the types of food that can be raised, hunted, fished, harvested, or gathered.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	ESS3.A: Natural Resources - Resource availability has guided the development of human society. ESS3.B: Natural Hazards - Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.	Cause and Effect - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Modern civilization depends on major technological systems.

HS-ESS3-2

Students who demonstrate understanding can: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*

Clarification Statement: Emphasis is on the conservation, recycling and reuse of resources (such as minerals and metals) where possible and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, all types of mining, extracting of fossil fuels, and collecting renewable resources. Scientific knowledge indicates what can happen in natural systems--not what should happen.

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Engaging in Argument from Evidence Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).	ESS3.A: Natural Resources All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. ETS1.B. Designing Solutions to Engineering Problems When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Engineers continuously modify these systems to increase benefits while decreasing costs and risks. Analysis of costs and benefits is a critical aspect of decisions about technology. Connections to Nature of Science Science Addresses Questions About the Natural and Material World - Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. - Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. - Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.

HS-ESS3-3

Students who demonstrate understanding can: Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.

Assessment Boundary: *Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Create a computational model or simulation of a phenomenon, designed device, process, or system.	ESS3.C: Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.	Stability and Change - Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Modern civilization depends on major technological systems. - New technologies can have deep impacts on society and the environment, including some that were not anticipated. Connections to Nature of Science Science is a Human Endeavor - Scientific knowledge is a result of human endeavors, imagination, and creativity.

HS-ESS3-4

Students who demonstrate understanding can: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*

Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Constructing Explanations and Designing Solutions Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	ESS3.C: Human Impacts on Earth Systems - Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. ETS1.B. Designing Solutions to Engineering Problems - When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	Stability and Change - Feedback (negative or positive) can stabilize or destabilize a system. Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Engineers continuously modify these systems to increase benefits while decreasing costs and risks.

HS-ESS3-6

Students who demonstrate understanding can: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.

Assessment Boundary: *Assessment does not include running computational representations but is limited to using the published results of scientific computational models.*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Concepts	Crosscutting Concepts
Using Mathematics and Computational Thinking Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.	ESS2.D: Weather and Climate - Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. ESS3.D: Global Climate Change - Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.	Systems and System Models When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.

Appendix F: Science and Engineering Practices

Appendix G: Crosscutting Concepts

Place holder for Crosscutting Concepts

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4 AAC 04.030. Subjects. A goal of the state public school system is to provide a working knowledge of

- (1) English/language arts;
- (2) mathematics;
- (3) science;
- (4) geography;
- (5) history;
- (6) skills for a healthy life;
- (7) government and citizenship;
- (8) [FINE] arts;
- (9) computer science and digital literacy[TECHNOLOGY]; [AND]
- (10) world languages;[.]
- [(11) library/information literacy; and
- (12) cultural standards.

(Eff. 6/24/93, Register 126; ____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.060 AS 14.07.165
AS 14.07.020

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(Eff. 3/2/2000, Register 153; am 11/10/2005, Register 176; am 5/18/2006, Register 178; am 8/18/2010, Register 195; am 10/16/2012, Register 204; am 9/29/2016, Register 219;

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 AS 14.03.120 AS 14.07.060

Editor's note: Copies of the publications *Alaska English/Language Arts and Mathematics Standards*; *Science Standards for Alaska*; *Alaska Computer Science Standards*; *Alaska Digital Literacy Standards*; *Alaska Standards: Content and Performance Standards for Alaska Students*; and *Alaska Physical Education Standards*, adopted by reference in 4 AAC 04.140, may be obtained by writing to the Department of Education and Early Development, 801 West 10th Street, Suite 200, P.O. Box 110500, Juneau, Alaska 99811-0500 or at www.eed.state.ak.us/standards/.

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Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
AS 14.03.120 AS 14.07.060

General Comments not Addressed by the Science Standards Writing Committee

Public Comment	Recommended Action/Revision	Rationale
All of these are the necessary standards that must be accepted by the state in order to remain progressive in science education for AK.	None required.	Statement of support
These new standards, modeled after NGSS, are much higher-level standards that require demonstrated critical thinking across all the science disciplines--incorporating engineering, and (weakly) technology. This will require a reassessment of curricula across the state, and most likely adoption of new textbooks and supporting materials. For instance, having taught high school chemistry for a number of years, I see a much stronger shift to modeling and testing those models than in the current system. New textbooks cost money, but I think their cost is justified. After reading some of the online versions and comments of other states' rewriting of NGSS, I was pleased to see that our (Alaska's) standards keep in NGSS language on the nature of anthropogenic climate change, evolution, and the age of the earth/universe, among others. To maintain the competitive edge in educational outcomes, we need to acknowledge the wealth of scientific data and thinking that exists.	None required.	Statement of support
Must be based on the Next Generation Science Standards (NGSS) that are accepted and created by collaborative efforts between educators and scientists.	None required.	The Writing Committee utilized multiple sources including the NGSS
Loosely defined	None	Comment intent is unclear

Public Comment	Recommended Action/Revision	Rationale
I personally like the Next Generation standards with a little tweeking [sic]. The AK ones are very similar to them. Consideration should be given to schools who have very few kids but all K-12 graders so the same topics can be taught to K-2, or K-4 with differing degrees of difficulty or in-depth. It is too difficult to try teaching 5 different grade levels in elementary classes.	None required	This comment is addressed in the application of curricula at the district/school level, not standards.
For the new Alaska Science Standards [sic] I would like to make sure that Alaskan AND Indigenous science knowledge and research are included in the standards. Science knowledge from Indigenous populations in our state are crucial to understanding long-term environmental changes and generations of observations.	None	The Writing Committee was selected to model the demographic and geographic distribution of our state as best possible to include the diversity of perspectives noted by the commenter. Also, the Committee included numerous indigenous and Alaska-specific examples in the Clarification Statements.

Alaska State Science Content Standards – Public Comments and Recommended Actions/Revisions
By the Writing Committee, May 7, 2019

Public Comment	Recommended Action/Revision	Rationale	Notes
<u>2-ESS2-3</u> Solid and liquid seems suitable. Watersheds and water has previously been applied in 3rd grade. This is the Fosses curriculum as well as the Alaska Seas curriculum.	No Change	Students need to know the location of water in order to understand later standards. NGSS is in grade spans and is intended to be used that way.	The standards are a road map/benchmark of what should be taught. District curricula offer teachers flexibility of where to use this suggestion, and what grade level it can be taught FOSS and AK Seas are materials. Materials don't drive standards.
<u>4-PS4-1</u> Use of a small wave pool or some container with water that will enable the water to flow more than a few feet.	Revise clarification statement. "Examples of models could include diagrams, analogies, and physical models such as wire and wave pools to illustrate wavelength and amplitude of waves."	It is helpful to include examples as "inspiration" for teachers' lessons.	

Public Comment	Recommended Action/Revision	Rationale	Notes
<u>4-PS4-2</u> Hydrographic survey sonar activities from NOAA will also satisfy this objective	No change	The committee does not want to recommend certain resources that would limit teacher choice. However, this comment was in relation to 4-LS1-2 and the clarification statement on the proposed draft was not the actual clarification statement for 4-PS4-2.	This public comment refers to the Clarification statements on 4-LS1-2. Examples can be adapted to local expertise and resources
<u>5-ESS1-1</u> Hopefully these limitations are addressed in higher grades (such as stellar masses, age, and stage)	No change	These assessment limitations are addressed later in High School HS-ESS1-1 5th grade standard is more about the sun than stars and star classification.	These limitations are addressed in higher grades because the proper response to this comment requires a deeper understanding of chemistry and physics than 5th grader has.
<u>MS-PS1-4</u> This is a typo, because it is verbatim, PS1-1. It needs to be rewritten to describe the fact that particle motion	Revise to: Develop a model that predicts and describes changes in particle motion, temperature, and state of a	To correct inconsistencies between standards.	

Public Comment	Recommended Action/Revision	Rationale	Notes
increases when thermal energy is added and the state of the pure substance can change (from solid, liquid, gas) to different state. Of course, particle motion decreases when thermal energy is lost by the system.	pure substance when thermal energy is added or removed.		
<u>MS-LS4-1</u> Why not add the NGSS verbage, "...throughout the 4.6 billion year old history of life on Earth..."?	No change	Original NGSS MS-LS4-1 does not include this language.	
<u>MS-LS4-2</u> Clarification / assessment could include cladograms: (Diagrams of related species and shared traits).	No change	No change as we do not want to recommend certain resources that would limit teacher choice.	Discussion of inclusion of dichotomous keys as a specific example so cladograms as well? Decided that dichotomous keys are broad and are a resource for general science teachers while cladograms are more specific based on understanding of the evidence of the day.

Public Comment	Recommended Action/Revision	Rationale	Notes
<u>MS-LS4-3</u> Excellent, but could include some connections between embryology and homologous genes (evolutionary development)	No change	This concept is addressed again in high school at a deeper level	

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 5B

◆ **ISSUE**

The board is being asked adopt the proposed amendments to regulation 4 AAC 04.140 Content Standards. The amendments add computer science standards as a new content area.

BACKGROUND

- Currently, 25 U.S. states have adopted K-12 computer science standards. Ten other states (including Alaska) are actively pursuing the adoption of computer science standards.
- Knowledge of computer science principles is an increasingly critical workforce-readiness skill. Well over 500,000 jobs are currently unfilled in computer science-related fields in the U.S., with over 800 of those in Alaska. Those well-paying jobs represent existing opportunities for Alaskan students across the employment landscape, including cybersecurity, fisheries management, mining, oil and natural gas development, education, and government management. *Source: Code.org*
- Proposed amendments to 4 AAC 04.140 establish computer science content standards for use by school districts in Alaska. Adopting *Alaska Computer Science Standards* would not require the establishment of a computer science program in schools, but would create a unified foundation for school districts with existing programs and for those that choose to develop programs.
- Process for developing computer science standards:
 - In April 2018, a committee of volunteer stakeholders was recruited by DEED to develop draft standards appropriate for Alaska. Committee members represented urban and rural schools districts, education partners, and industry. Volunteers were divided into writing and reading committees that worked over the subsequent seven months to write and refine the draft standards.
 - The draft standards were developed by reviewing adopted standards from other states, the *Computer Science Teachers Association's (CSTA) Interim K–12 Computer Science Standards*, and the *Advanced Placement (AP) Computer Science Curriculum*.
 - The draft standards are platform-agnostic, align with college and career expectations, and anticipate emerging developments in computer science.
- Behind this cover memo are the proposed computer science standards.
- Deb Riddle, Division Operations Manager, will be present via teleconference to brief the board.

◆ **OPTIONS**

This is a work session item. Action will take place under agenda item 8A.

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Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
AS 14.03.120 AS 14.07.060

Alaska Computer Science Standards



Alaska Board of Education & Early Development

James K. Fields, Chair/REAA Representative

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Colonel Spencer Van Meter, Military Advisor

Tanis Lorrington, Student Advisor

Computer Science Standards Committee Members

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Anyia Toole, Anchorage School District
Cheryl Bobo, Alaska Staff Development Network
Chris Igel, Alaska Communications
Devon Roberts, Anchorage School District
Greg Bianchi, Microsoft Inc.
Jared O'Leary, BootUpPD
Jeffrey Blackburn, Matanuska-Susitna Borough School District
Jennifer Barnes, Matanuska-Susitna Borough School District
John Drescher, Apple Inc.
Kenrick Mock, University of Alaska, Anchorage
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Norm Wooten (Facilitator), Association and Alaska School Boards
Ryan Stanley, Southeast Regional Resource Center
Sarah Peterson, Anchorage School District
Samuel Jordan (Convener), Alaska Department of Education and Early Development

Introduction:

There is an urgent need to improve the level of public understanding of computer science as an academic and professional field. To successfully function in society, every citizen in the 21st century must understand, at the minimum, the principles of computer science. A commitment to implementing K–12 computer science standards in Alaska will aid in creating this broad public understanding and also help meet the evolving needs of the Alaskan workforce.

Computer science is an established discipline at the collegiate and post-graduate levels. It is best defined as “the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.” All students need to understand a world that is increasingly influenced by technology and to apply computing as a tool for learning and expression across a variety of disciplines and interests.

The Alaska Computer Science Standards are meant to establish a baseline literacy in computer science for all Alaskan students and provide guidance for designing curriculum, assessments, and teacher preparation programs. The standards represent a vision in which all students, from a young age, engage in the concepts and practices of computer science. From kindergarten through 12th grade, students will develop new approaches to problem solving that harness the power of computational thinking, while not only becoming users, but creators of computing technology.

The Alaska Computer Science Standards are based on the Computer Science Teachers Association’s Interim K–12 Computer Science Standards. The standards introduce the principles and methodologies of computer science to all students, whether they are college bound or career bound after high school. The standards outlined in this document address the entire K–12 range.

K-12 educators from around the state, institutions of higher education, as well as industry were engaged as part of the standards creation process. Students proficient in Alaska’s Computer Science Standards will be prepared for either entry into postsecondary education or into positions in industry. Implementation of these standards will help ensure that Alaskans are prepared for the high-demand, good-wage jobs available across the employment landscape of Alaska and the world.

These standards do not tell teachers how to teach, nor do they attempt to override the unique qualities of each student and classroom. They simply establish a strong foundation of knowledge and skills that students need for success after graduation. It is up to schools and teachers to decide how to put the standards into practice and incorporate other state and local standards, including cultural standards.

The Alaska Computer Science Standards are organized into five core concepts, and further broken down into subconcepts as listed:

Computing Systems

- Devices
- Hardware and Software
- Troubleshooting

Network and the Internet

- Network Communication and Organization
- Cybersecurity

Data Analysis

- Storage
- Collection, Visualization and Transformation
- Inference and Models

Algorithms and Programing

- Algorithms
- Variables
- Control
- Modularity
- Program Development

Community, Global and Ethical Impacts

- Culture
- Social Interactions
- Safety, Law and Ethics

Standards are provided for each grade from kindergarten through 8th grade. High school standards are broken into two levels, representing a progression from entry level employment competence in Level 1 to post-secondary education entry for Level 2. Each standard is coded using the following pattern: grade level, concept, subconcept, and item number. For example:

K.CS.D.01 = kindergarten, computing systems, devices, item 1

A glossary of computer science terms is located in the Appendix where it was felt by the Standards Committee that definitions would be useful to educators.

Computing Systems: Devices

K.CS.D.01 With guidance, follow directions and make choices while using computing devices to perform a variety of tasks.

1.CS.D.01 With guidance, select and use a computing device to perform a variety of tasks for an intended outcome.

2.CS.D.01 Select and use a computing device to perform a variety of tasks for an intended outcome.

3.CS.D.01 Define how computer hardware and software work together as a system to accomplish tasks (e.g., input, output, processor, sensors, and storage).

4.CS.D.01 Define and discuss how computer hardware and software work together as a system to accomplish tasks (e.g., input, output, processor, sensors, and storage).

5.CS.D.01 Define, discuss, and model how computer hardware and software work together as a system to accomplish tasks (e.g., input, output, processor, sensors, and storage).

6.CS.D.01 Review and analyze device(s) based on personal use and recommend improvements to the device.

7.CS.D.01 Review, analyze, and evaluate device(s) and how other users interact with devices and recommend improvements to design.

8.CS.D.01 Develop and implement a process to evaluate existing computing devices and recommend improvements to design based on analysis of how other users interact with the device.

L1.CS.D.01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.

Computing Systems: Hardware and Software

K.CS.HS.01 Use accurate terminology to locate and identify common computing devices and components, in a variety of environments (e.g., laptop, tablet, mouse).

1.CS.HS.01 Use accurate terminology in naming and describing the function of common computing devices and components (e.g., laptop, tablet, mouse).

2.CS.HS.01 Identify computer system components and peripherals, and their basic use (e.g., hard drive, memory, processor).

3.CS.HS.01 Define binary, and how that relates to computers transmitting information. Review Binary's relationship to off and on.

4.CS.HS.01 Define and discuss how information flows through hardware and software to accomplish tasks using binary.

5.CS.HS.01 Define, discuss, and model how information flows through hardware and software to accomplish tasks such as converting a word to binary.

6.CS.HS.01 Identify ways that hardware and software (User Interface) design are combined to collect and exchange data.

7.CS.HS.01 Evaluate and recommend improvements to hardware and software (User Interface) design to collect and exchange data.

8.CS.HS.01 Design and refine projects that combine hardware and software (User Interface) to collect and exchange data.

L1.CS.HS.01 Explain the interactions between application software, system software, and hardware.

L2.CS.HS.01 Identify the interactions of an operating system between software and hardware.

Computing Systems: Troubleshooting

K.CS.T.01 Recognize that computing systems might not work as expected and use accurate terminology to identify simple hardware or software problems (e.g., volume turned down on headphones, monitor turned off).

1.CS.T.01 Identify simple hardware and software problems that may occur during use (e.g., app or program is not working as expected; no sound is coming from the device; caps lock turned on).

2.CS.T.01 Identify simple hardware and software problems that may occur during use and discuss problems with peers and adults (e.g., app or program is not working as expected; no sound is coming from the device; caps lock turned on).

3.CS.T.01 Identify and discuss simple hardware and software problems that may occur during everyday use.

4.CS.T.01 Identify and research simple hardware and software problems that may occur during everyday use.

5.CS.T.01 Identify, discuss, and apply strategies for solving simple hardware and software problems that may occur using everyday use (e.g., rebooting the device; checking the power; force shut down of an application).

6.CS.T.01 Identify and discuss increasingly complex software and hardware problems with computing devices and their components.

7.CS.T.01 Identify and fix increasingly complex software and hardware problems with computing devices and their components.

8.CS.T.01 Systematically identify, fix, and document increasingly complex software and hardware problems with computing devices and their components.

L1.CS.T.01 Develop and apply criteria for systematic discovery of errors and strategies for correction in computing systems.

Network and the Internet: Network Communication and Organization

K.NI.NCO.01 Recognize that computing devices can be connected together.

1.NI.NCO.01 Recognize that by connecting computing devices together they can share information (e.g., remote storage, printing, the internet).

2.NI.NCO.01 Recognize that computing devices can be connected at various scales (e.g., Bluetooth, Wi-Fi).

3.NI.NCO.01 Recognize that information is sent and received over both physical or wireless paths.

4.NI.NCO.01 Recognize and explain how information is sent and received over both physical and wireless paths.

5.NI.NCO.01 Recognize, explain, and model how information is broken down into packets (smaller pieces), transmitted between devices, and reassembled.

6.NI.NCO.01 Model a simple protocol for transferring information using packets.

7.NI.NCO.01 Explain how a system recovers when a packet is lost and the effect it has on the transferred information.

8.NI.NCO.01 Explain protocols and their importance to data transmission; model how packets are broken down into smaller pieces and how they are delivered.

L1.NI.NCO.01 Evaluate the scalability and reliability of networks by identifying and illustrating the basic components of computer networks and network protocols (e.g., routers, switches, servers, IP, DNS).

L2.NI.NCO.01 Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology).

Network and the Internet: Cybersecurity

K.NI.C.01 Discuss what passwords are and why we do not share them with others. With guidance, use passwords to access technological devices, apps, etc.

1.NI.C.01 Identify what passwords are; explain why they are not shared; and discuss what makes a password strong. Independently, use passwords to access technological devices, apps etc.

2.NI.C.01 Explain what passwords are; why we use them, and write and design strong passwords to protect devices and information from unauthorized access. Identify other forms of authentication (biometrics).

3.NI.C.01 Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use.

4.NI.C.01 Define cybersecurity and discuss real-world cybersecurity problems and how physical and digital personal information can be protected.

5.NI.C.01 Discuss real-world cybersecurity problems and how personal information can be protected. Discussion topics could be based on current events related to cybersecurity or topics that are applicable to students.

6.NI.C.01 Identify existing cybersecurity concerns with the Internet and systems it uses.

6.NI.C.02 Explain the importance of secured websites and describe how one method of encryption works.

7.NI.C.01 Explain how to protect electronic information, both physical and digital, identify cybersecurity concerns and options to address issues with the Internet and the systems it uses

7.NI.C.02 Identify and explain two or more methods of encryption used to ensure and secure the transmission of information.

8.NI.C.01 Evaluate physical and digital procedures that could be implemented to protect electronic data/information. Explain the impacts of malware (e.g., hacking, ransomware).

8.NI.C.02 Compare the advantages and disadvantages of multiple methods of encryption to model the secure transmission of information.

L1.NI.C.01 Compare various security measures by evaluating tradeoffs between the usability and security of a computing system.

L1.NI.C.02 Illustrate how sensitive data can be affected by attacks.

L1.NI.C.03 Recommend security measures to address various scenarios based on the principles of information security.

L1.NI.C.04 Explain tradeoffs when selecting and implementing cybersecurity recommendations from multiple perspectives such as the user, enterprise, and government.

L2.NI.C.01 Compare and refine ways in which software developers protect devices and information from unauthorized access.

L2.NI.C.02 Learn detection and prevention methods to respond to attacks on sensitive data. Develop a response plan that enables recovery from such attacks.

Data Analysis: Storage

K.DA.S.01 Identify types of data from our everyday lives and computing devices (e.g., digital images, videos, apps, documents)

1.DA.S.01 With guidance, locate, open, modify and save an existing file with a computing device.

2.DA.S.01 With guidance, create, copy, locate, modify, and delete a file on a computing device and define the information stored as data.

3.DA.S.01 Recognize that different applications work with different types of files (e.g., images, documents).

- 4.DA.S.01 Explain how many kilobytes make one megabyte, and how many megabytes make one gigabyte.
- 5.DA.S.01 Using correct terminology explain why various types of files differ in size (e.g., video, images and documents).
- 6.DA.S.01 Identify how the same data can be represented in multiple ways.
- 7.DA.S.01 Create multiple representations of data.
- 8.DA.S.01 Analyze multiple methods of representing data and choose the most appropriate method for representing data.
- L1.DA.S.01 Translate and compare different bit representations of real-world phenomena, such as characters, numbers, and images.
- L1.DA.S.02 Review different database types.
- L2.DA.S.01 Evaluate and explain the various types of databases, with their specific benefits and limitation.

Data Analysis: Collection, Visualization and Transformation

- K.DA.CVT.01 With guidance, collect data and present it visually.
- 1.DA.CVT.01 With guidance, collect data and present it two different ways.
- 2.DA.CVT.01 With guidance, collect and present the same data in various visual formats.
- 3.DA.CVT.01 Collect and organize data in a spreadsheet.
- 4.DA.CVT.01 Collect and organize data to highlight and display relationships.
- 5.DA.CVT.01 Collect, organize, interpret, and display data to highlight relationships and support a claim.
- 6.DA.CVT.01 Collect data using computational tools and transform the data to make it more useful (e.g., spreadsheet formulas)
- 7.DA.CVT.01 Collect data using computational tools and transform the data to make it more useful and reliable.
- 8.DA.CVT.01 Develop, implement, and refine a process that utilizes computational tools to collect and transform data to make it more useful and reliable.
- L1.DA.CVT.01 Use tools and techniques to locate, collect and create visualizations of small and large-scale data sets (e.g., paper surveys, online data sets, etc.).
- L2.DA.CVT.01 Use data analysis tools and techniques to identify patterns from complex real- world phenomena.
- L2.DA.CVT.02 Generate data sets that support a claim or communicates information using a variety of data collection tools and analysis techniques.

Data Analysis: Inference and Models

- K.DA.IM.01 With guidance, draw conclusions and make predictions based on picture graphs or patterns (e.g., make predictions based on weather data presented in a picture graph; complete a pattern).
- 1.DA.IM.01 With guidance, interpret data from a chart or graph (visualization) in order to make a prediction, with or without a computing device.
- 2.DA.IM.01 With guidance, construct and interpret data and present it in a chart or graph (visualization) in order to make a prediction, with or without a computing device.
- 3.DA.IM.01 With guidance, utilize data to make predictions and discuss whether there is adequate data to make reliable predictions.
- 4.DA.IM.01 Determine the accuracy of conclusions and how they are influenced by the amount of data collected.

5.DA.IM.01 Use data to highlight or propose cause and effect relationships, predict outcomes, or communicate an idea.

6.DA.IM.01 Use models and simulations to formulate, refine, and test hypotheses.

7.DA.IM.01 Discuss the correctness of a model representing a system by comparing the model's generated results with observed data from the modeled system.

8.DA.IM.01 Refine computational models based on the data generated by the models.

L1.DA.IM.01 Use computational models such as data analysis, pattern recognition, and/or simulations to show the relationships between collected data elements.

L2.DA.IM.01 Use models and simulations to help formulate, refine, and test scientific hypotheses.

Algorithms and Programming: Algorithms

K.AP.A.01 With guidance, model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.

1.AP.A.01 With guidance, model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.

2.AP.A.01 With guidance, model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.

3.AP.A.01 Create and follow algorithms to accomplish a simple task or solve a simple problem

4.AP.A.01 Create, compare & refine multiple algorithms for the same task.

5.AP.A.01 Compare and refine multiple algorithms for the same task and determine which is the most appropriate.

6.AP.A.01 Use an existing algorithm in natural language or pseudocode to solve complex problems.

7.AP.A.01 Select and modify an existing algorithm in natural language or pseudocode to solve complex problems.

8.AP.A.01 Design algorithms in natural language, flow and control diagrams, comments within code, and/or pseudocode to solve complex problems.

L1.AP.A.01 Use algorithms (e.g., sequencing, selection, iteration, recursion, etc.) to create a prototype to provide a possible solution for a common problem.

L2.AP.A.01 Describe how artificial intelligence drives many software and physical systems (e.g., autonomous robots, computer vision, pattern recognition, text analysis).

L2.AP.A.02 Develop an artificial intelligence algorithm to play a game against a human opponent or solve a common problem.

L2.AP.A.03 Critically examine and adapt classic algorithms (e.g. selection sort, insertion sort, etc.).

L2.AP.A.04 Evaluate algorithms (e.g., sorting, searching) in terms of their efficiency, correctness, and clarity.

Algorithms and Programming: Variables

K.AP.V.01 With guidance, model and represent grade level appropriate data (e.g., print, numbers, kinesthetic movement, symbols, and robot manipulatives).

1.AP.V.01 With guidance, model and represent grade level appropriate data (e.g., print, numbers, kinesthetic movement, symbols and robot manipulatives).

2.AP.V.01 Model the way a computer program manipulates grade level appropriate data (e.g., print, numbers, kinesthetic movement, symbols and robot manipulatives).

- 3.AP.V.01 Create programs that use variables to store and modify grade level appropriate data.
- 4.AP.V.01 Create programs that use variables to store and modify grade level appropriate data.
- 5.AP.V.01 Create programs that use variables to store and modify grade level appropriate data.
- 6.AP.C.01 Develop programs that utilize combinations of repetition, conditionals, functions, and the manipulation of variables representing different data types.
- 7.AP.C.01 Develop programs that utilize combinations of repetition, compound conditionals, functions, and the manipulation of variables representing different data types.
- 8.AP.C.01 Develop programs that utilize combinations of nested repetition, compound conditionals, functions, and the manipulation of variables representing different data types.
- L1.AP.V.01 Demonstrate the use of lists to simplify solutions and to generalize computation problems instead of repeatedly using simple variables.
- L2.AP.V.01 Compare and contrast simple data structures and their uses (e.g., arrays, lists, stacks, queues, maps, trees, graphs, and databases).

Algorithms and Programming: Control

- K.AP.C.01 With guidance, create programs to accomplish tasks as a means of creative expression using a programming language, robot device or unplugged activity, either independently or collaboratively, including sequencing, emphasizing the beginning, middle, and end.
- 1.AP.C.01 With guidance, create programs to accomplish tasks as a means of creative expression or problem solving using a programming language, robot device or unplugged activity, either independently or collaboratively including sequencing and repetition.
- 2.AP.C.01 With guidance, create programs using a programming language, robot device or unplugged activity that utilize sequencing and repetition to solve a problem or express ideas both independently and collaboratively.
- L1.AP.C.01 Justify the selection of specific control structures when trade-offs involve implementation, readability, and program performance.
- L1.AP.C.02 Develop an event-based program that will solve a practical problem, or allow self-expression.
- L2.AP.C.01 Trace the execution of recursive algorithms, illustrating output and changes in values of named variables.

Algorithms and Programming: Modularity

- K.AP.M.01 With guidance, decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1.AP.M.01 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 2.AP.M.01 Decompose (break down) and explain the steps needed to solve a problem into a precise sequence of instructions.
- 3.AP.M.01 Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 4.AP.M.01 Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 5.AP.M.01 Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 6.AP.M.01 Decompose (break down) problems into abstraction layers to facilitate the design, implementation, and review of programs.

7.AP.M.01 Decompose (break down) problems into abstraction layers to facilitate the design, implementation, and review of increasingly complex programs.

8.AP.M.01 Decompose (break down) problems and sub-problems into abstraction layers to facilitate the design, implementation, and review of complex programs.

L1.AP.M.01 Using systematic analysis and design, break down a solution into basic elements such as procedures, functions, or methods.

L1.AP.M.02 Create computational artifacts by using common structures to organize, manipulate and/or process data.

L2.AP.M.01 Construct solutions to problems using student-created components, such as functions, procedures, modules, and/or objects.

L2.AP.M.02 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution.

L2.AP.M.03 Create programming solutions using code reuse and applied technique with appropriate attribution (e.g., libraries, APIs, collaboration software, and versioning software).

Algorithms and Programming: Program Development

K.AP.PD.01 With guidance, create a grade level appropriate document to illustrate thoughts, ideas, and stories in a sequential (step-by-step) manner (e.g., story map, storyboard, and sequential graphic organizer).

K.AP.PD.02 Independently or with guidance give credit to ideas, creations and solutions of others while writing and/or developing programs.

K.AP.PD.03 Independently and collaboratively, identify and correct errors in an algorithm that includes sequencing and repeated procedures using a programming language or unplugged activities.

K.AP.PD.04 Use correct terminology (first, second...) in the development of an algorithm to solve a simple problem

1.AP.PD.01 Independently or with guidance, create a grade level appropriate document to illustrate thoughts, ideas, and stories in a sequential (step-by- step) manner (e.g., story map, storyboard, and sequential graphic organizer).

1.AP.PD.02 Independently or with guidance give credit to ideas, creations and solutions of others while writing and/or developing programs.

1.AP.PD.03 Independently and collaboratively, debug programs, which include sequencing and repetition to accomplish tasks as a means of creative expression or problem solving using a programming language and/or unplugged activities.

1.AP.PD.04 Use correct terminology (beginning, middle, end...), and explain the choices made in the development of an algorithm and/or program to solve a simple problem.

2.AP.PD.01 Independently or with guidance, create a grade level appropriate document to illustrate thoughts, ideas, and stories in a sequential (step-by- step) manner (e.g., story map, storyboard, and sequential graphic organizer).

2.AP.PD.02 Independently or with guidance give credit to ideas, creations and solutions of others while writing and/or developing programs.

2.AP.PD.03 Independently and collaboratively, create and debug programs, which include sequencing and repetition to accomplish tasks as a means of creative expression or problem solving using a programming language and/or unplugged activities.

2.AP.PD.04 Use correct terminology (debug, program input/output, code ...) to explain the development of an algorithm to solve a problem in an unplugged activity, hands on manipulatives or a programming language.

3.AP.PD.01 Outline problems and potential solutions using a sequence of steps and conditional logic (e.g., if-then-else statements).

3.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.

- 4.AP.PD.01 Create and debug programs using variables, loops, functions that intake, store, and display data.
- 4.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.
- 5.AP.PD.01 Define the concept of abstraction and create increasingly complex programs.
- 5.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.
- 6.AP.PD.01 Seek and incorporate feedback from team members to refine a solution to a problem.
- 6.AP.PD.02 Incorporate existing code, media, and libraries into original programs and give attribution.
- 6.AP.PD.03 Test and refine programs using teacher provided inputs.
- 6.AP.PD.04 Break down tasks and follow an individual timeline when developing a computational artifact.
- 6.AP.PD.05 Document block-based or text-based programs in order to make them easier to follow, test, and debug.
- 7.AP.PD.01 Seek and incorporate feedback from team members and users to refine a solution to a problem.
- 7.AP.PD.02 Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution.
- 7.AP.PD.03 Test and refine programs using a variety of student created inputs.
- 7.AP.PD.04 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.
- 7.AP.PD.05 Document block-based or text-based programs of increasing complexity in order to make them easier to follow, test, and debug.
- 8.AP.PD.01 Seek and incorporate feedback from team members and users to refine a solution to a problem that meets the needs of diverse users.
- 8.AP.PD.02 Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution.
- 8.AP.PD.03 Systematically test and refine programs using a range of student created inputs.
- 8.AP.PD.04 Explain how effective communication between participants is required for successful collaboration when developing computational artifacts.
- L1.AP.PD.01 Create software by analyzing a problem and/or process, developing a solution, testing outcomes, debug, documenting, and adapting the program for a variety of users.
- L1.AP.PD.02 Classify and define a variety of software licensing schemes and discuss the advantages and disadvantages of the different schemes in software development (e.g. open source, freeware, commercial).
- L1.AP.PD.03 Evaluate and refine computational artifacts to make them more user- friendly, efficient and/or accessible.
- L1.AP.PD.04 Design and develop a computational artifact while working in a team.
- L1.AP.PD.05 Using visual aids and documentation, illustrate the design elements and data flow of the development of a complex program (e.g. flowcharts, pseudocode, etc.).
- L2.AP.PD.01 Compare multiple programming languages and discuss features that make them useful for solving problems and developing systems.
- L2.AP.PD.02 Using the software life cycle process, create software that will provide solutions for a variety of users.
- L2.AP.PD.03 Design software in a project team environment using Agile Development methods (e.g., versioning and collaboration systems).
- L2.AP.PD.04 Explain security issues that might lead to compromised computer programs.
- L2.AP.PD.05 Develop programs for multiple computing platforms.

L2.AP.PD.06 Develop and use a series of test cases to verify that a program performs according to its design specifications.

L2.AP.PD.07 Through peer review systematically check code for correctness, usability, readability, efficiency, portability, and scalability (e.g. code review).

L2.AP.PD.08 Modify an existing program to add additional functionality and discuss intended and unintended implications with appropriate attribution.

Community, Global and Ethical Impacts: Culture

K.CGEI.C.01 List different ways in which computing devices are used in your daily life.

1.CGEI.C.01 Identify how people use many types of technologies in their daily work and personal lives.

2.CGEI.C.01 List different technology tools, and describe how people use them in their daily work and personal lives.

3.CGEI.C.01 Discuss ongoing trends in technologies that have changed the world, and express how those trends influence and are influenced by cultural practices.

3.CGEI.C.02 Brainstorm ways to improve the accessibility and usability of technology product for the diverse needs and wants of users.

4.CGEI.C.01 Discuss ongoing trends in technologies that have changed the world, and express how those trends influence and are influenced by cultural practices.

4.CGEI.C.02 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

5.CGEI.C.01 Discuss ongoing trends in technologies that have changed the world, and express how those trends influence and are influenced by cultural practices.

5.CGEI.C.02 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

6.CGEI.C.01 Explain how computing impacts people's' everyday activities and explore careers related to the field of computer science.

6.CGEI.C.02 Identify and discuss the technology proficiencies needed in the classroom and the workplace, and how to meet the needs of diverse users.

7.CGEI.C.01 Explain how computing impacts innovation in other fields and explore careers related to the field of computer science.

7.CGEI.C.02 Relate the distribution of computing resources in a global society to issues of equity, access, and power.

8.CGEI.C.01 Describe the trade-offs associated with computing technologies, explaining their effects on economies and global societies, and explore community and global careers related to the field of computer science (e.g., automation).

8.CGEI.C.02 Evaluate and improve the design of existing technologies to meet the needs of diverse users and increase accessibility and usability. Evaluate how technology can be used to distort, exaggerate, and misrepresent information.

L1.CGEI.C.01 Test and refine computational artifacts to reduce bias and equity deficits.

L1.CGEI.C.02 Demonstrate how a given algorithm applies to problems across disciplines.

L2.CGEI.C.01 Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society.

L2.CGEI.C.02 Based on research, evaluate how computing has revolutionized an aspect of our culture and predict how it might evolve (e.g., education, healthcare, art/entertainment, and energy).

Community, Global and Ethical Impacts: Social Interactions

K.CGEI.SI.01 With guidance, identify appropriate manners while participating in a digital community.

1.CGEI.SI.01 With guidance, identify appropriate and inappropriate behavior. Act responsibly while participating in an online community and know how and who to report concerns.

2.CGEI.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in a digital community. Identify and report inappropriate behavior.

3.CGEI.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

3.CGEI.SI.02 Identify how computational products may be, or have been, improved to incorporate diverse perspectives. Seek diverse perspectives for the purpose of improving computational artifacts.

4.CGEI.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

4.CGEI.SI.02 As a collaborative team, consider and leverage each other's diverse perspectives on improving a computational product.

5.CGEI.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

5.CGEI.SI.02 As a team, collaborate with outside resources (other grade levels, online collaborative spaces) to include diverse perspectives to improve computational products.

6.CGEI.SI.01 Individually and collaboratively develop and conduct an online survey that seeks input from a broad audience. Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).

7.CGEI.SI.01 Individually and collaboratively use advanced tools to design and create online content (e.g., digital portfolio, multimedia, blog, web page). Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).

8.CGEI.SI.01 Communicate and publish key ideas and details individually or collaboratively in a way that informs, persuades, and/or entertains using a variety of digital tools and media-rich resources. Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).

L1.CGEI.SI.01 Demonstrate how computing increases connectivity to people in various cultures.

Community, Global and Ethical Impacts: Safety, Law and Ethics

K.CGEI.SLE.01 With guidance, keep log in information private, and log off of devices appropriately

1.CGEI.SLE.01 Keep log in information private, and log off of devices appropriately.

2.CGEI.SLE.01 Be able to explain the reasoning of keeping login information private. Keep log in information private, and log off of devices appropriately.

3.CGEI.SLE.01 Identify types of digital data that may have intellectual property rights that prevent copying or require attribution.

4.CGEI.SLE.01 Discuss the social impact of violating intellectual property rights. Use public domain or creative commons media, and refrain from copying or using material created by others without permission.

5.CGEI.SLE.01 Observe intellectual property rights, give appropriate credit when using resources and consider the licenses on computational artifacts while using resources.

6.GCEI.SLE.01 Differentiate between appropriate and inappropriate content on the Internet, and identify unethical and illegal online behavior.

6.GCEI.SLE.02 Identify what distinguishes humans from machines focusing on human intelligence versus machine intelligence (e.g., robot motion; speech and language understanding; computer vision)

7.GCEI.SLE.01 Explain the connection between the longevity of data on the Internet, personal online identity, and personal privacy.

7.GCEI.SLE.02 Describe ways in which computers use models of intelligent behavior (e.g., robot motion; speech and language understanding; computer vision)

8.GCEI.SLE.01 Discuss the social impacts and ethical considerations associated with cybersecurity, including the positive and malicious purposes of hacking.

8.GCEI.SLE.02 Compare and contrast human intelligence and computer intelligence (e.g., emotional decision making versus logical decisions; common sense; literal versus abstract).

L1.CGEI.SLE.1 Explain the beneficial and harmful effects that intellectual property laws can have on innovation.

L1.CGEI.SLE.2 Explain the privacy concerns related to the collection and large scale analysis of information about individuals that may not be evident to users (e.g., how businesses, social media, and the government collect and use data).

L1.CGEI.SLE.3 Evaluate the social and economics implications as related to privacy, data, property, information, and identity in the context of safety, law, or ethics.

L1.CGEI.SLE.4 Describe the beneficial and intrusive aspects of advancing and emerging technologies (e.g., artificial intelligent agents, IoT, robotics).

L1.CGEI.SLE.5 Discuss diverse careers that are influenced by computer science and its availability to all regardless of background.

L2.CGEI.SLE.1 Debate laws and regulations that impact the development and use of software.

L2.CGEI.SLE.4 Identify the ethical and moral implications encountered in managing and curating knowledge (e.g., harvesting; information overload; knowledge management; reposting; sharing; summarizing).

L2.CGEI.SLE.5 Explain how cutting-edge technology may affect the way business is conducted in the future (e.g., eCommerce, entrepreneurship, payment methods, business responsibilities).

Appendix A:

Glossary

A

Abstraction: The process of reducing complexity by focusing on the main idea. By hiding details irrelevant to the question at hand and bringing together related and useful details, abstraction reduces complexity and allows one to focus on the problem.

Accessibility: The design of products, devices, services, or environments for people who experience disabilities. Accessibility standards that are generally accepted by professional groups include the Web Content Accessibility Guidelines (WCAG) 2.0 and Accessible Rich Internet Applications (ARIA) standards.

Algorithm: A step-by-step process to complete a task.

App: A type of application software designed to run on a mobile device, such as a smartphone or tablet computer. Also known as a mobile application.

Artifact: Anything created by a human. See computational artifact for the definition used in computer science.

Artificial Intelligence (A.I.): The branch of computer science dealing with the simulation of intelligent behavior in computers.

Audience: Expected end users of a computational artifact or system.

Authentication: The verification of the identity of a person or process.

B

Binary: A numeric system that only uses two digits — 0 and 1. Computers operate in binary, meaning they store data and perform calculations using only zeros and ones.

Block-based: Using pre-programmed “blocks” of instructions to teach kids coding.

C

Code: Any set of instructions expressed in a programming language.

Complexity: The minimum amount of resources, such as memory, time, or messages, needed to solve a problem or execute an algorithm.

Component: An element of a larger group. Usually, a component provides a particular service or group of related services.

Computational: Relating to computers or computing methods.

Computational artifact: Anything created by a human using a computational thinking process and a computing device. A computational artifact can be, but is not limited to, a program, image, audio, video, presentation, or web page file.

Computational thinking: The human ability to formulate problems so that their solutions can be represented as computational steps or algorithms to be executed by a computer.

Computer: A machine or device that performs processes, calculations, and operations based on instructions provided by a software or hardware program.

Computer science: The study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society.

Computing: Any goal-oriented activity requiring, benefiting from, or creating algorithmic processes.

Computing device: A physical device that uses hardware and software to receive, process, and output information. Computers, mobile phones, and computer chips inside appliances are all examples of computing devices.

Computing system: A collection of one or more computers or computing devices, together with their hardware and software, integrated for the purpose of accomplishing shared tasks. Although a computing system can be limited to a single computer or computing device, it more commonly refers to a collection of multiple connected computers, computing devices, and hardware.

Conditional: A feature of a programming language that performs different computations or actions depending on whether a programmer-specified Boolean condition evaluates to true or false.

Configuration:

- (process): Defining the options that are provided when installing or modifying hardware and software or the process of creating the configuration (product).
- (product): The specific hardware and software details that tell exactly what the system is made up of, especially in terms of devices attached, capacity, or capability.

Connection: A physical or wireless attachment between multiple computing systems, computers, or computing devices.

Connectivity: A program's or device's ability to link with other programs and devices.

Control structure: A programming (code) structure that implements control. Conditionals and loops are examples of control structures.

Culture: A human institution manifested in the learned behavior of people, including their specific belief systems, language(s), social relations, technologies, institutions, organizations, and systems for using and developing resources.

Cybersecurity: The protection against access to, or alteration of, computing resources through the use of technology, processes, and training.

D

Data: Information that is collected and used for reference or analysis. Data can be digital or nondigital and can be in many forms, including numbers, text, show of hands, images, sounds, or video.

Data structure: A particular way to store and organize data within a computer program to suit a specific purpose so that it can be accessed and worked with in appropriate ways.

Data type: A classification of data that is distinguished by its attributes and the types of operations that can be performed on it. Some common data types are integer, string, Boolean (true or false), and floating-point.

Debug/debugging: The process of finding and correcting errors (bugs) in programs.

Decompose/decomposition: Breaking down a problem or system into components.

Device: A unit of physical hardware that provides one or more computing functions within a computing system. It can provide input to the computer, accept output, or both.

Digital citizenship: The norms of appropriate, responsible behavior with regard to the use of technology.

E

Efficiency: A measure of the amount of resources an algorithm uses to find an answer. It is usually expressed in terms of the theoretical computations, the memory used, the number of messages passed, the number of disk accesses, etc.

Encryption: The conversion of electronic data into another form, called ciphertext, which cannot be easily understood by anyone except authorized parties.

Event: Any identifiable occurrence that has significance for system hardware or software. User-generated events include keystrokes and mouse clicks; system-generated events include program loading and errors.

Execute: To carry out (or "run") an instruction or set of instructions (program, app, etc.).

G

Gigabyte: A unit of computer memory. One gigabyte equals 1,000,000,000 bytes.

H

Hacking: Gaining unauthorized access to other computers.

Hardware: The physical components that make up a computing system, computer, or computing device.

I

Implementation: The process of expressing the design of a solution in a programming language (code) that can be made to run on a computing device.

Inference: A conclusion reached on the basis of evidence and reasoning.

Input: The signals or instructions sent to a computer.

Internet: The global collection of computer networks and their connections, all using shared protocols to communicate.

Internet of Things (IoT): An umbrella term that refers to anything connected to the Internet. It includes traditional computing devices, but also includes a growing list of other devices, including home appliances, automobiles, wearable electronics and security cameras.

Iterative: Involving the repeating of a process with the aim of approaching a desired goal, target, or result.

K

Kilobyte: A unit of computer memory. One kilobyte equals 1,000 bytes.

L

Loop: A programming structure that repeats a sequence of instructions as long as a specific condition is true.

M

Megabyte: A unit of computer memory. One megabyte equals 1,000,000 bytes.

Memory: Temporary storage used by computing devices.

Model: A representation of some part of a problem or a system. Note: This definition differs from that used in science.

Modularity: The characteristic of a software/web application that has been divided (decomposed) into smaller modules. An application might have several procedures that are called from inside its main procedure. Existing procedures could be reused by recombining them in a new application.

Module: A software component or part of a program that contains one or more procedures. One or more independently developed modules make up a program.

N

Network: A group of computing devices (personal computers, phones, servers, switches, routers, etc.) connected by cables or wireless media for the exchange of information and resources.

O

Operation: An action, resulting from a single instruction that changes the state of data.

P

Packet: The unit of data sent over a network.

Procedure: An independent code module that fulfills some concrete task and is referenced within a larger body of program code. The fundamental role of a procedure is to offer a single point of reference for some small goal or task that the developer or programmer can trigger by invoking the procedure itself.

Process: A series of actions or steps taken to achieve a particular outcome.

Program: A set of instructions that the computer executes to achieve a particular objective.

Programming: The craft of analyzing problems and designing, writing, testing, and maintaining programs to solve them.

Protocol: The special set of rules used by endpoints in a telecommunication connection when they communicate. Protocols specify interactions between the communicating entities.

R

Reliability: An attribute of any system that consistently produces the same results, preferably meeting or exceeding its requirements.

Remix: The process of creating something new from something old. Originally a process that involved music, remixing involves creating a new version of a program by recombining and modifying parts of existing programs, and often adding new pieces, to form new solutions.

Router: A device or software that determines the path that data packets travel from source to destination.

S

Scalability: The capability of a network to handle a growing amount of work or its potential to be enlarged to accommodate that growth. [Wikipedia]

Software: Programs that run on a computing system, computer, or other computing device.

Storage:

- (place) A place, usually a device, into which data can be entered, in which the data can be held, and from which the data can be retrieved at a later time.
- (process) A process through which digital data is saved within a data storage device by means of computing technology. Storage is a mechanism that enables a computer to retain data, either temporarily or permanently.

String: A sequence of letters, numbers, and/or other symbols. A string might represent, for example, a name, address, or song title. Some functions commonly associated with strings are length, concatenation, and substring.

Structure: A general term used in the framework to discuss the concept of encapsulation without specifying a particular programming methodology.

Switch: A high-speed device that receives incoming data packets and redirects them to their destination on a local area network (LAN).

System: A collection of elements or components that work together for a common purpose.

T

Test case: A set of conditions or variables under which a tester will determine whether the system being tested satisfies requirements or works correctly.

Topology: The physical and logical configuration of a network; the arrangement of a network, including its nodes and connecting links. A logical topology is the way devices appear connected to the user. A physical topology is the way they are actually interconnected with wires and cables.

Troubleshooting: A systematic approach to problem solving that is often used to find and resolve a problem, error, or fault within software or a computing system.

U

User Interface (U.I.): The means in which a person controls a software application or hardware device.

V

Variable: A symbolic name that is used to keep track of a value that can change while a program is running. Variables are not just used for numbers; they can also hold text, including whole sentences (strings) or logical values (true or false). A variable has a data type and is associated with a data storage location; its value is normally changed during the course of program execution. Note: This definition differs from that used in math.

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 5C

◆ **ISSUE**

The board is being asked to adopt the proposed amendments to regulation 4 AAC 04.140 Content Standards. The amendments remove the technology content standards from the *Alaska Standards: Content and Performance Standards for Alaska Students (2016)* and publish them separately as the updated *Alaska Digital Literacy Standards*.

BACKGROUND

- Since the last revision of the Alaska's technology standards in 2006, the landscape of technology has significantly changed the functions of society and the delivery of learning opportunities. Student and educators will benefit from renewed standards that reflect a current vision for leveraging technology for learning, expression, digital citizenship, and communication.
- Process for developing draft digital literacy standards:
 - In August 2018, a committee of volunteer stakeholders reviewed available standards for appropriateness in the Alaska education context.
 - The draft standards were created based on the *International Society for Technology in Education Standards for Students (2016)*.
 - The draft standards include technology use and digital citizenship principles, organized by grade bands.
 - The draft standards are platform-agnostic, align with college and career expectations, and anticipate emerging developments in technology.
- Behind this cover memo are the current technology standards and the proposed *Alaska Digital Literacy Standards*.
- Deb Riddle, Division Operations Manager, will be present via teleconference to brief the board.

◆ **OPTIONS**

This is a work session item. Action will take place under agenda item 8A.

4 AAC 04.030 is amended to read:

4 AAC 04.030. Subjects. A goal of the state public school system is to provide a working knowledge of

- (1) English/language arts;
- (2) mathematics;
- (3) science;
- (4) geography;
- (5) history;
- (6) skills for a healthy life;
- (7) government and citizenship;
- (8) [FINE] arts;
- (9) computer science and digital literacy[TECHNOLOGY]; [AND]
- (10) world languages;[.]
- [(11) library/information literacy; and
- (12) cultural standards.

(Eff. 6/24/93, Register 126; ____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.060 AS 14.07.165
AS 14.07.020

4 AAC 04.140(a) is amended to read:

(a) The content standards for English/language arts and mathematics, as set out in the department's publication *Alaska English/Language Arts and Mathematics Standards*, revised as of June 2012, are adopted by reference. The standards for science, as set out in the

department's publication, *Science Standards for Alaska*, revised as of March 2019, are adopted by reference. The standards for computer science, as set out in the department's publication, *Alaska Computer Science Standards*, revised as of March 2019, are adopted by reference. The standards for digital literacy, as set out in the department's publication, *Alaska Digital Literacy Standards*, revised as of March 2019, are adopted by reference. The content standards for [SCIENCE,] geography, government and citizenship, history, Alaska history, skills for a healthy life, arts, world languages, [TECHNOLOGY,] and employability, as set out in the department's publication *Alaska Standards: Content and Performance Standards for Alaska Students*, revised as of March **2019** [2016], are adopted by reference.

(Eff. 3/2/2000, Register 153; am 11/10/2005, Register 176; am 5/18/2006, Register 178; am 8/18/2010, Register 195; am 10/16/2012, Register 204; am 9/29/2016, Register 219;

____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
 AS 14.03.120 AS 14.07.060

Editor's note: Copies of the publications *Alaska English/Language Arts and Mathematics Standards*; *Science Standards for Alaska*; *Alaska Computer Science Standards*; *Alaska Digital Literacy Standards*; *Alaska Standards: Content and Performance Standards for Alaska Students*; and *Alaska Physical Education Standards*, adopted by reference in 4 AAC 04.140, may be obtained by writing to the Department of Education and Early Development, 801 West 10th Street, Suite 200, P.O. Box 110500, Juneau, Alaska 99811-0500 or at www.eed.state.ak.us/standards/.

4 AAC 04.180 is amended to read:

4 AAC 04.180. Student cultural standards. The cultural standards for students in the state, as set out in the department's publication entitled *Alaska Standards: Content and Performance Standards for Alaska Students*, [AS] revised as of March **2019** [2006], are adopted by reference. (Eff. 5/14/2000, Register 154; am 11/10/2005, Register 176; am 5/18/2006, Register 178; ____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
AS 14.03.120 AS 14.07.060

Alaska Digital Literacy Standards



Alaska Board of Education & Early Development

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Norm Wooten (Facilitator), Association and Alaska School Boards
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Introduction:

The Alaska Digital Literacy Standards update the 2006 Alaska Technology Standards, bringing them into alignment with contemporary technology opportunities available to districts and students in Alaska. They focus on leveraging technology for learning, expression, digital citizenship and communication. The standards are based on the International Society for Technology in Education (ISTE) student standards (2016 edition).

The Alaska Digital Literacy Standards provide a framework for leveraging technology tools for learning and participating in a digital society. The standards are organized into seven concept areas, by grade bands: Kindergarten through 2nd grade, 3rd grade through 5th grade and 6th grade through 12th grade. Each standards is coded using the following patten: grade band, concept, and item number. For example:

K-2.EL.1 = Kindergarten through 2nd grade, Empowered Learning, item 1

Empowered Learning

K-2.EL.1 With guidance from an educator, students consider and set personal learning goals and utilize appropriate technologies that will demonstrate knowledge and reflection of the process.

K-2.EL.2 With guidance from an educator, students learn about various technologies that can be used to connect to others or make their leaning environments personal and select resources from those available to enhance their learning.

K-2.EL.3 With guidance from an educator, students recognize performance feedback from digital tools, make adjustments based on that feedback and use age-appropriate technology to share learning.

K-2.EL.4 With guidance from an educator, students explore a variety of technologies that will help them in their learning and begin to demonstrate an understanding of how knowledge can be transferred between tools.

3-5.EL.1 Students develop learning goals in collaboration with an educator, select the technology tools to achieve them, and reflect on and revise the learning process as needed to achieve goals.

3-5.EL.2 With the oversight and support of an educator Students build a network of experts and peers within school policy and customize their environments to enhance their learning.

3-5.EL.3 Students seek from feedback from both people and features embedded in digital tools, and use age-appropriate technology to share learning.

3-5.EL.4 Students explore age-appropriate technologies and begin to transfer their learning to different tools or learning environments.

6-12.EL.1 Students articulate personal learning goals, select and manage appropriate technologies to achieve them, and reflect on their successes and areas of improvement in working toward their goals.

6-12.EL.2 Students identify and develop online networks within school policy, and customize their learning environments in ways that support their learning, in collaboration with an educator.

6-12.EL.3 Students actively seek performance feedback from people, including teachers, and from functionalities embedded in digital tools to improve their learning process, and they select technology to demonstrate their learning in a variety of ways.

6-12.EL.4 Students are able to navigate a variety of technologies and transfer their knowledge and skills to learn how to use new technologies.

Digital Citizenship

K-2.DC.1 Students practice responsible use of technology through teacher-guided online activities and interactions to understand how the digital space impacts their life.

K-2.DC.2 With guidance from an educator, students understand how to be careful when using devices and how to be safe online, follow safety rules when using the internet and collaborate with others.

K-2.DC.3 With guidance from an educator, students learn about ownership and sharing of information, and how to respect the work of others.

K-2.DC.4 With guidance from an educator, students demonstrate an understanding that technology is all around them and the importance of keeping their information private.

3-5.DC.1 Students demonstrate an understanding of the role an online identity plays in the digital world and learn the permanence of their decisions when interacting online.

3-5.DC.2 Students practice and encourage others in safe, legal and ethical behavior when using technology and interacting online, with guidance from an educator.

3-5.DC.3 Students learn about, demonstrate and encourage respect for intellectual property with both print and digital media when using and sharing the work of others.

3-5.DC.4 Students demonstrate an understanding of what personal data is, how to keep it private and how it might be shared online.

6-12.DC.1 Students manage their digital identities and reputations within school policy, including demonstrating an understanding of how digital actions are never fully erasable.

6-12.DC.2 Students demonstrate and advocate for positive, safe, legal and ethical habits when using technology and when interacting with others online.

6-12.DC.3 Students demonstrate and advocate for an understanding of intellectual property with both print and digital media—including copyright, permission and fair use—by creating a variety of media products that include appropriate citation and attribution elements.

6-12.DC.4 Students demonstrate an understanding of what personal data is and how to keep it private and secure, including the awareness of terms such as encryption, HTTPS, password, cookies and computer viruses; they also understand the limitations of data management and how data-collection technologies work.

Knowledge Construction

K-2.KC.1 With guidance from an educator, students use digital tools and resources, contained within a classroom platform or otherwise provided by the teacher, to find information on topics of interest.

K-2.KC.2 With guidance from an educator, students become familiar with age-appropriate criteria for evaluating digital content.

K-2.KC.3 With guidance from an educator, students explore a variety of teacher-selected tools to organize information and make connections to their learning.

K-2.KC.4 With guidance from an educator, students explore real-world issues and problems and share their ideas about them with others.

3-5.KC.1 Students collaborate with a teacher to employ appropriate research techniques to locate digital resources that will help them in their learning process.

3-5.KC.2 Students learn how to evaluate sources for accuracy, perspective, credibility and relevance.

3-5.KC.3 Using a variety of strategies, students organize information and make meaningful connections between resources

3-5.KC.4 Students explore real-world problems and issues and collaborate with others to find answers or solutions.

6-12.KC.1 Students demonstrate and practice the ability to effectively utilize research strategies to locate appropriate digital resources in support of their learning.

6-12.KC.2 Students practice and demonstrate the ability to evaluate resources for accuracy, perspective, credibility and relevance.

6-12.KC.3 Students locate and collect resources from a variety of sources and organize assets into collections for a wide range of projects and purposes.

6-12.KC.4 Students explore real-world issues and problems and actively pursue an understanding of them and solutions for them.

Innovative Design

K-2.ID.1 With guidance from an educator, students ask questions, suggest solutions, test ideas to solve problems and share their learning.

K-2.ID.2 Students use age-appropriate digital and non-digital tools to design something and are aware of the step-by-step process of designing.

K-2.ID.3 Students use a design process to develop ideas or creations, and they test their design and redesign if necessary.

K-2.ID.4 Students demonstrate perseverance when working to complete a challenging task.

3-5.ID.1 Students explore and practice how a design process works to generate ideas, consider solutions, plan to solve a problem or create innovative products that are shared with others.

3-5.ID.2 Students use digital and non-digital tools to plan and manage a design process.

3-5.ID.3 Students engage in a cyclical design process to develop prototypes and reflect on the role that trial and error plays.

3-5.ID.4 Students demonstrate perseverance when working with open-ended problems.

6-12.ID.1 Students engage in a design process and employ it to generate ideas, create innovative products or solve authentic problems.

6-12.ID.2 Students select and use digital tools to support a design process and expand their understanding to identify constraints and trade-offs and to weigh risks.

6-12.ID.3 Students engage in a design process to develop, test and revise prototypes, embracing the cyclical process of trial and error and understanding problems or setbacks as potential opportunities for improvement.

6-12.ID.4 Students demonstrate an ability to persevere and handle greater ambiguity as they work to solve open-ended problems.

Computational Thinking

K-2.CT.1 With guidance from an educator, students identify a problem and select appropriate technology tools to explore and find solutions.

K-2.CT.2 With guidance from an educator, students analyze age-appropriate data and look for similarities in order to identify patterns and categories.

K-2.CT.3 With guidance from an educator, students break a problem into parts and identify ways to solve the problem.

K-2.CT.4 Students understand how technology is used to make a task easier or repeatable and can identify real-world examples.

3-5.CT.1 Students explore or solve problems by selecting technology for data analysis, modeling and algorithmic thinking, with guidance from an educator.

3-5.CT.2 Students select effective technology to represent data.

3-5.CT.3 Students break down problems into smaller parts, identify key information and propose solutions.

3-5.CT.4 Students understand and explore basic concepts related to automation, patterns and algorithmic thinking.

6-12.CT.1 Students practice defining problems to solve by computing for data analysis, modeling or algorithmic thinking.

6-12.CT.2 Students find or organize data and use technology to analyze and represent it to solve problems and make decisions.

6-12.CT.3 Students break problems into component parts, identify key pieces and use that information to problem solve.

6-12.CT.4 Students demonstrate an understanding of how automation works and use algorithmic thinking to design and automate solutions.

Creative Communication

K-2.CC.1 With guidance from an educator, students choose different tools for creating something new or for communicating with others.

K-2.CC.2 Students use digital tools to create original works.

K-2.CC.3 With guidance from an educator, students share ideas in multiple ways—visual, audio, etc.

K-2.CC.4 With guidance from an educator, students select technology to share their ideas with different people.

3-5.CC.1 Students recognize and utilize the features and functions of a variety of creation or communication tools.

3-5.CC.2 Student create original works and learn strategies for remixing or repurposing to create new artifacts.

3-5.CC.3 Students create digital artifacts to communicate ideas visually and graphically.

3-5.CC.4 Students learn about audience and consider their expected audience when creating digital artifacts and presentations.

6-12.CC.1 Students select appropriate platforms and tools to create, share and communicate their work effectively.

6-12.CC.2 Students create original works or responsibly repurpose other digital resources into new creative works.

6-12.CC.3 Students communicate complex ideas clearly using various digital tools to convey the concepts textually, visually, graphically, etc.

6-12.CC.4 Students publish or present content designed for specific audiences and select platforms that will effectively convey their ideas to those audiences.

Global Collaboration

K-2.GC.1 With guidance from an educator, students use technology tools to work with friends and with people outside their neighborhood, city and beyond.

K-2.GC.2 With guidance from an educator, students use technology to communicate with others and to look at problems from different perspectives.

K-2.GC.3 With guidance from an educator, students take on different team roles and use age-appropriate technologies to complete projects.

K-2.GC.4 With guidance from an educator, students use age-appropriate technologies to work together to understand problems and suggest solutions.

3-5.GC.1 Students use digital tools to work with friends and people from different backgrounds or cultures.

3-5.GC.2 Students use collaborative technologies to connect with others, including peers, experts and community members, to explore different points of view on various topics.

3-5.GC.3 Students perform a variety of roles within a team using age-appropriate technology to complete a project or solve a problem.

3-5.GC.4 Students work with others using collaborative technologies to explore local and global issues.

6-12.GC.1 Students use digital tools to interact with others to develop a richer understanding of different perspectives and cultures.

6-12.GC.2 Students use collaborative technologies to connect with others, including peers, experts and community members, to learn about issues and problems or to gain broader perspective.

6-12.GC.3 Students determine their role on a team to meet goals, based on their knowledge of technology and content, as well as personal preference.

6-12.GC.4 Students select collaborative technologies and use them to work with others to investigate and develop solutions related to local and global issues.



Anchorage School District

Education Center

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May 2, 2019

Commissioner Michael Johnson
Department of Education and Early Development
801 West Tenth Street, Suite 200
Juneau, AK 99811-0500

Dear Dr. Johnson,

I am writing on behalf of the Anchorage School District in support of the proposed Alaska Digital Literacy Learning Standards and Alaska Computer Science Standards. Anchorage School District staff participated in both of the committees that worked to update these standards and were very pleased with the outcome of the committees' efforts.

Digital literacy and computational thinking are critical to the success of students and the economic development of Alaska. The utilization of technologies for exploring, organizing, experimenting, creating, designing, collaborating, and communicating made a part of these standards supports the knowledge and skills necessary for students to pursue high paying technical and professional careers.

Likewise, the understanding of computer science, including hardware and software, networks and security, the analysis of data, programming, and the cultural, global, and ethical impacts of technology is vital for our students to compete in today's world.

Both sets of standards are the result of state-level alignment with well-researched and broadly reviewed national standards. By adopting the proposed standards, Alaska will insure that our students are not left behind, will continue to grow and learn each year, and are held to the same high expectations as students across the nation.

Finally, by declaring that digital literacy is a content standard and providing a solid framework for computer science education, Alaska is making the statement that we are fully engaged in the future of digital transformation and innovation. Our district is committed to preparing students with a strong foundation in the knowledge, skills, and ethics necessary for success in the workforce they will enter.

Thank you for allowing our staff to participate in the process and to provide comments on the proposed revisions to Alaska's digital literacy standards.

Sincerely,

Dr. Deena Bishop
Superintendent

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 5D

◆ ISSUE

The board is being asked to adopt the proposed amendment of the accreditation regulation that incorporates two new AdvancED published documents, *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems* in place of the outdated *Standards for Quality Schools* currently adopted by reference.

◆ BACKGROUND

- Under 4 AAC 04.300, the department recognizes school accreditation status as determined by the Northwest Accreditation Commission, a division of AdvancED (currently referred to in the regulation as AdvancED Northwest, but updated in the amended regulation), based upon its established accreditation process.
- AdvancED has recently updated its accreditation protocols starting with the 2017/2018 school year. The previous document, *Standards for Quality Schools*, adopted by reference in current regulation (4 AAC 04.300(b)), has in practice been replaced by *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems*.
- The proposed amended regulation updates the materials adopted by reference in 4 AAC 04.300 to be *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems* as published by AdvancED in 2017. The “Editor’s note” is also being updated to reflect current contact information.
- The proposed amended regulation and the two publications to be adopted by reference can be found behind this cover memo.
- Brad Billings, Administrator for School Improvement, will be present to brief the board.

◆ OPTIONS

This is a work session item. Action will take place under Agenda Item 8B.

4 AAC 04.300(b) is amended to read:

(b) The standards for state accreditation for a public or private school in this state are set out in *AdvancED Performance Standards for Schools and AdvancED Performance Standards for School Systems* [*STANDARDS FOR QUALITY SCHOOLS*], published by AdvancED **in 2017** [AS OF 2011,] and adopted by reference.

4 AAC 04.300(c) is amended to read:

(c) A public or private school in this state will be accredited by the department under AS 14.07.020(a)(6) if the school is accredited by the **Northwest Accreditation Commission, a division of** AdvancED [NORTHWEST] after completion of the accreditation process, including the internal review and the external review. (Eff. 10/25/98, Register 148; am 10/16/2021, Register 204; am 4/4/2013, Register 206; am __/__/____, Register ____)

Authority: AS 14.07.020 AS 14.07.060

Editor's note: A copy of the *AdvancED Performance Standards for Schools and AdvancED Performance Standards for School Systems* [*STANDARDS FOR QUALITY SCHOOLS*], adopted by reference in 4 AAC 04.300(b), may be obtained by writing to the Department of Education and Early Development, 801 West 10th Street, Suite 200, P.O. Box 110500, Juneau, AK 99811-0500 or **by contacting AdvancED** at **<http://www.advanced.org/managing-office-locations/alaska-office>** [[HTTP://WWW.ADVANCED.ORG/WEBFM_SEND/288](http://WWW.ADVANCED.ORG/WEBFM_SEND/288)].



AdvancED[®] Performance Standards

for School Systems

AdvancED® Performance Standards



Continuous improvement that results in success for all learners should be the goal of every institution. The *Improvement Journey* for each institution may look different but should always include measures of quality of learning and instruction. The *AdvancED Performance Standards* serve this purpose by providing a set of evaluative criteria that lays the foundation for improvement planning and implementation. Based on rigorous research and best practices, the Standards are a powerful tool for driving institutional change.

AdvancED is committed to quality and meeting the needs of the educational institutions we serve. Every five years, we use an iterative process to review, revise and renew our Standards to ensure they remain relevant and challenge institutions to reach higher. Our guiding question is: What will support the success of each and every learner?

The *AdvancED Performance Standards* embody our belief that high quality learning can transform lives, communities and the world.

Anatomy of the *AdvancED Performance Standards*

The new Standards, varying in number based on institution type, are organized under three Domains:

- 1** Leadership Capacity
- 2** Learning Capacity
- 3** Resource Capacity

The Domains are statements that define the capacity of an organization or institution to provide quality and meet the rigorous demands of continuous improvement. Each Domain is further defined by Standards, which in turn, are defined by Performance Rubrics.

The *AdvancED Performance Standards* are research-based statements that describe conditions that are necessary for institutions to support organizational effectiveness and improve student performance.

In addition to the Domains and accompanying Standards, two Performance Rubrics also are aligned to the Standards to help provide measurable progress and an overall assessment of practices. The Rubrics act as a diagnostic tool, each consisting of four performance levels, that contain evaluative criteria related to concepts contained within the Standard statement.

Collectively, the elements of the *AdvancED Performance Standards* serve as a road map for the continuous improvement process for institutions and as the foundation of the accreditation process used by AdvancED Review Teams to provide relevant and quality feedback on how institutions are serving the learner.

1

Leadership Capacity Domain

The capacity of leadership to ensure an institution's progress toward its stated objectives is an essential element of organizational effectiveness. An institution's leadership capacity includes the fidelity and commitment to its purpose and direction, the effectiveness of governance and leadership to enable the institution to realize its stated objectives, the ability to engage and involve stakeholders in meaningful and productive ways, and the capacity to implement strategies that improve learner and educator performance.

Standard 1.1:

The system commits to a purpose statement that defines beliefs about teaching and learning, including the expectations for learners.

4

The system has a documented and systematic process for the development and/or review of the purpose statement that includes collaboration and input from all representative stakeholder groups.

3

The system has a documented process for the development and/or review of the purpose statement that includes collaboration and input from most representative stakeholder groups.

2

The system has a process for the development and/or review of the purpose statement that includes input from some stakeholder groups.

1

The system does not have a process for the development and/or review of the purpose statement and the involvement of stakeholder groups.

4

The purpose statement contains clearly defined and measurable expectations for student learning that include shared beliefs about teaching and learning and is used to guide decisions about teaching and learning.

3

The purpose statement contains defined expectations for student learning that include shared beliefs about teaching and learning and is used to guide decisions about teaching and learning.

2

The purpose statement contains some defined expectations for student learning and sometimes is used to guide decisions about teaching and learning.

1

The purpose statement contains limited expectations for student learning and may not guide decisions about teaching and learning.

Standard 1.2:

Stakeholders collectively demonstrate actions to ensure the achievement of the system's purpose and desired outcomes for learners.

4

The system has clearly documented evidence of actions involving all stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

3

The system has some documented evidence of actions involving most stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

2

The system has limited evidence of actions involving stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

1

The system has little to no evidence of actions involving stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

4

There is a documented process to collect and use data to evaluate the achievement of the purpose and desired outcomes for learners.

3

There is a process to use data to evaluate the achievement of the purpose and desired outcomes for learners.

2

There is some data used to evaluate the achievement of the purpose and desired outcomes for learners.

1

There is no evidence of data used to evaluate the achievement of the purpose and desired outcomes for learners.

Standard 1.3:

The system engages in a continuous improvement process that produces evidence, including measurable results of improving student learning and professional practice.

4

The system engages in a focused, intentional, data-driven, and collaborative planning process for continuous improvement and monitors and revises the improvement plan based on evidence and results of implementation.

3

The system engages in a data-driven planning process for continuous improvement and monitors and revises the improvement plan based on evidence and results of implementation.

2

The system engages in a planning process for continuous improvement that is based on some data and monitors the implementation.

1

The system has no evidence of planning for continuous improvement.

4

The plan is well-articulated, widely communicated, and contains clearly identified and specific goals, strategies, activities, and measures based on identified needs. The results are systematically evaluated and clearly communicated to all representative stakeholder groups.

3

The plan contains identified goals, strategies, activities and measures based on identified needs. The results are evaluated and communicated to some representative stakeholder groups.

2

The plan contains goals, strategies, activities and measures, and the results are evaluated.

1

The plan lacks sufficient information regarding goals, strategies, activities and measures, and there is no evidence of evaluation or communication of results.

Standard 1.4:

The governing authority establishes and ensures adherence to policies that are designed to support system effectiveness.

4

The governing authority has a documented, data-driven process for the ongoing development, review and revision of policies.

3

The governing authority has a documented process for the development, review and revision of policies.

2

The governing authority has a limited and inconsistent process for the development, review and revision of policies.

1

The governing authority does not have a process for the development, review and revision of policies.

4

The governing authority adopts, updates, and holds itself accountable to clearly written policies that comply with applicable laws and regulations and ensure integrity and effective operations.

3

The governing authority adopts and updates written policies that comply with applicable laws and regulations and ensure integrity and effective operations.

2

The governing authority has policies that comply with applicable laws and regulations and ensure effective operations.

1

The governing authority's policies are vague, and it is unclear whether they comply with applicable laws and regulations or whether they ensure effective operations.

Standard 1.5:

The governing authority adheres to a code of ethics and functions within defined roles and responsibilities.

4

The governing authority adopts and holds itself accountable to a written code of ethics that defines principles of conduct and ethical standards for governance that include policies and practices that provide leadership the autonomy for day-to-day effective operations of the system.

3

The governing authority has a written code of ethics that defines principles of conduct and ethical standards for governance that include policies and practices that provide leadership the autonomy for day-to-day operations of the system.

2

The governing authority has a written code of ethics for governance that include policies that provide leadership the autonomy for day-to-day operations of the system.

1

The governing authority has a vague code of ethics or does not have a code of ethics and does not provide leadership the autonomy for day-to-day operations of the system.

4

The governing authority adopts, updates, and holds itself accountable to policies that define its roles and responsibilities and regularly engages in ongoing professional learning to enable it to stay current and informed regarding roles and responsibilities, applicable laws, regulations, organizational best practices, and the use of evidence to guide decision-making.

3

The governing authority adopts and updates policies that define its roles and responsibilities and engages in professional learning to enable it to stay current and informed regarding roles and responsibilities, applicable laws, regulations, and organizational best practices.

2

The governing authority has policies that define its roles and responsibilities and engages in limited professional learning to enable it to stay current regarding roles and responsibilities, applicable laws, and regulations.

1

The governing authority does not maintain policies or has vague policies that define its roles and responsibilities and rarely engages in professional learning to enable it to be effective in its roles and responsibilities.

Standard 1.6:

Leaders implement staff supervision and evaluation processes to improve professional practice and organizational effectiveness.

4

The system has written supervision and evaluation processes for staff members that include specific criteria and models for effective performance and use the results to inform and improve professional practice and student performance.

3

The system has written supervision and evaluation processes for staff members that include specific criteria for performance and use the results to inform and improve professional practice.

2

The system has an evaluation process for staff members that includes general criteria for performance and provides limited results for improving professional practice.

1

The system does not have a supervision and evaluation process for staff members or has a vague or unclear process for supervising and evaluating staff members.

4

The evaluation process is systematically implemented with fidelity by evaluators who have the knowledge, expertise, and training and includes mechanisms for ongoing feedback and monitoring.

3

The evaluation process is implemented by evaluators who have the knowledge, expertise, and training and includes mechanisms for feedback and monitoring.

2

The evaluation process is implemented by trained evaluators and includes a mechanism for feedback.

1

The evaluation process is implemented without consistency and provides little or no feedback.

Standard 1.7:

Leaders implement operational processes and procedures to ensure organizational effectiveness in support of teaching and learning.

4

The system establishes, trains staff, and has evidence of effective implementation of systematic and systemic written processes and procedures.

3

The system establishes and trains staff to implement written processes and procedures.

2

The system establishes written processes and procedures.

1

The system establishes vague or few, if any, written processes and procedures.

4

The system gathers evidence, including the performance of educators and learners, to evaluate the effectiveness and inform the review and revision of processes and procedures.

3

The system gathers evidence to evaluate the effectiveness and inform the review and revision of processes and procedures.

2

The system evaluates and makes revisions, when needed, of processes and procedures.

1

The system does not evaluate the effectiveness of processes and procedures.

Standard 1.8:

Leaders engage stakeholders to support the achievement of the system's purpose and direction.

4

Leaders at all levels implement a formal program that provides for meaningful roles and active participation of internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

3

Leaders at all levels provide opportunities for active participation of internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

2

Leaders at all levels engage staff, students and parent stakeholder groups.

1

Leaders rarely or never engage internal and external stakeholder groups.

4

Leaders at all levels consistently and deliberately enact strategies that provide opportunities for two-way communication with internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

3

Leaders at all levels enact strategies that provide opportunities for two-way communication with internal and external stakeholders.

2

Leaders at all levels provide opportunities for communication with stakeholders.

1

Leaders rarely or never enact strategies that provide opportunities for communication with stakeholders.

Standard 1.9:

The system provides experiences that cultivate and improve leadership effectiveness.

4

The system enacts a formal program designed to build capacity for effective leadership that includes modeling, coaching and team-building activities.

3

The system supports activities that are designed to improve leadership effectiveness.

2

The system provides support to individuals to engage in activities that are designed to improve leadership effectiveness.

1

The system has little or no evidence of opportunities designed to build leadership capacity.

4

The system and its leaders nurture a collaborative culture that includes multiple and varied opportunities for shared leadership among stakeholders.

3

The system and its leaders support a culture that includes opportunities for shared leadership among stakeholders.

2

The system and its leaders provide opportunities for shared leadership among stakeholders.

1

The system and its leaders provide limited opportunities for shared leadership among stakeholders.

Standard 1.10:

Leaders collect and analyze a range of feedback data from multiple stakeholder groups to inform decision-making that results in improvement.

4

The system has a comprehensive system for the collection and analysis of feedback data from multiple, reliable sources, including internal and external stakeholder groups.

3

The system collects and analyzes feedback data from multiple sources, including internal and external stakeholder groups.

2

The system collects and analyzes feedback data from parent, staff, and student stakeholder groups.

1

The system rarely collects and analyzes feedback data.

4

The system systematically uses evidence from multiple sources of feedback data to inform decisions that clearly result in improvement. Decisions, progress and improvement are regularly communicated to stakeholder groups through a variety of media.

3

The system uses feedback data to inform decisions that result in improvement and regularly communicates decisions to stakeholder groups.

2

The system includes feedback data as a part of the continuous improvement process and sometimes communicates decisions to stakeholder groups.

1

The system rarely or never uses feedback data to inform decisions for improvement.

Standard 1.11:

Leaders implement a quality assurance process for its institutions to ensure system effectiveness and consistency.

4

The system has clearly defined policies and procedures for ensuring each of its institutions engages in a focused, intentional, data-driven, and collaborative planning process for continuous improvement and monitors and revises its improvement plan based on evidence and results of implementation.

3

The system has procedures for ensuring each of its institutions engages in a data-driven planning process for continuous improvement and monitors and revises its improvement plan based on evidence and results of implementation.

2

The system engages in a planning process for each of its institutions that is based on some data and monitors the implementation.

1

The system has no evidence of planning for continuous improvement.

4

The plan is well-articulated, widely communicated, and contains clearly identified and specific goals, strategies, activities, and measures based on identified needs. The results are systematically evaluated and clearly communicated to all representative stakeholder groups.

3

The plan contains identified goals, strategies, activities and measures based on identified needs. The results are evaluated and communicated to some representative stakeholder groups.

2

The plan contains goals, strategies, activities and measures, and the results are evaluated.

1

The plan lacks sufficient information regarding goals, strategies, activities and measures, and there is no evidence of evaluation or communication of results.

The impact of teaching and learning is the primary expectation of every system and its institutions. The establishment of a learning culture built on high expectations for learning, along with quality programs and services, which include an analysis of results, are all key indicators of the system's impact on teaching and learning.

Standard 2.1:

Learners have equitable opportunities to develop skills and achieve the content and learning priorities established by the system.

4

Personalizing learning opportunities for all learners is an integral part of the system's culture and permeates teaching and learning.

3

Learning opportunities are personalized to meet most individual learners' needs and interests.

2

Learning opportunities are sometimes personalized to meet some individual learners' needs and interests.

1

Personalizing learning opportunities is not a regular part of the system's teaching and learning culture.

4

Alignment between learning opportunities and the system's high learning expectations is unmistakably evident.

3

The system strives to align learning opportunities with its high learning expectations, with some work still to be accomplished.

2

Learning opportunities sometimes align to the system's learning expectations.

1

There is little to no alignment between learning opportunities and the system's learning expectations.

Standard 2.2:

The learning culture promotes creativity, innovation and collaborative problem-solving.

4

Faculty and staff throughout the system purposefully plan and implement all learning experiences and activities to actively promote a high level of learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection through the completion of projects and inquiry-based activities.

3

Most learning experiences and activities are planned and implemented to promote learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection through the completion of projects and inquiry-based activities.

2

Some learning experiences demonstrate learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection through the completion of projects and inquiry-based activities.

1

Few or no learning experiences demonstrate learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection through the completion of projects and inquiry-based activities.

4

Faculty and staff throughout the system enthusiastically embrace and consistently demonstrate a set of shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

3

Faculty and staff throughout the system exhibit a set of shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

2

Most faculty and staff exhibit some shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

1

Few or no faculty and staff exhibit shared beliefs that focus on learner engagement and the development of creativity and innovation.

Standard 2.3:

The learning culture develops learners' attitudes, beliefs and skills needed for success.

4

Educators throughout the system consistently provide numerous and equitable experiences that teach learners effective communication skills in all formats (oral, written and digital) and self-direction by expecting them to set goals for their learning and monitor their own progress.

3

Educators throughout the system frequently provide experiences that teach learners effective communication skills in all formats (oral, written and digital) and self-direction by encouraging them to set goals for their learning and monitor their own progress.

2

Educators throughout the system sometimes provide experiences that teach learners communication skills in all formats (oral, written and digital) and self-direction by encouraging them to set goals for their learning and monitor their own progress.

1

Educators rarely or never provide experiences to teach learners communication skills or the skills of self-direction.

4

The system clearly and consistently demonstrates the explicit and intentional development of learners' positive attitudes, self-perceptions, and beliefs about learning.

3

The system demonstrates the explicit development of learners' positive attitudes, self-perceptions and beliefs about learning.

2

The system demonstrates some development of learners' positive attitudes, self-perceptions and beliefs about learning.

1

The system demonstrates little or no explicit development of learners' positive attitudes, self-perceptions and beliefs about learning.

Standard 2.4:

The system has a formal structure to ensure learners develop positive relationships with and have adults/peers that support their educational experiences.

4

The system implements and regularly and comprehensively evaluates a formal structure for all learners to have frequent and consistent access to a particular adult, selected by the learner, who ensures the learners are fully supported throughout their educational experiences.

3

The system implements and evaluates a formal structure for learners to have consistent access to an adult who ensures the learners are supported during their educational experiences.

2

The system implements a minimal structure for learners to have access to an adult who ensures the learners are supported during their educational experiences.

1

The system has no structure for learners to have access to an adult who ensures the learners are supported during their educational experiences.

4

The system consistently ensures each learner has numerous opportunities to develop strong and mutually respectful relationships with the system's adults and the learner's peers.

3

The system ensures learners have opportunities to develop strong and mutually respectful relationships with the system's adults and the learner's peers.

2

The system provides learners with some opportunities to develop respectful relationships with the system's adults and the learner's peers.

1

The system provides learners with limited or no opportunities to develop respectful relationships with the system's adults and the learner's peers.

Standard 2.5:

Educators implement a curriculum that is based on high expectations and prepares learners for their next levels.

4

The system has adopted and all educators consistently implement a relevant, rigorous, and aligned curriculum across all grade levels and content areas.

3

The system has adopted and most educators consistently implement a relevant, rigorous, and aligned curriculum across most grade levels and content areas.

2

The system has adopted a relevant, rigorous, and aligned curriculum across some grade levels and content areas, but few educators implement it consistently.

1

The system has adopted a curriculum but can provide little or no evidence of consistent implementation.

4

Educators expect all learners to participate in a curriculum that is based on high expectations and prepares them to be successful at their next levels.

3

Educators expect most learners to participate in a curriculum that is based on high expectations and prepares them for their next levels.

2

Educators expect some learners to participate in a curriculum that has high expectations for learning and may prepare them for their next levels.

1

Educators engage learners in a curriculum that has expectations for learning that appear lower than would be expected and may or may not prepare them for their next levels.

Standard 2.6:

The system implements a process to ensure the curriculum is aligned to standards and best practices.

4

The system implements a systematic process to ensure the curriculum is clearly aligned to a recognized, rigorous set of standards.

3

The system implements a process to ensure the curriculum is aligned to a rigorous set of standards.

2

The system appears to have a process to ensure the curriculum is aligned to a set of standards.

1

The system rarely or never ensures the curriculum is aligned to a set of standards.

4

The curriculum is clearly aligned to research and best practices related to the system's purpose.

3

The curriculum is aligned to research and best practices related to the system's purpose.

2

The curriculum is somewhat aligned to research or best practices related to the system's purpose.

1

The curriculum has minimal or no alignment to research or best practices related to the system's purpose.

Standard 2.7:

Instruction is monitored and adjusted to meet individual learners' needs and the system's learning expectations.

4

Educators throughout the system consistently use current and relevant data and a clearly defined process to monitor and adjust instruction to ensure individual learners' needs and the system's learning expectations are met.

3

Educators throughout the system frequently use current and relevant data from major content areas and a process to monitor and adjust instruction to ensure individual learners' needs and the system's learning expectations are met.

2

Educators throughout the system sometimes use relevant data and a process to monitor and adjust instruction to ensure individual learners' needs and the system's learning expectations are met.

1

Educators rarely or never use data or a process to monitor and adjust instruction to ensure individual learners' needs and the system's learning expectations are met.

4

Educators throughout the system consistently implement effective, individualized instructional strategies that address each learner's needs based on deliberate and purposeful planning.

3

Educators throughout the system frequently implement individualized instructional strategies that address each learner's needs based on purposeful planning.

2

Educators throughout the system sometimes implement effective, somewhat individualized instructional strategies that address each learner's needs based on planning.

1

Educators rarely or never engage in deliberate and purposeful planning to determine or implement effective instructional strategies that address each learner's needs.

Standard 2.8:

The system provides programs and services for learners' educational future and career planning.

4

The system identifies and implements comprehensive programs and services for all learners to identify strengths and interests that support their career planning and/or educational success at the next level.

3

The system identifies and implements many programs and services for learners to identify strengths and interests that support their career planning and/or educational success at the next level.

2

The system identifies and implements some programs or services for learners to identify strengths and interests that support their career planning and/or educational success at the next level.

1

The system implements few or no programs or services for learners to identify strengths and interests for career planning and/or educational success at the next level.

4

All learners develop and document individualized goals, plans, and achievements, based on interests and needs, to support their success at the next level.

3

Most learners develop and document individualized goals, plans and achievements to support their success at the next level.

2

Some learners develop goals and plans and/or document some achievements to support their success at the next level.

1

Few or no learners develop goals and plans to support their success at the next level.

Standard 2.9:

The system implements processes to identify and address the specialized needs of learners.

4

The system and its institutions consistently implement a formalized and documented process for the identification and referral of all students who need additional assistance, services, and resources.

3

The system and its institutions usually implement a formalized process for the identification and referral of all students who need additional assistance, services, and resources.

2

The system and its institutions have some processes for the identification and referral of students who need additional assistance, services, and resources.

1

The system has few or no processes for the identification and referral of students who need additional assistance, services, and resources.

4

The system and its institutions consistently utilize internal and external resources and monitor and evaluate all programs and progress toward addressing the specialized needs of students, and relevant data are regularly used to modify and adjust services.

3

The system and its institutions utilize internal and external resources and monitor and evaluate most programs and progress toward addressing specialized needs of students, and data are used to modify and adjust services.

2

The system and its institutions utilize available resources and sometimes monitor and evaluate progress toward addressing the specialized needs of students.

1

The system utilizes available resources and seldom or never monitors progress toward addressing the specialized needs of students.

Standard 2.10:

Learning progress is reliably assessed and consistently and clearly communicated.

4

Educators across all grades and subject areas throughout the system consistently and with fidelity use the institution's established common grading practices and criteria to represent the learner's attainment of content knowledge and skills. These are assessed based on a cohesive set of formative and summative assessments to ensure each learner improves and is prepared for the next level through consistent and clear communication.

3

Educators throughout the system consistently use the institution's established common grading practices and criteria to represent the learner's attainment of content knowledge and skills. These are assessed based on a variety of formative and summative assessment data to ensure each learner improves and is prepared for the next level through consistent and clear communication.

2

Some educators throughout the system use common grading practices and criteria to represent the learner's attainment of content knowledge and skills based on data.

1

Few or no educators use common grading practices and criteria to represent the learner's attainment of content knowledge and skills.

4

Formal and informal communication about each learner's progress is consistently and frequently provided to all appropriate stakeholders, including the individual learner, in language that is clear and understandable.

3

Formal and informal communication about each learner's progress is frequently provided to appropriate stakeholders, including the individual learner, in language that is clear and understandable.

2

Formal and informal communication about each learner's progress is sometimes provided to appropriate stakeholders, including the individual learner, in language that is clear and understandable.

1

Communication about each learner's progress is inconsistently, rarely or never provided to stakeholders in language that is clear and understandable.

Standard 2.11:

Educators gather, analyze, and use formative and summative data that lead to demonstrable improvement of student learning.

4

All educators throughout the system analyze data from a cohesive set of formative and summative assessments that lead to the demonstrable improvement of achievement and success of individual and collective groups of learners in preparation for the next educational level.

3

Most educators throughout the system analyze data from multiple types of formative and summative assessments that lead to the demonstrable improvement of achievement and success of individual and collective groups of learners in preparation for the next educational level.

2

Some educators throughout the system analyze data from assessments that improve the achievement and success of individual and collective groups of learners.

1

Few or no educators analyze data from assessments that lead to improvement of achievement of individual and collective groups of learners.

4

All educators throughout the system consistently use data to modify instruction and transform learning experiences for learners.

3

Most educators throughout the system use data to modify instruction and transform learning experiences for learners.

2

Some educators throughout the system occasionally use data to modify instruction and improve the learning experiences for learners.

1

Few educators use data to modify instruction or improve the learning experiences for learners.

Standard 2.12:

The system implements a process to continuously assess its programs and organizational conditions to improve student learning.

4

The system implements a formal, documented evaluation process that includes contextually based research and an ongoing and systematic analysis of trend and comparison data related to student learning across the curriculum and organizational effectiveness.

3

The system implements an evaluation process that includes an ongoing analysis of trend and comparison data related to student learning in most academic areas and organizational effectiveness.

2

The system implements an evaluation process that includes analysis of trend or comparison data related to student learning in some academic areas or organizational effectiveness.

1

The system implements few or no evaluation processes related to student learning or organizational effectiveness.

4

The system uses results from the evaluation process to inform decision-making, improve and refine curriculum, programs, and innovative practices, and improve student learning.

3

The system uses results from the evaluation process to inform decision-making, improve and refine curriculum and programs, and improve student learning.

2

The system uses the results of the evaluation process to inform decision-making and improve and refine curriculum.

1

The system rarely or never uses results for improvement.

The use and distribution of resources align and support the needs of the system and institutions served. Systems ensure that resources are aligned with its stated purpose and direction and distributed equitably so that the needs of the system are adequately and effectively addressed. The utilization of resources includes support for professional learning for all staff. The system examines the allocation and use of resources to ensure appropriate levels of funding, sustainability, and system effectiveness.

Standard 3.1:

The system plans and delivers professional learning to improve the learning environment, learner achievement, and the system's effectiveness.

4

Using data from a variety of sources, the system plans, evaluates the effectiveness of, and uses the results of professional learning to improve practice and learner achievement and increase content and pedagogical knowledge and organizational effectiveness.

3

Using data from evaluation and supervision processes, the system plans and evaluates the effectiveness of professional learning to improve practice and learner achievement and increase content and pedagogical knowledge and organizational effectiveness.

2

Using limited data, the system plans professional learning to improve practice and organizational effectiveness.

1

Professional learning, if offered, is not based on data.

4

The system delivers relevant and job-embedded professional learning for all staff members to improve their practice and achieve organizational goals.

3

The system frequently delivers relevant professional learning for most staff members to improve their practice and achieve organizational goals.

2

The system sometimes delivers professional learning for staff members related to their position and organizational needs and goals.

1

The system rarely delivers professional learning for staff members related to their position or organizational needs and goals.

Standard 3.2:

The system's professional learning structure and expectations promote collaboration and collegiality to improve learner performance and organizational effectiveness.

4

All staff members throughout the system participate in structured, accountable professional learning communities that focus their discussions on data analysis and use the results of their analyses to improve learner performance and organizational effectiveness.

3

All professional staff members throughout the system participate in structured, accountable professional learning communities that analyze data and use the results of their analyses to improve student learning.

2

Some staff members participate in professional learning communities that sometimes review data on student learning.

1

Few or no staff members participate in professional learning communities.

4

The system consistently allocates ample resources to provide both formal and informal structures for collaboration.

3

The system allocates adequate resources to provide formal and informal structures for collaboration.

2

The system provides some resources for collaboration.

1

The system provides few or no resources for collaboration.

Standard 3.3:

The system provides induction, mentoring, and coaching programs that ensure all staff members have the knowledge and skills to improve student performance and organizational effectiveness.

4

The system provides, monitors, evaluates, and modifies induction and mentoring programs for all new staff that include performance expectations and are designed to meet individual needs.

3

The system provides and monitors induction and mentoring programs for new professional staff that include performance expectations and are designed to meet individual needs.

2

The system provides some induction and mentoring programs for new staff.

1

The system provides little or no induction or mentoring for new staff.

4

The system provides, monitors, evaluates, and modifies coaching and modeling programs that address unique professional practices and organizational expectations for all staff through guidance, support, and feedback from peers and leaders.

3

The system provides and monitors coaching and modeling programs that address organizational expectations for all professional staff through guidance, support, and feedback from peers and leaders.

2

The system provides coaching and modeling programs for some staff through guidance, support, and feedback from peers and leaders.

1

Instructional coaching and modeling is rarely or never used.

Standard 3.4:

The system attracts and retains qualified personnel who support the system's purpose and direction.

4

The system uses and regularly evaluates a documented and ongoing process that uses data to determine personnel needs, which includes an assessment of talent, qualifications, and assurance of sufficient numbers, to ensure learners' and organizational needs are met.

3

The system uses a documented process that uses data to determine personnel needs, which includes an assessment of talent, qualifications and sufficient numbers, to ensure organizational needs are met.

2

The system uses a process to determine personnel needs that sometimes includes an assessment of talent, qualifications and sufficient numbers.

1

The system uses an informal process or has no process to assess personnel needs.

4

The system uses and regularly evaluates a deliberate and formalized process to recruit and retain personnel through meaningful learning opportunities, personal growth, financial support, and leadership opportunities.

3

The system uses a deliberate and formalized process to recruit and retain personnel.

2

The system uses a formal process to recruit and retain personnel.

1

The system uses a vague and/or informal process to recruit and retain personnel.

Standard 3.5:

The system integrates digital resources into teaching, learning, and operations to improve professional practice, student performance, and organizational effectiveness.

4

Using a variety of data sources, including needs assessments, the system engages in a comprehensive planning process that focuses on the integration of digital resources into teaching, learning, and operations and evaluates and demonstrates improvements in professional practice, student performance, and organizational effectiveness.

3

Using a needs assessment, the system engages in a comprehensive planning process that focuses on the integration of digital resources into teaching, learning, and operations and evaluates improvements in professional practice, student performance, and organizational effectiveness.

2

The system engages in a planning process that focuses on the integration of digital resources into teaching, learning and operations.

1

The system engages in little or no planning focused on the integration of digital resources into teaching, learning and operations.

4

The system provides ample human, material, and fiscal resources and monitors that these resources are appropriately used to effectively integrate digital resources into teaching, learning, and operations.

3

The system provides sufficient human, material, and fiscal resources to effectively integrate digital resources into teaching, learning, and operations.

2

The system provides some resources to integrate digital resources into teaching, learning and operations.

1

The system provides few or no resources to integrate digital resources into teaching, learning and operations.

Standard 3.6:

The system provides access to information resources and materials to support the curriculum, programs, and needs of students, staff, and the system.

4

The system implements a documented comprehensive process based on research and best practice for the identification, acquisition, use, and updating of appropriate materials and resources aligned to curricular and instructional programs as well as organizational needs and initiatives.

3

The system implements a documented process for the identification, acquisition, use, and updating of materials and resources aligned to curricular and instructional programs as well as organizational needs and initiatives.

2

The system implements a process for the identification, acquisition, use, and updating of materials and resources.

1

The system has limited or no processes for the identification, acquisition, use, and updating of materials and resources.

4

The system provides a wide variety of high-quality resources that are easily accessible and sufficiently address the needs and interests of students, staff, and the system.

3

The system provides a variety of high-quality resources that are easily accessible and address the needs and interests of students, staff, and the system.

2

The system provides a variety of resources that are accessible and address the needs of students, staff, and the system.

1

The system provides minimal resources that address the needs of students, staff and the system.

Standard 3.7:

The system demonstrates strategic resource management that includes long-range planning and use of resources in support of the system's purpose and direction.

4

The system implements and evaluates formal planning processes for long-range strategic resource management of budgets, facilities and other organizational needs.

3

The system implements a planning process for long-range strategic resource management of budgets, facilities and other organizational needs.

2

The system uses a planning process to manage budgets, facilities and other organizational needs.

1

The system does not use a planning process to manage budgets, facilities and other organizational needs.

4

The system demonstrates effective practices for long-range, strategic management of budgets, facilities and other organizational needs in support of the system's purpose and direction.

3

The system implements practices for long-range, strategic management of budgets, facilities and other organizational needs in support of the system's purpose and direction.

2

The system implements some clear practices for management of budgets, facilities and other organizational needs.

1

The system implements vague and/or unclear practices for management of budgets, facilities and other organizational needs.

Standard 3.8:

The system allocates human, material, and fiscal resources in alignment with the system's identified needs and priorities to improve student performance and organizational effectiveness.

4

The system has a formal budgeting process that allocates and aligns resources to address priorities for improvement designed to improve student learning and is equitably distributed to meet the needs of students.

3

The system frequently aligns resources to address priorities for improvement designed to improve student learning and is equitably distributed to meet the needs of students.

2

The system sometimes aligns resources to address priorities for improvement designed to improve student learning.

1

The system rarely or never aligns resources to address priorities for improvement designed to improve student learning.

4

The system consistently evaluates and demonstrates effective use of human, material, and fiscal resources to meet the learners' and system's identified needs and priorities.

3

The system frequently evaluates and demonstrates effective use of human, material, and fiscal resources to meet the learners' and system's identified needs and priorities.

2

The system sometimes evaluates and demonstrates effective use of human, material, and fiscal resources.

1

The system rarely or never evaluates or demonstrates effective use of human, material, and fiscal resources.



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AdvancED[®] Performance Standards

for Schools

AdvancED® Performance Standards



Continuous improvement that results in success for all learners should be the goal of every institution. The *Improvement Journey* for each institution may look different but should always include measures of quality of learning and instruction. The *AdvancED Performance Standards* serve this purpose by providing a set of evaluative criteria that lays the foundation for improvement planning and implementation. Based on rigorous research and best practices, the Standards are a powerful tool for driving institutional change.

AdvancED is committed to quality and meeting the needs of the educational institutions we serve. Every five years, we use an iterative process to review, revise and renew our Standards to ensure they remain relevant and challenge institutions to reach higher. Our guiding question is: What will support the success of each and every learner?

The *AdvancED Performance Standards* embody our belief that high quality learning can transform lives, communities and the world.

Anatomy of the *AdvancED Performance Standards*

The new Standards, varying in number based on institution type, are organized under three Domains:

- 1** Leadership Capacity
- 2** Learning Capacity
- 3** Resource Capacity

The Domains are statements that define the capacity of an organization or institution to provide quality and meet the rigorous demands of continuous improvement. Each Domain is further defined by Standards, which in turn, are defined by Performance Rubrics.

The *AdvancED Performance Standards* are research-based statements that describe conditions that are necessary for institutions to support organizational effectiveness and improve student performance.

In addition to the Domains and accompanying Standards, two Performance Rubrics also are aligned to the Standards to help provide measurable progress and an overall assessment of practices. The Rubrics act as a diagnostic tool, each consisting of four performance levels, that contain evaluative criteria related to concepts contained within the Standard statement.

Collectively, the elements of the *AdvancED Performance Standards* serve as a road map for the continuous improvement process for institutions and as the foundation of the accreditation process used by AdvancED Review Teams to provide relevant and quality feedback on how institutions are serving the learner.

1

Leadership Capacity Domain

The capacity of leadership to ensure an institution's progress toward its stated objectives is an essential element of organizational effectiveness. An institution's leadership capacity includes the fidelity and commitment to its purpose and direction, the effectiveness of governance and leadership to enable the institution to realize its stated objectives, the ability to engage and involve stakeholders in meaningful and productive ways, and the capacity to implement strategies that improve learner and educator performance.

Standard 1.1:

The institution commits to a purpose statement that defines beliefs about teaching and learning, including the expectations for learners.

4

The institution has a documented and systematic process for the development and/or review of the purpose statement that includes collaboration and input from all representative stakeholder groups.

3

The institution has a documented process for the development and/or review of the purpose statement that includes collaboration and input from most representative stakeholder groups.

2

The institution has a process for the development and/or review of the purpose statement that includes input from some stakeholder groups.

1

The institution does not have a process for the development and/or review of the purpose statement and the involvement of stakeholder groups.

4

The purpose statement contains clearly defined and measurable expectations for student learning that include shared beliefs about teaching and learning and is used to guide decisions about teaching and learning.

3

The purpose statement contains defined expectations for student learning that include shared beliefs about teaching and learning and is used to guide decisions about teaching and learning.

2

The purpose statement contains some defined expectations for student learning and sometimes is used to guide decisions about teaching and learning.

1

The purpose statement contains limited expectations for student learning and may not guide decisions about teaching and learning.

Standard 1.2:

Stakeholders collectively demonstrate actions to ensure the achievement of the institution's purpose and desired outcomes for learners.

4

The institution has clearly documented evidence of actions involving all stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

3

The institution has some documented evidence of actions involving most stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

2

The institution has limited evidence of actions involving stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

1

The institution has little to no evidence of actions involving stakeholder groups and decisions aligned with the purpose in support of the achievement of desired outcomes for learners.

4

There is a documented process to collect and use data to evaluate the achievement of the purpose and desired outcomes for learners.

3

There is a process to use data to evaluate the achievement of the purpose and desired outcomes for learners.

2

There is some data used to evaluate the achievement of the purpose and desired outcomes for learners.

1

There is no evidence of data used to evaluate the achievement of the purpose and desired outcomes for learners.

Standard 1.3:

The institution engages in a continuous improvement process that produces evidence, including measurable results of improving student learning and professional practice.

4

The institution engages in a focused, intentional, data-driven, and collaborative planning process for continuous improvement and monitors and revises the improvement plan based on evidence and results of implementation.

3

The institution engages in a data-driven planning process for continuous improvement and monitors and revises the improvement plan based on evidence and results of implementation.

2

The institution engages in a planning process for continuous improvement that is based on some data and monitors the implementation.

1

The institution has no evidence of planning for continuous improvement.

4

The plan is well-articulated, widely communicated, and contains clearly identified and specific goals, strategies, activities, and measures based on identified needs. The results are systematically evaluated and clearly communicated to all representative stakeholder groups.

3

The plan contains identified goals, strategies, activities and measures based on identified needs. The results are evaluated and communicated to some representative stakeholder groups.

2

The plan contains goals, strategies, activities and measures, and the results are evaluated.

1

The plan lacks sufficient information regarding goals, strategies, activities and measures, and there is no evidence of evaluation or communication of results.

Standard 1.4:

The governing authority establishes and ensures adherence to policies that are designed to support institutional effectiveness.

4

The governing authority has a documented, data-driven process for the ongoing development, review and revision of policies.

3

The governing authority has a documented process for the development, review and revision of policies.

2

The governing authority has a limited and inconsistent process for the development, review and revision of policies.

1

The governing authority does not have a process for the development, review and revision of policies.

4

The governing authority adopts, updates, and holds itself accountable to clearly written policies that comply with applicable laws and regulations and ensure integrity and effective operations.

3

The governing authority adopts and updates written policies that comply with applicable laws and regulations and ensure integrity and effective operations.

2

The governing authority has policies that comply with applicable laws and regulations and ensure effective operations.

1

The governing authority's policies are vague, and it is unclear whether they comply with applicable laws and regulations or whether they ensure effective operations.

Standard 1.5:

The governing authority adheres to a code of ethics and functions within defined roles and responsibilities.

4

The governing authority adopts and holds itself accountable to a written code of ethics that defines principles of conduct and ethical standards for governance that include policies and practices that provide leadership the autonomy for day-to-day effective operations of the institution.

3

The governing authority has a written code of ethics that defines principles of conduct and ethical standards for governance that include policies and practices that provide leadership the autonomy for day-to-day operations of the institution.

2

The governing authority has a written code of ethics for governance that include policies that provide leadership the autonomy for day-to-day operations of the institution.

1

The governing authority has a vague code of ethics or does not have a code of ethics and does not provide leadership the autonomy for day-to-day operations of the institution.

4

The governing authority adopts, updates, and holds itself accountable to policies that define its roles and responsibilities and regularly engages in ongoing professional learning to enable it to stay current and informed regarding roles and responsibilities, applicable laws, regulations, organizational best practices, and the use of evidence to guide decision-making.

3

The governing authority adopts and updates policies that define its roles and responsibilities and engages in professional learning to enable it to stay current and informed regarding roles and responsibilities, applicable laws, regulations, and organizational best practices.

2

The governing authority has policies that define its roles and responsibilities and engages in limited professional learning to enable it to stay current regarding roles and responsibilities, applicable laws, and regulations.

1

The governing authority does not maintain policies or has vague policies that define its roles and responsibilities and rarely engages in professional learning to enable it to be effective in its roles and responsibilities.

Standard 1.6:

Leaders implement staff supervision and evaluation processes to improve professional practice and organizational effectiveness.

4

The institution has written supervision and evaluation processes for staff members that include specific criteria and models for effective performance and use the results to inform and improve professional practice and student performance.

3

The institution has written supervision and evaluation processes for staff members that include specific criteria for performance and use the results to inform and improve professional practice.

2

The institution has an evaluation process for staff members that includes general criteria for performance and provides limited results for improving professional practice.

1

The institution does not have a supervision and evaluation process for staff members or has a vague or unclear process for supervising and evaluating staff members.

4

The evaluation process is systematically implemented with fidelity by evaluators who have the knowledge, expertise, and training and includes mechanisms for ongoing feedback and monitoring.

3

The evaluation process is implemented by evaluators who have the knowledge, expertise, and training and includes mechanisms for feedback and monitoring.

2

The evaluation process is implemented by trained evaluators and includes a mechanism for feedback.

1

The evaluation process is implemented without consistency and provides little or no feedback.

Standard 1.7:

Leaders implement operational processes and procedures to ensure organizational effectiveness in support of teaching and learning.

4

The institution establishes, trains staff on, and has evidence of effective implementation of systematic and systemic written processes and procedures.

3

The institution establishes and trains staff to implement written processes and procedures.

2

The institution establishes written processes and procedures.

1

The institution establishes vague or few, if any, written processes and procedures.

4

The institution gathers evidence, including the performance of educators and learners, to evaluate the effectiveness and inform the review and revision of processes and procedures.

3

The institution gathers evidence to evaluate the effectiveness and inform the review and revision of processes and procedures.

2

The institution evaluates and makes revisions, when needed, of processes and procedures.

1

The institution does not evaluate the effectiveness of processes and procedures.

Standard 1.8:

Leaders engage stakeholders to support the achievement of the institution's purpose and direction.

4

Leaders implement a formal program that provides for meaningful roles and active participation of internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

3

Leaders provide opportunities for active participation of internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

2

Leaders engage staff, students and parent stakeholder groups.

1

Leaders rarely or never engage internal and external stakeholder groups.

4

Leaders consistently and deliberately enact strategies that provide opportunities for two-way communication with internal and external stakeholder groups, including staff, students, parents, community, governmental, and educational policy groups.

3

Leaders enact strategies that provide opportunities for two-way communication with internal and external stakeholders.

2

Leaders provide opportunities for communication with stakeholders.

1

Leaders rarely or never enact strategies that provide opportunities for communication with stakeholders.

Standard 1.9:

The institution provides experiences that cultivate and improve leadership effectiveness.

4

The institution enacts a formal program designed to build capacity for effective leadership that includes modeling, coaching and team-building activities.

3

The institution supports activities that are designed to improve leadership effectiveness.

2

The institution provides support to individuals to engage in activities that are designed to improve leadership effectiveness.

1

The institution has little or no evidence of opportunities designed to build leadership capacity.

4

The institution and its leaders nurture a collaborative culture that includes multiple and varied opportunities for shared leadership among stakeholders.

3

The institution and its leaders support a culture that includes opportunities for shared leadership among stakeholders.

2

The institution and its leaders provide opportunities for shared leadership among stakeholders.

1

The institution and its leaders provide limited opportunities for shared leadership among stakeholders.

Standard 1.10:

Leaders collect and analyze a range of feedback data from multiple stakeholder groups to inform decision-making that results in improvement.

4

The institution has a comprehensive system for the collection and analysis of feedback data from multiple, reliable sources, including internal and external stakeholder groups.

3

The institution collects and analyzes feedback data from multiple sources, including internal and external stakeholder groups.

2

The institution collects and analyzes feedback data from parent, staff, and student stakeholder groups.

1

The institution rarely collects and analyzes feedback data.

4

The institution systematically uses evidence from multiple sources of feedback data to inform decisions that clearly result in improvement. Decisions, progress and improvement are regularly communicated to stakeholder groups through a variety of media.

3

The institution uses feedback data to inform decisions that result in improvement and regularly communicates decisions to stakeholder groups.

2

The institution includes feedback data as a part of the continuous improvement process and sometimes communicates decisions to stakeholder groups.

1

The institution rarely or never uses feedback data to inform decisions for improvement.

The impact of teaching and learning on student achievement and success is the primary expectation of every institution. An effective learning culture is characterized by positive and productive teacher/learner relationships, high expectations and standards, a challenging and engaging curriculum, quality instruction and comprehensive support that enable all learners to be successful, and assessment practices (formative and summative) that monitor and measure learner progress and achievement. Moreover, a quality institution evaluates the impact of its learning culture, including all programs and support services, and adjusts accordingly.

Standard 2.1:

Learners have equitable opportunities to develop skills and achieve the content and learning priorities established by the institution.

4

Personalizing learning opportunities for all learners is an integral part of the institution's culture and permeates teaching and learning.

3

Learning opportunities are personalized to meet most individual learners' needs and interests.

2

Learning opportunities are sometimes personalized to meet some individual learners' needs and interests.

1

Personalizing learning opportunities is not a regular part of the institution's teaching and learning culture.

4

Alignment between learning opportunities and the institution's high learning expectations is unmistakably evident.

3

The institution strives to align learning opportunities with its high learning expectations, with some work still to be accomplished.

2

Learning opportunities sometimes align to the institution's learning expectations.

1

There is little to no alignment between learning opportunities and the institution's learning expectations.

Standard 2.2:

The learning culture promotes creativity, innovation and collaborative problem-solving.

4

Faculty and staff purposefully plan and implement all learning experiences and activities to actively promote a high level of learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection and include the completion of projects and inquiry-based activities within all courses and subjects.

3

Most learning experiences and activities are planned and implemented to promote learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection and include the completion of projects and inquiry-based activities within all courses and subjects.

2

Some learning experiences demonstrate learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection through the completion of projects and inquiry-based activities within most courses and subjects.

1

Few or no learning experiences demonstrate learner engagement, creativity, critical thinking, application of knowledge, innovation, collaborative problem-solving, and self-reflection or the completion of projects and inquiry-based activities within courses and subjects.

4

Faculty and staff enthusiastically embrace and consistently demonstrate a set of shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

3

Faculty and staff exhibit a set of shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

2

Most faculty and staff exhibit some shared beliefs that focus on learner engagement and the development of creativity, innovation, and problem-solving.

1

Few or no faculty and staff exhibit shared beliefs that focus on learner engagement and the development of creativity and innovation.

Standard 2.3:

The learning culture develops learners' attitudes, beliefs and skills needed for success.

4

Educators consistently provide numerous and equitable experiences that teach learners effective communication skills in all formats (oral, written and digital) and self-direction by expecting them to set goals for their learning and monitor their own progress.

3

Educators frequently provide experiences that teach learners effective communication skills in all formats (oral, written and digital) and self-direction by encouraging them to set goals for their learning and monitor their own progress.

2

Educators sometimes provide experiences that teach learners communication skills in all formats (oral, written and digital) and self-direction by encouraging them to set goals for their learning and monitor their own progress.

1

Educators rarely or never provide experiences to teach learners communication skills or the skills of self-direction.

4

The institution clearly and consistently demonstrates the explicit and intentional development of learners' positive attitudes, self-perceptions, and beliefs about learning.

3

The institution demonstrates the explicit development of learners' positive attitudes, self-perceptions and beliefs about learning.

2

The institution demonstrates some development of learners' positive attitudes, self-perceptions and beliefs about learning.

1

The institution demonstrates little or no explicit development of learners' positive attitudes, self-perceptions and beliefs about learning.

Standard 2.4:

The institution has a formal structure to ensure learners develop positive relationships with and have adults/peers who support their educational experiences.

4

The institution implements and regularly and comprehensively evaluates a formal structure for all learners to have frequent and consistent access to a particular adult, selected by the learner, who ensures the learners are fully supported throughout their educational experiences.

3

The institution implements and evaluates a formal structure for learners to have consistent access to an adult who ensures the learners are supported during their educational experiences.

2

The institution implements a minimal structure for learners to have access to an adult who ensures the learners are supported during their educational experiences.

1

The institution has no structure for learners to have access to an adult who ensures the learners are supported during their educational experiences.

4

The institution consistently ensures each learner has numerous opportunities to develop strong and mutually respectful relationships with the institution's adults and the learner's peers.

3

The institution ensures learners have opportunities to develop strong and mutually respectful relationships with the institution's adults and the learner's peers.

2

The institution provides learners with some opportunities to develop respectful relationships with the institution's adults and the learner's peers.

1

The institution provides learners with limited or no opportunities to develop respectful relationships with the institution's adults and the learner's peers.

Standard 2.5:

Educators implement a curriculum that is based on high expectations and prepares learners for their next levels.

4

The institution has adopted and all educators consistently implement a relevant, rigorous, and aligned curriculum across all grade levels and content areas.

3

The institution has adopted and most educators consistently implement a relevant, rigorous, and aligned curriculum across most grade levels and content areas.

2

The institution has adopted a relevant, rigorous, and aligned curriculum across some grade levels and content areas, but few educators implement it consistently.

1

The institution has adopted a curriculum but can provide little or no evidence of consistent implementation.

4

Educators expect all learners to participate in a curriculum that is based on high expectations and prepares them to be successful at their next levels.

3

Educators expect most learners to participate in a curriculum that is based on high expectations and prepares them for their next levels.

2

Educators expect some learners to participate in a curriculum that has high expectations for learning and may prepare them for their next levels.

1

Educators engage learners in a curriculum that has expectations for learning that appear lower than would be expected and may or may not prepare them for their next levels.

Standard 2.6:

The institution implements a process to ensure the curriculum is aligned to standards and best practices.

4

The institution implements a systematic process to ensure the curriculum is clearly aligned to a recognized, rigorous set of standards.

3

The institution implements a process to ensure the curriculum is aligned to a rigorous set of standards.

2

The institution appears to have a process to ensure the curriculum is aligned to a set of standards.

1

The institution rarely or never ensures the curriculum is aligned to a set of standards.

4

The curriculum is clearly aligned to research and best practices related to the institution's purpose.

3

The curriculum is aligned to research and best practices related to the institution's purpose.

2

The curriculum is somewhat aligned to research or best practices related to the institution's purpose.

1

The curriculum has minimal or no alignment to research or best practices related to the institution's purpose.

Standard 2.7:

Instruction is monitored and adjusted to meet individual learners' needs and the institution's learning expectations.

4

Educators consistently use current and relevant data and a clearly defined process to monitor and adjust instruction to ensure individual learners' needs and the institution's learning expectations are met.

3

Educators frequently use current and relevant data from major content areas and a process to monitor and adjust instruction to ensure individual learners' needs and the institution's learning expectations are met.

2

Educators sometimes use relevant data and a process to monitor and adjust instruction to ensure individual learners' needs and the institution's learning expectations are met.

1

Educators rarely or never use data or a process to monitor and adjust instruction to ensure individual learners' needs and the institution's learning expectations are met.

4

Educators consistently implement effective, individualized instructional strategies that address each learner's needs based on deliberate and purposeful planning.

3

Educators implement individualized instructional strategies that address each learner's needs based on purposeful planning.

2

Educators sometimes implement effective, somewhat individualized instructional strategies that address each learner's needs based on planning.

1

Educators rarely or never engage in deliberate and purposeful planning to determine or implement effective instructional strategies that address each learner's needs.

Standard 2.8:

The institution provides programs and services for learners' educational futures and career planning.

4

The institution identifies and implements comprehensive programs and services for all learners to identify strengths and interests that support their career planning and/or educational success at the next level.

3

The institution identifies and implements many programs and services for learners to identify strengths and interests that support their career planning and/or educational success at the next level.

2

The institution identifies and implements some programs or services for learners to identify strengths and interests that support their career planning and/or educational success at the next level.

1

The institution implements few or no programs or services for learners to identify strengths and interests for career planning and/or educational success at the next level.

4

The institution assists all learners in developing and documenting their personal goals and achievements, based on interests and needs, to support their success at the next level.

3

The institution assists most learners in developing and documenting their personal goals and achievements to support their success at the next level.

2

The institution assists some learners in developing and documenting their personal goals and achievements.

1

The institution does not assist learners in developing and documenting their personal goals and achievements.

Standard 2.9:

The institution implements, evaluates, and monitors processes to identify and address the specialized social, emotional, developmental, and academic needs of students.

4

The institution consistently implements a formalized and documented process for the identification and referral of all students who need additional assistance, services, and resources.

3

The institution usually implements a formalized process for the identification and referral of all students who need additional assistance, services, and resources.

2

The institution has some processes for the identification and referral of students who need additional assistance, services, and resources.

1

The institution has few or no processes for the identification and referral of students who need additional assistance, services, and resources.

4

The institution consistently utilizes internal and external resources and monitors and evaluates all programs and progress toward addressing the specialized needs of students, and relevant data are regularly used to modify and adjust services.

3

The institution utilizes internal and external resources and monitors and evaluates most programs and progress toward addressing specialized needs of students, and data are used to modify and adjust services.

2

The institution utilizes available resources and sometimes monitors and evaluates progress toward addressing the specialized needs of students.

1

The institution utilizes available resources and seldom or never monitors progress toward addressing the specialized needs of students.

Standard 2.10:

Learning progress is reliably assessed and consistently and clearly communicated.

4

Educators across all grades and subject areas consistently and with fidelity use the institution's established common grading practices and criteria to represent the learner's attainment of content knowledge and skills. These are assessed based on a cohesive set of formative and summative assessments to ensure each learner improves and is prepared for the next level through consistent and clear communication.

3

Educators consistently use the institution's established common grading practices and criteria to represent the learner's attainment of content knowledge and skills. These are assessed based on a variety of formative and summative assessment data to ensure each learner improves and is prepared for the next level through consistent and clear communication.

2

Some educators use common grading practices and criteria to represent the learner's attainment of content knowledge and skills based on data.

1

Few or no educators use common grading practices and criteria to represent the learner's attainment of content knowledge and skills.

4

Formal and informal communication about each learner's progress is consistently and frequently provided to all appropriate stakeholders, including the individual learner, in language that is clear and understandable.

3

Formal and informal communication about each learner's progress is frequently provided to appropriate stakeholders, including the individual learner, in language that is clear and understandable.

2

Formal and informal communication about each learner's progress is sometimes provided to appropriate stakeholders, including the individual learner, in language that is clear and understandable.

1

Communication about each learner's progress is inconsistently, rarely or never provided to stakeholders in language that is clear and understandable.

Standard 2.11:

Educators gather, analyze, and use formative and summative data that lead to demonstrable improvement of student learning.

4

All educators analyze data from a cohesive set of formative and summative assessments that lead to the demonstrable improvement of achievement and success of individual and collective groups of learners in preparation for the next educational level.

3

Most educators analyze data from multiple types of formative and summative assessments that lead to the demonstrable improvement of achievement and success of individual and collective groups of learners in preparation for the next educational level.

2

Some educators analyze data from assessments that improve the achievement and success of individual and collective groups of learners.

1

Few or no educators analyze data from assessments that lead to improvement of achievement of individual and collective groups of learners.

4

All educators consistently use data to modify instruction and transform learning experiences for learners.

3

Most educators use data to modify instruction and transform learning experiences for learners.

2

Some educators occasionally use data to modify instruction and improve the learning experiences for learners.

1

Few educators use data to modify instruction or improve the learning experiences for learners.

Standard 2.12:

The institution implements a process to continuously assess its programs and organizational conditions to improve student learning.

4

The institution implements a formal, documented evaluation process that includes contextually based research and an ongoing and systematic analysis of trend and comparison data related to student learning across the curriculum and organizational effectiveness.

3

The institution implements an evaluation process that includes an ongoing analysis of trend and comparison data related to student learning in most academic areas and organizational effectiveness.

2

The institution implements an evaluation process that includes analysis of trend or comparison data related to student learning in some academic areas or organizational effectiveness.

1

The institution implements few or no evaluation processes related to student learning or organizational effectiveness.

4

The institution uses results from the evaluation process to inform decision-making, improve and refine curriculum, programs, and innovative practices, and improve student learning.

3

The institution uses results from the evaluation process to inform decision-making, improve and refine curriculum and programs, and improve student learning.

2

The institution uses the results of the evaluation process to inform decision-making and improve and refine curriculum.

1

The institution rarely or never uses results for improvement.

The use and distribution of resources support the stated mission of the institution. Institutions ensure that resources are distributed and utilized equitably so that the needs of all learners are adequately and effectively addressed. The utilization of resources includes support for professional learning for all staff. The institution examines the allocation and use of resources to ensure appropriate levels of funding, sustainability, organizational effectiveness, and increased student learning.

Standard 3.1:

The institution plans and delivers professional learning to improve the learning environment, learner achievement, and the institution's effectiveness.

4

Using data from a variety of sources, the institution plans, evaluates the effectiveness of, and uses the results of professional learning to improve practice and learner achievement and increase content and pedagogical knowledge and organizational effectiveness.

3

Using data from evaluation and supervision processes, the institution plans and evaluates the effectiveness of professional learning to improve practice and learner achievement and increase content and pedagogical knowledge and organizational effectiveness.

2

Using limited data, the institution plans professional learning to improve practice and organizational effectiveness.

1

Professional learning, if offered, is not based on data.

4

The institution delivers relevant and job-embedded professional learning for all staff members to improve their practice and achieve institutional goals.

3

The institution frequently delivers relevant professional learning for most staff members to improve their practice and achieve institutional goals.

2

The institution sometimes delivers professional learning for staff members related to their position and institutional needs and goals.

1

The institution rarely delivers professional learning for staff members related to their position or institutional needs and goals.

Standard 3.2:

The institution's professional learning structure and expectations promote collaboration and collegiality to improve learner performance and organizational effectiveness.

4

All staff members participate in structured, accountable professional learning communities that focus their discussions on data analysis and use the results of their analyses to improve learner performance and organizational effectiveness.

3

All professional staff members participate in structured, accountable professional learning communities that analyze data and use the results of their analyses to improve student learning.

2

Some staff members participate in professional learning communities that sometimes review data on student learning.

1

Few or no staff members participate in professional learning communities.

4

The institution consistently allocates ample resources to provide both formal and informal structures for collaboration.

3

The institution allocates adequate resources to provide formal and informal structures for collaboration.

2

The institution provides some resources for collaboration.

1

The institution provides few or no resources for collaboration.

Standard 3.3:

The institution provides induction, mentoring, and coaching programs that ensure all staff members have the knowledge and skills to improve student performance and organizational effectiveness.

4

The institution provides, monitors, evaluates, and modifies induction and mentoring programs for all new staff that include performance expectations and are designed to meet individual needs.

3

The institution provides and monitors induction and mentoring programs for new professional staff that include performance expectations and are designed to meet individual needs.

2

The institution provides some induction and mentoring programs for new staff.

1

The institution provides little or no induction or mentoring for new staff.

4

The institution provides, monitors, evaluates, and modifies coaching and modeling programs that address unique professional practices and organizational expectations for all staff through guidance, support, and feedback from peers and leaders.

3

The institution provides and monitors coaching and modeling programs that address organizational expectations for all professional staff through guidance, support, and feedback from peers and leaders.

2

The institution provides coaching and modeling programs for some staff through guidance, support, and feedback from peers and leaders.

1

Instructional coaching and modeling is rarely or never used.

Standard 3.4:

The institution attracts and retains qualified personnel who support the institution's purpose and direction.

4

The institution uses and regularly evaluates a documented and ongoing process that uses data to determine personnel needs, which includes an assessment of talent, qualifications, and assurance of sufficient numbers, to ensure learners' and organizational needs are met.

3

The institution uses a documented process that uses data to determine personnel needs, which includes an assessment of talent, qualifications and sufficient numbers, to ensure organizational needs are met.

2

The institution uses a process to determine personnel needs that sometimes includes an assessment of talent, qualifications and sufficient numbers.

1

The institution uses an informal process or has no process to assess personnel needs.

4

The institution uses and regularly evaluates a deliberate and formalized process to recruit and retain personnel through meaningful learning opportunities, personal growth, financial support, and leadership opportunities.

3

The institution uses a deliberate and formalized process to recruit and retain personnel.

2

The institution uses a formal process to recruit and retain personnel.

1

The institution uses a vague and/or informal process to recruit and retain personnel.

Standard 3.5:

The institution integrates digital resources into teaching, learning, and operations to improve professional practice, student performance, and organizational effectiveness.

4

Using a variety of data sources, including needs assessments, the institution engages in a comprehensive planning process that focuses on the integration of digital resources into teaching, learning, and operations and evaluates and demonstrates improvements in professional practice, student performance, and organizational effectiveness.

3

Using a needs assessment, the institution engages in a comprehensive planning process that focuses on the integration of digital resources into teaching, learning, and operations and evaluates improvements in professional practice, student performance, and organizational effectiveness.

2

The institution engages in a planning process that focuses on the integration of digital resources into teaching, learning and operations.

1

The institution engages in little or no planning focused on the integration of digital resources into teaching, learning and operations.

4

The institution provides ample human, material, and fiscal resources and monitors that these resources are appropriately used to effectively integrate digital resources into teaching, learning, and operations.

3

The institution provides sufficient human, material, and fiscal resources to effectively integrate digital resources into teaching, learning, and operations.

2

The institution provides some resources to integrate digital resources into teaching, learning and operations.

1

The institution provides few or no resources to integrate digital resources into teaching, learning and operations.

Standard 3.6:

The institution provides access to information resources and materials to support the curriculum, programs, and needs of students, staff, and the institution.

4

The institution implements a documented comprehensive process based on research and best practice for the identification, acquisition, use, and updating of appropriate materials and resources aligned to curricular and instructional programs as well as organizational needs and initiatives.

3

The institution implements a documented process for the identification, acquisition, use, and updating of materials and resources aligned to curricular and instructional programs as well as organizational needs and initiatives.

2

The institution implements a process for the identification, acquisition, use, and updating of materials and resources.

1

The institution has limited or no processes for the identification, acquisition, use, and updating of materials and resources.

4

The institution provides a wide variety of high-quality resources that are easily accessible and sufficiently address the needs and interests of students, staff, and the institution.

3

The institution provides a variety of high-quality resources that are easily accessible and address the needs and interests of students, staff, and the institution.

2

The institution provides a variety of resources that are accessible and address the needs of students, staff, and the institution.

1

The institution provides minimal resources that address the needs of students, staff and the institution.

Standard 3.7:

The institution demonstrates strategic resource management that includes long-range planning and use of resources in support of the institution's purpose and direction.

4

The institution implements and evaluates formal planning processes for long-range strategic resource management of budgets, facilities and other organizational needs.

3

The institution implements a planning process for long-range strategic resource management of budgets, facilities and other organizational needs.

2

The institution uses a planning process to manage budgets, facilities and other organizational needs.

1

The institution does not use a planning process to manage budgets, facilities and other organizational needs.

4

The institution demonstrates effective practices for long-range, strategic management of budgets, facilities and other organizational needs in support of the institution's purpose and direction.

3

The institution implements practices for long-range, strategic management of budgets, facilities and other organizational needs in support of the institution's purpose and direction.

2

The institution implements some clear practices for management of budgets, facilities and other organizational needs.

1

The institution implements vague and/or unclear practices for management of budgets, facilities and other organizational needs.

Standard 3.8:

The institution allocates human, material, and fiscal resources in alignment with the institution's identified needs and priorities to improve student performance and organizational effectiveness.

4

The institution has a formal budgeting process that allocates and aligns resources to address priorities for improvement designed to improve student learning and is equitably distributed to meet the needs of students.

3

The institution frequently aligns resources to address priorities for improvement designed to improve student learning and is equitably distributed to meet the needs of students.

2

The institution sometimes aligns resources to address priorities for improvement designed to improve student learning.

1

The institution rarely or never aligns resources to address priorities for improvement designed to improve student learning.

4

The institution consistently evaluates and demonstrates effective use of human, material, and fiscal resources to meet the learners' and institution's identified needs and priorities.

3

The institution frequently evaluates and demonstrates effective use of human, material, and fiscal resources to meet the learners' and institution's identified needs and priorities.

2

The institution sometimes evaluates and demonstrates effective use of human, material, and fiscal resources.

1

The institution rarely or never evaluates or demonstrates effective use of human, material, and fiscal resources.



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**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: James Fields, Chair

Agenda Item: 6

◆ ISSUE

This is a report to the board regarding the committee work of the State Board of Education and Early Development.

◆ BACKGROUND

- The board will be briefed on current committee work from the four committee chairs:
 - Standards and Assessments, Sally Stockhausen
 - Tribal Compacting, Sandra Kowalski
 - Regulations, Lorri Van Diest
 - Funding Formula, Tiffany Scott

◆ OPTIONS

This is an information update. No action is required.

Establishing a Pilot Program for State-Tribal Compacting in Education

What is the objective?

Establish one (1) or more State-Tribal Compact Schools, as soon as possible (i.e., 2019 or 2020).

How do we get there?

It is important to honor and apply the following principles and practices during each step of the process outlined below: **Recognition. Sovereignty. Transformation. Healing. Honesty. Listening.**

Community *(Foundations to keep in mind)*

Working together: Trust-building is key throughout the entire process, as is learning from past compacting successes and failures.

Inclusion and communication to build support from the bottom up and top down, so that no group feels left behind or left out: It is important to note that while bringing people up to speed and gathering feedback is part of the process, clearly defining who has authority to represent their Tribe and who has the authority to represent the State of Alaska in compact negotiations and agreements is critical.

Communication and Relationship Building: What are other considerations to keep in mind as the circle of involvement grows? How do we keep from getting lost or derailed as the process is developed and defined?

Technical *(Overall Compacting Framework Established Through a Pilot Program Bill)*

In order to achieve a successful outcome for compacting in education, the State of Alaska needs to work with Tribes to develop an overall framework that addresses, among other things, the negotiation process, application process, funding mechanism, certification of teachers, development of curricula, and an assessment reporting mechanism that truly honors the government-to-government relationship that exists between the State of Alaska and Tribes. This would be accomplished most effectively through a bill that establishes a pilot program for compacting in education. Such a bill would include, but not be limited to, the following:

Motivations/Intensions: Start out by clearly defining the intensions the State of Alaska has and why Tribal compacting in education is important.

Signatory Authority on Behalf of State of Alaska: Authorize and empower the Commissioner of Education to enter into State Tribal Compact Agreements with Tribes.

Point of Access: Define the point of access and organizational model through which the State of Alaska and Tribes will interface. Creating provision for a Tribal School district could address how the State of Alaska and Tribes interface.

Application and Negotiation Process: Define the application process and subsequent negotiation process. Current successful compacts include two separate negotiations, one for the compact agreement and one for the funding agreement. Discussing the terms of the agreement and the funding mechanism separately helps to create better outcomes.

With respect to the application process, we will need to decide whether the pilot should be geared primarily towards Tribes that are ready to establish a school the same year the pilot bill is passed into law, whether there should be a broader window that allows other Tribes to apply to open new schools, or a provision for schools to transition from a currently operated State school to a State-Tribal Compact school.

With respect to negotiations and consultation, the Department of Defense's negotiation framework might be a good place to start. The previous administration's work on consultation, ESSA frameworks, and NIEA guidelines also may be instructive.

Reporting & Evaluation: Define the reporting and evaluation process.

Flexibility and Construction: The pilot needs to be flexible enough to allow for innovation and creativity, but also specific enough that it adequately addresses local Tribal area needs.

Duration of Pilot: The pilot program should remain in effect at least 2-4 years. This will enable the State of Alaska to test and quickly address issues related to funding, interfacing, and reporting. It also will provide sufficient time to refine the application and teacher certification processes that will need to be in place when compacting in education is expanded across the state of Alaska for all interested Tribes.

Evaluating the Pilot: The pilot bill should define what success looks like, and establish a process by which the pilot program itself can be evaluated.

Conflict Resolution Pathway: The pilot bill should address how any compact-related grievances must be resolved – e.g., in Tribal court, in State of Alaska court, in a joint State-Tribal court, or through some other form of mutually agreed upon mediation, etc.

Short term goals?

Community: Engage in outreach, information gathering, and education with stakeholders on State of Alaska side and Tribal side. Ideally, this would take place within twelve (12) months or before a bill is introduced, with Tribal Governance and Protocols training for State leaders in May or June 2019.

Letter to Tribal Leaders: Send out a “Dear Tribal Leader” letter to initiate the process and affirm the State’s commitment to pursue compacting in education.

Align State Stakeholders: Ensure appropriate State of Alaska stakeholders are aligned and on the same page.

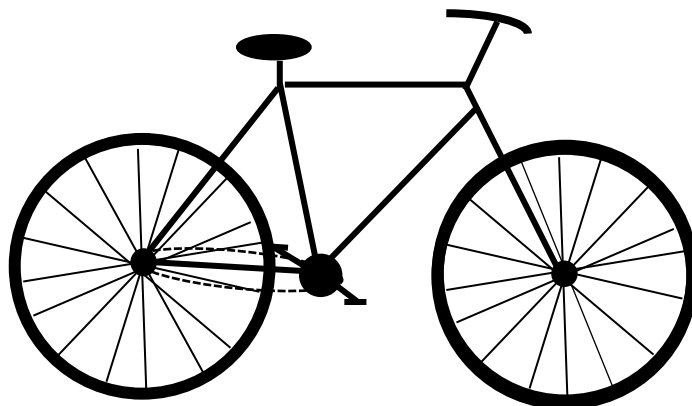
Tribal Survey: Send out a survey to Tribes to gather input from them regarding Tribal compacting in education.

Tribal Engagement: Begin relationship-building between the State of Alaska and Tribes. Hold a series of “Difficult Dialogues” to better enable the State and the Tribes to work together from a place of respect and good faith.

Drafting bill language: Throughout the above process, we would draft and refine the pilot bill’s language.

Keep the Vehicle Moving?

This process is like a bicycle. In order to create forward momentum, both wheels have to be turning. Compacting cannot be successful, unless the community and technical components are moving together in the same direction and at similar speeds. If one gets out in front of the other, or one stops, the bicycle will careen out of control or will stop moving altogether.



**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: James Fields, Chair

Agenda Item: 7

◆ ISSUE

This is a report to the board regarding Alaska's performance on the National Assessment of Educational Progress (NAEP).

◆ BACKGROUND

- The board will be briefed on the NAEP State of Alaska Report Card published by the National Center for Education Statistics.
- Member Bob Griffin will be present to brief the board.

◆ OPTIONS

This is an information update. No action is required.

Alaska Reading Scores Not Keeping Pace

Alaska's school system produces a variety of excellent student outcomes in many areas as a result of dedicated efforts from educators, administrators and other staff. Unfortunately, in the basic fundamental task of early childhood reading skills, Alaska lags significantly behind the US average, across a broad spectrum of the state's student population.

According to the US Department of Education's most recent NAEP 4th grade reading scores, (2017) Alaska has not kept pace with the US trend of general improvement in reading scores since 2003 – the year that all states were first required to participate in NAEP.

In 2003, Alaska was ranked of 42nd in the US 4th grade NAEP reading scores. By 2017 Alaska fell to a ranking of 51st – dead last, behind every other state and the District of Columbia – more than an entire school year in achievement behind the US average.

Although Alaska does have some of the largest NAEP reading score increases between 4th and 8th grade, Alaskan kids start so far behind in 4th grade that they're still ranked 47th out of 51 in 8th grade NAEP reading.

Some have attributed our low-test scores to poverty. It's true that poverty correlates closely with poor academic achievement. But despite our recent state recession, Alaska's poverty rate is well below the US average.

Others have attributed our low reading scores to rural Alaska. Unfortunately, NAEP scores are not available at district level for comparison. Using PEAKS data as a comparison proxy, it's true many of our rural communities post very low scores in English and Language Arts (ELA). However, the top 10 performing districts in PEAKS ELA proficiency rates are all rural districts.

Still others have pointed to the low-test scores of particular ethnic groups to blame for our overall

poor showing. As the bar charts below will show, Alaska posts disappointing results across a wide variety of ethnic backgrounds and economic status.

The more likely culprit to Alaska's disappointing outcomes and lack of improvement are related policy choices. Places like Florida, Indiana, Mississippi, Ohio, Arizona and the District of Columbia have embraced bold education reforms and seen dramatic improvements in reading scores since 2003.

In 2002, the state of Florida was the first to adopt significant changes in their approach to teaching kids to read. By 2010 Indiana and Arizona had adopted the Florida model. Ohio and DC adopted it in 2012 and Mississippi in 2013. All of those jurisdictions have significant improvement in 4th grade reading scores since 2003, especially in the case of low-income and ethnic minority students.

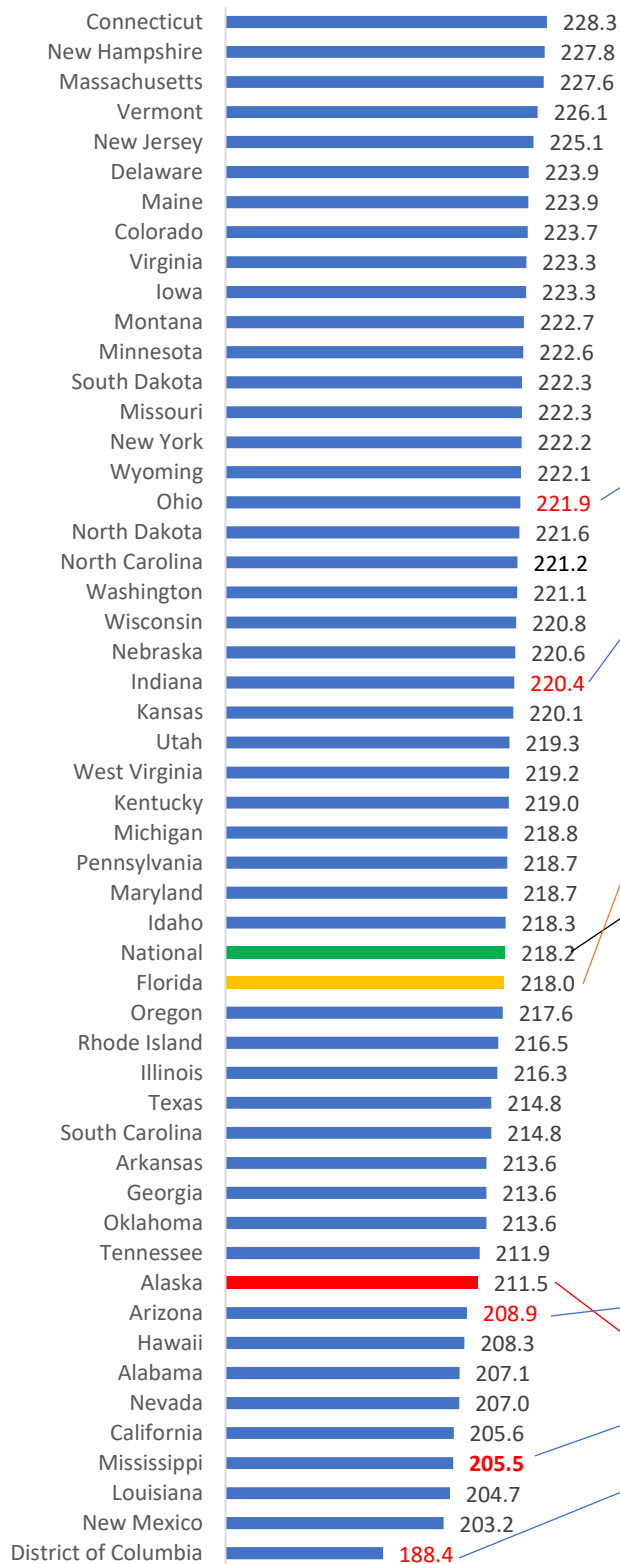
The bar charts below give a visual comparison of NAEP test scores changes of all 50 states and the District of Columbia between 2003 and 2017.

The states that use the Florida reading model are highlighted with arrows connecting their 2003 and 2017 scores for 4th grade reading scores. The 8th grade scores are only connected by arrows for states that have adopted the Florida model for more than two NAEP cycles (Florida, Indiana and Arizona).

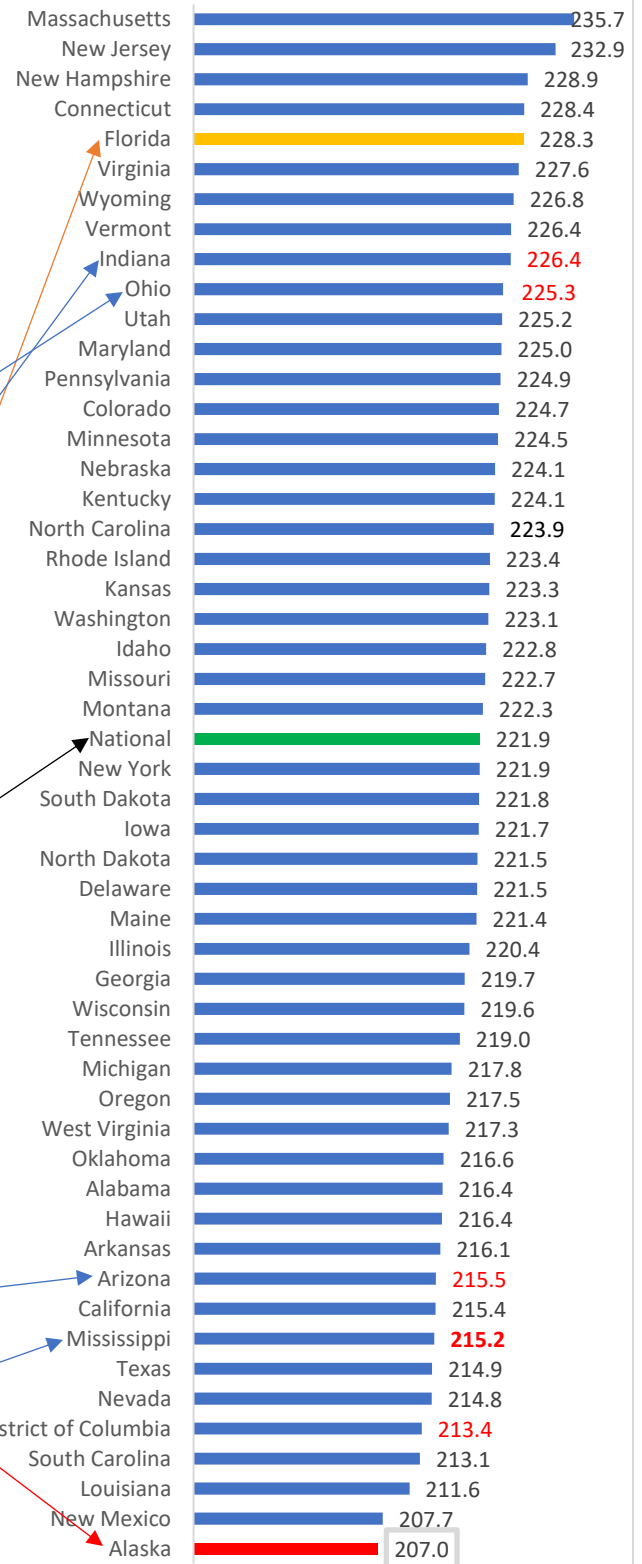
Some of the bar charts below have fewer states represented than others because of low student populations in certain categories that make them statistically insignificant. For example, in 2017, not enough Black students who qualify for free or reduced lunch in Alaska were sampled to have a statistically reliable sample -- so no score is posted for that year for Alaska.

The hope is that these charts will help focus further policy discussions on improving early childhood literacy in Alaska.

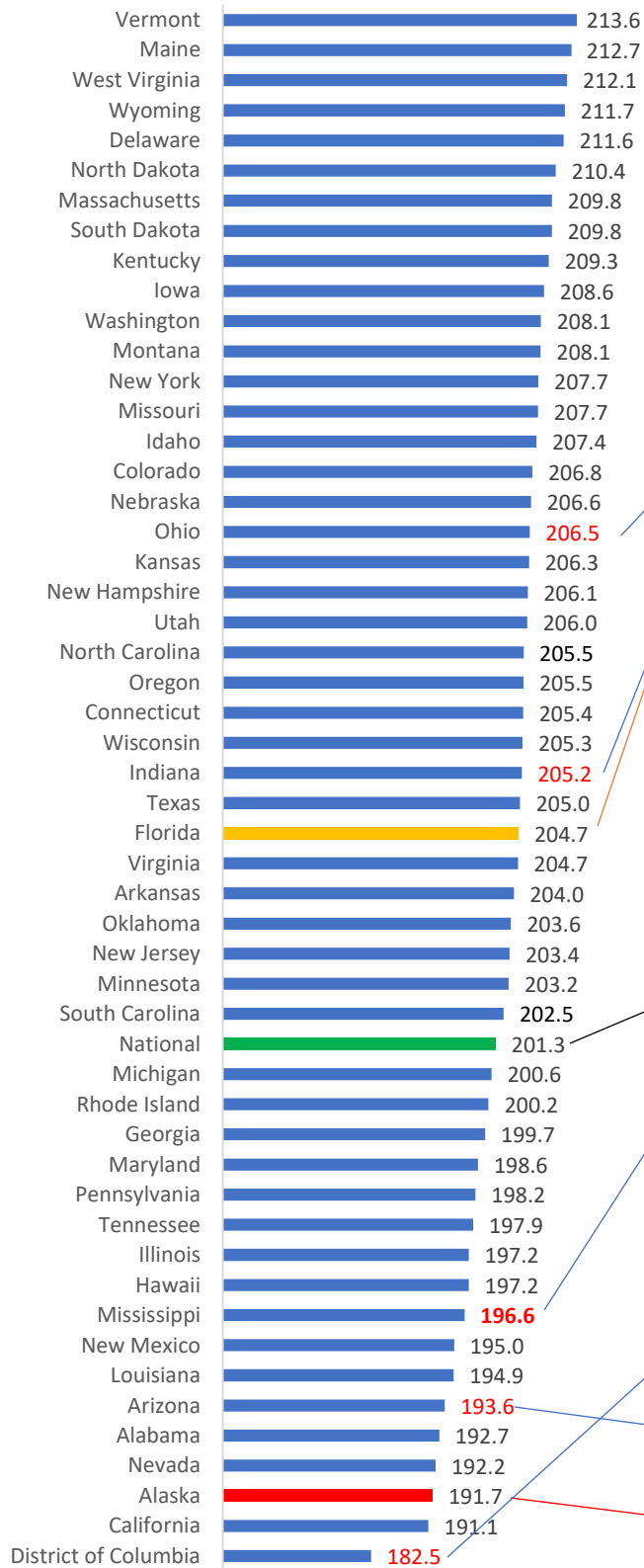
2003 NAEP 4th Grade Reading All Students



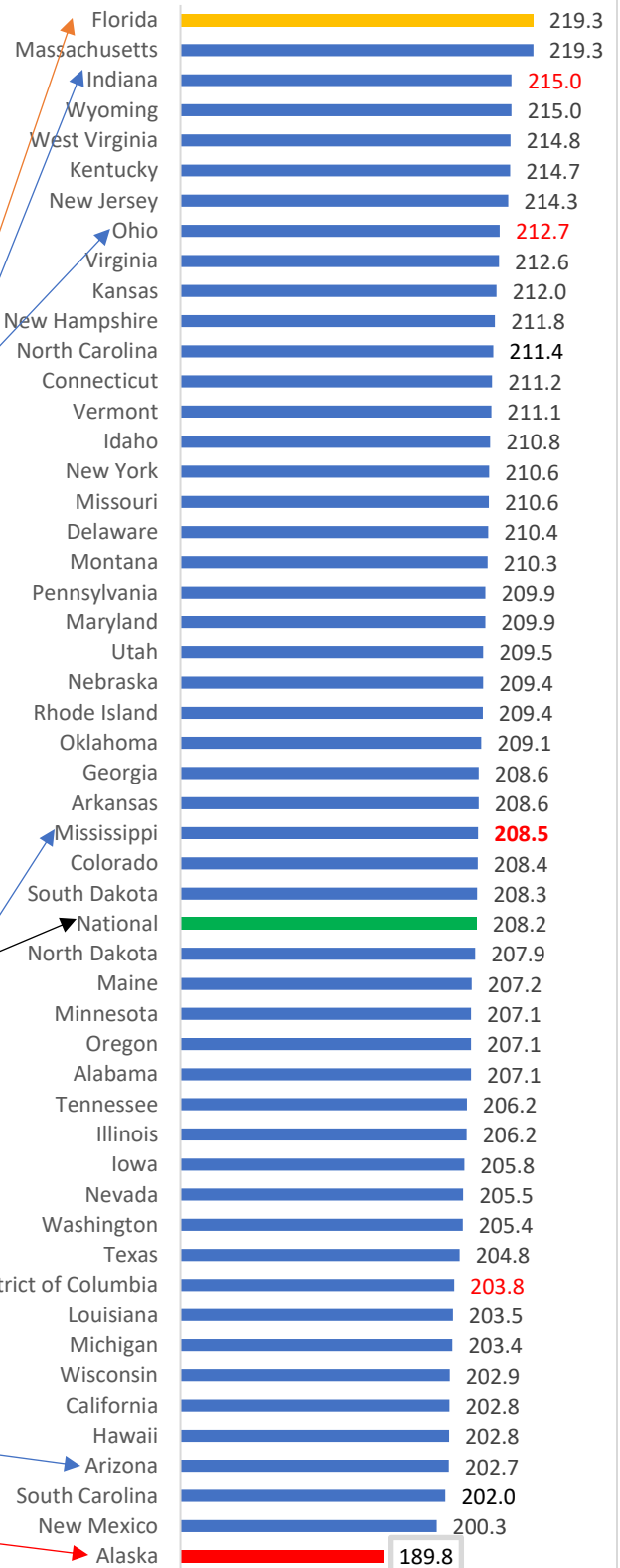
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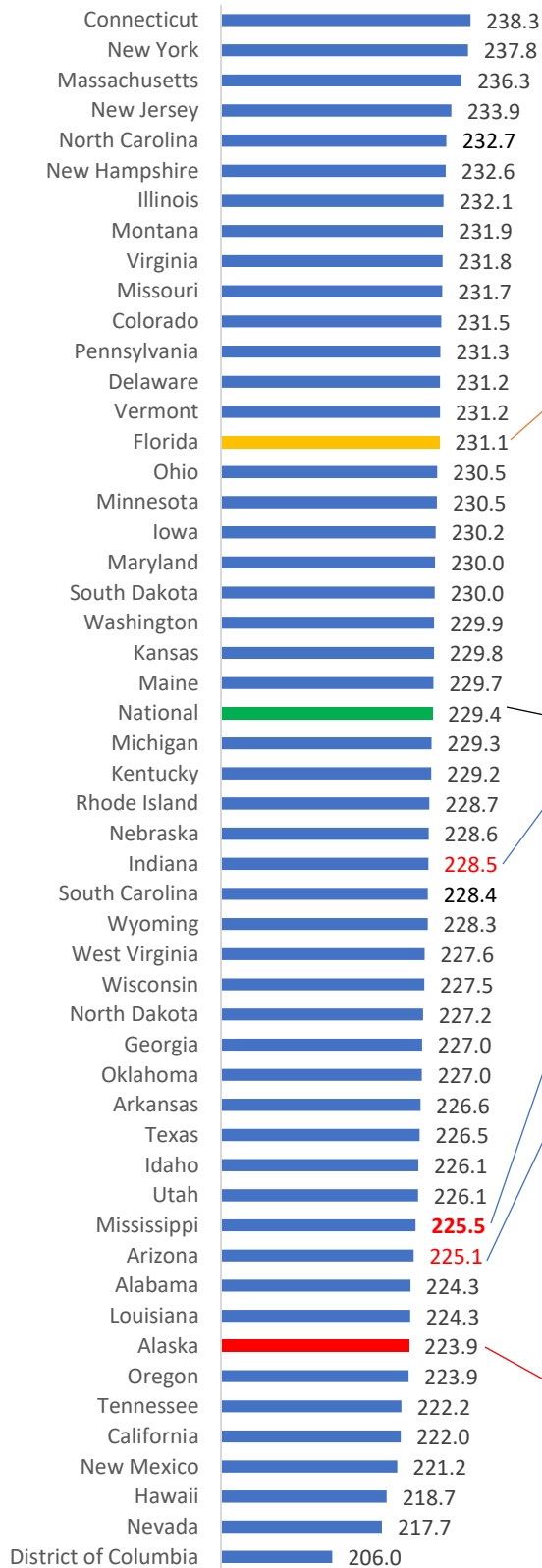
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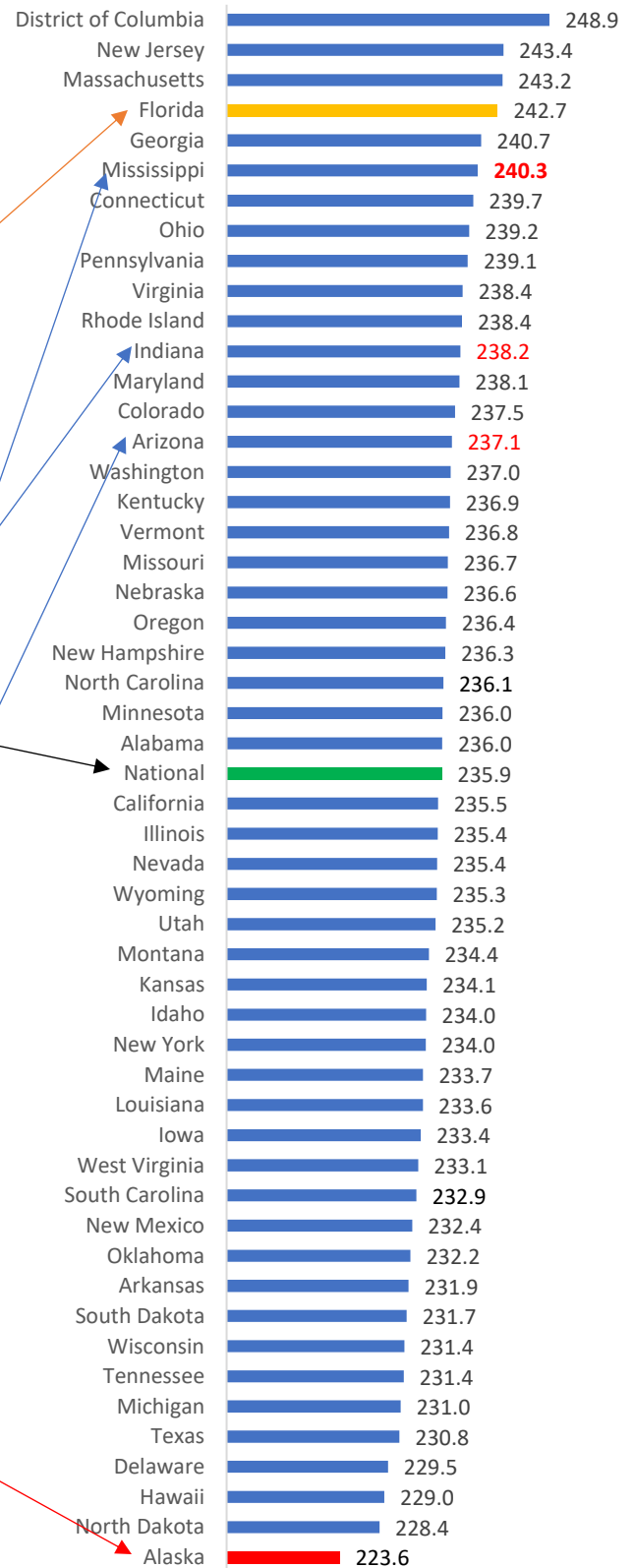
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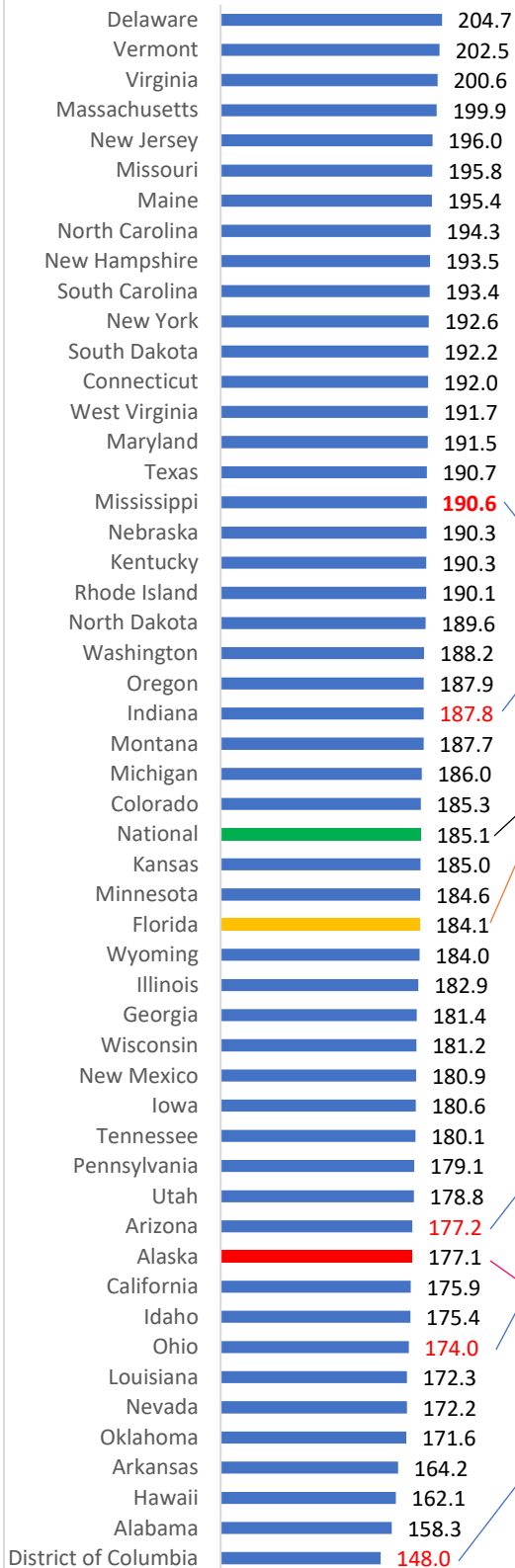
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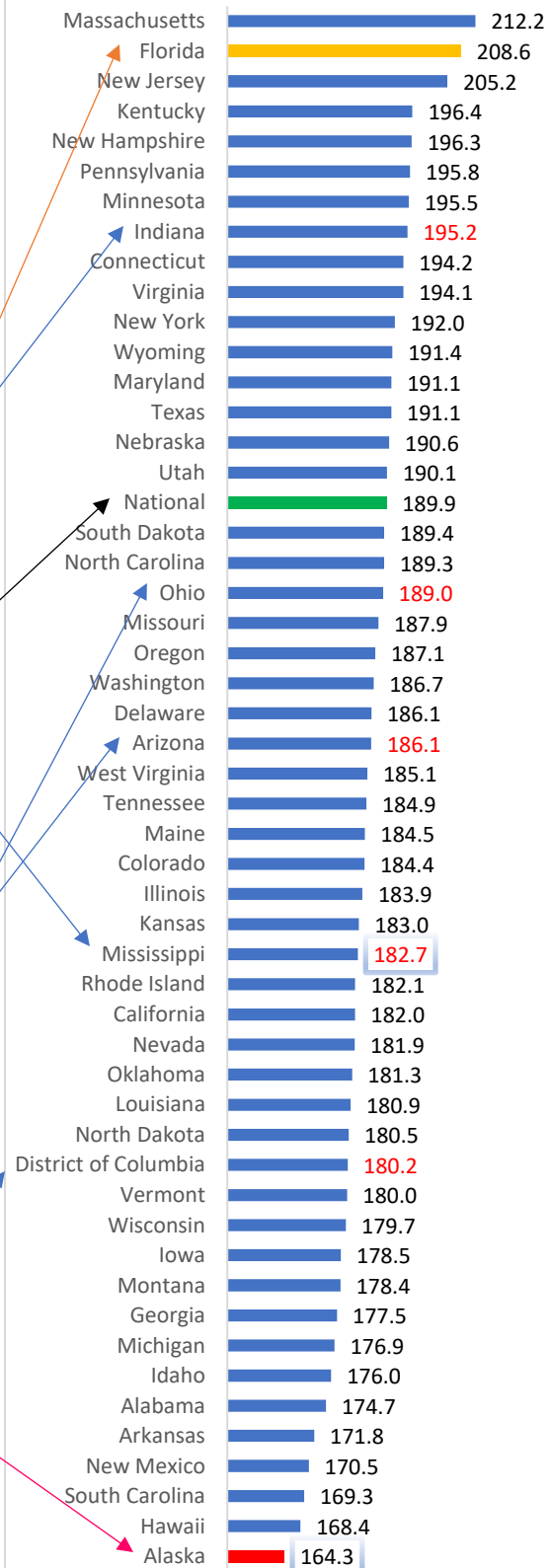
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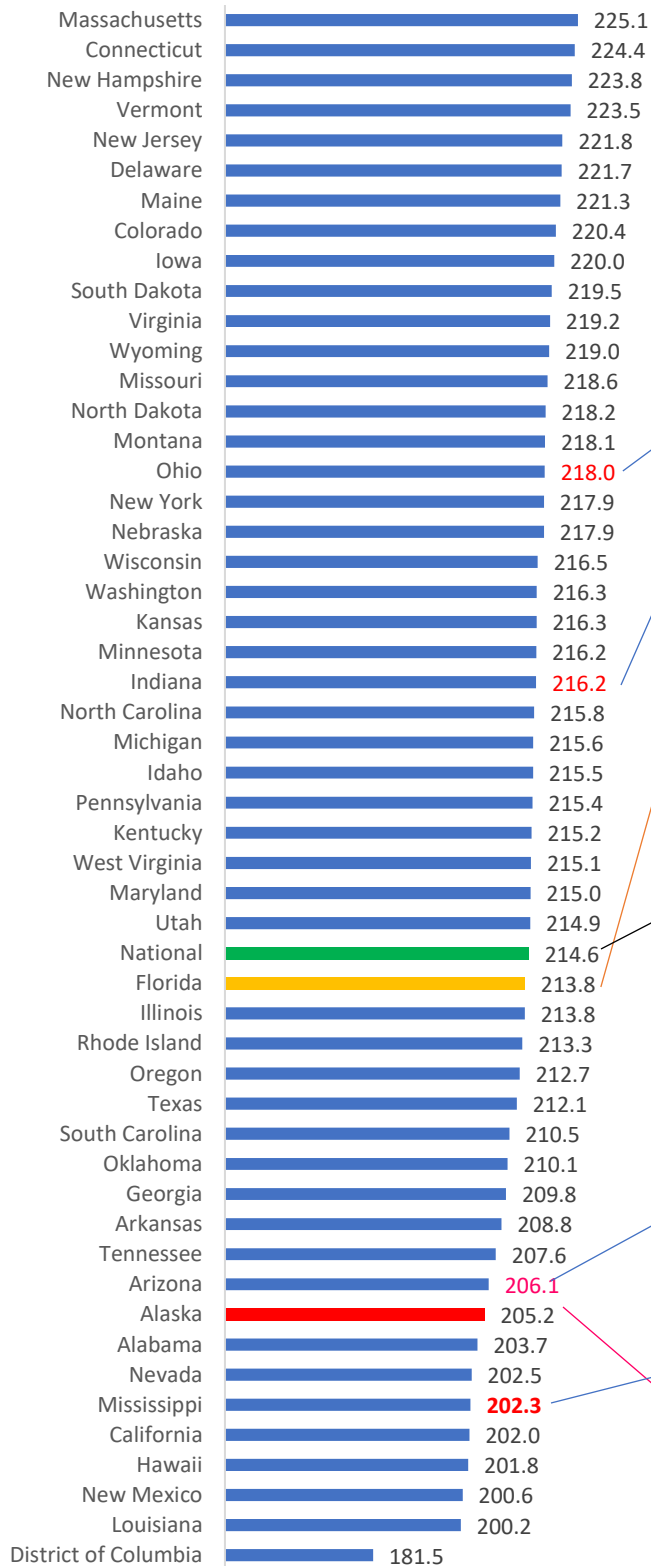
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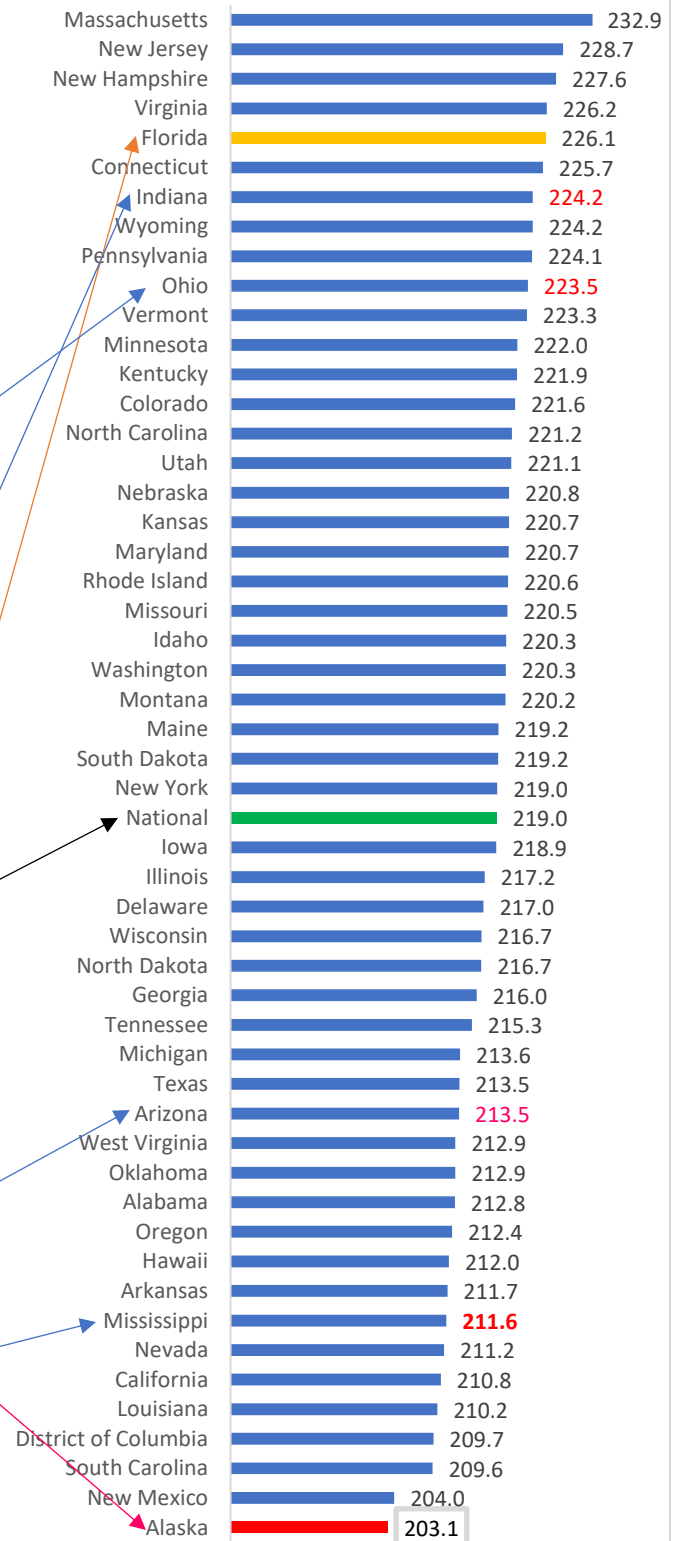
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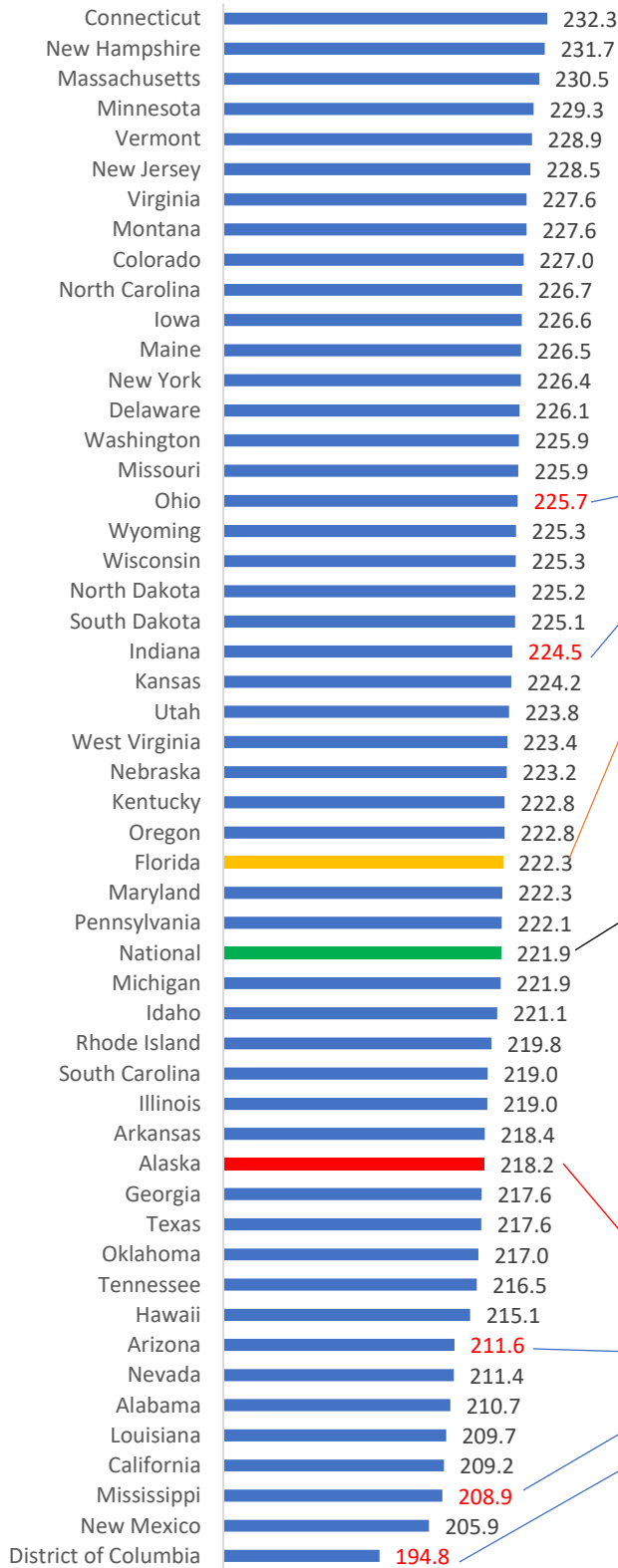
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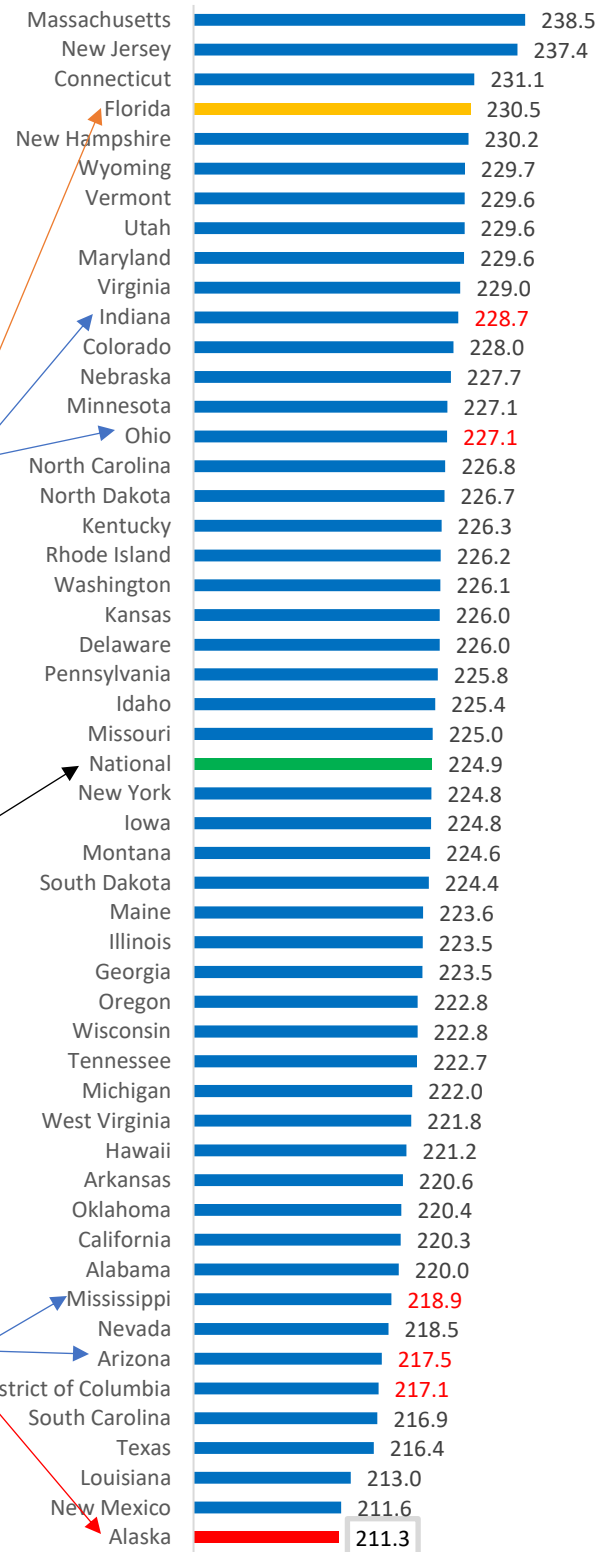
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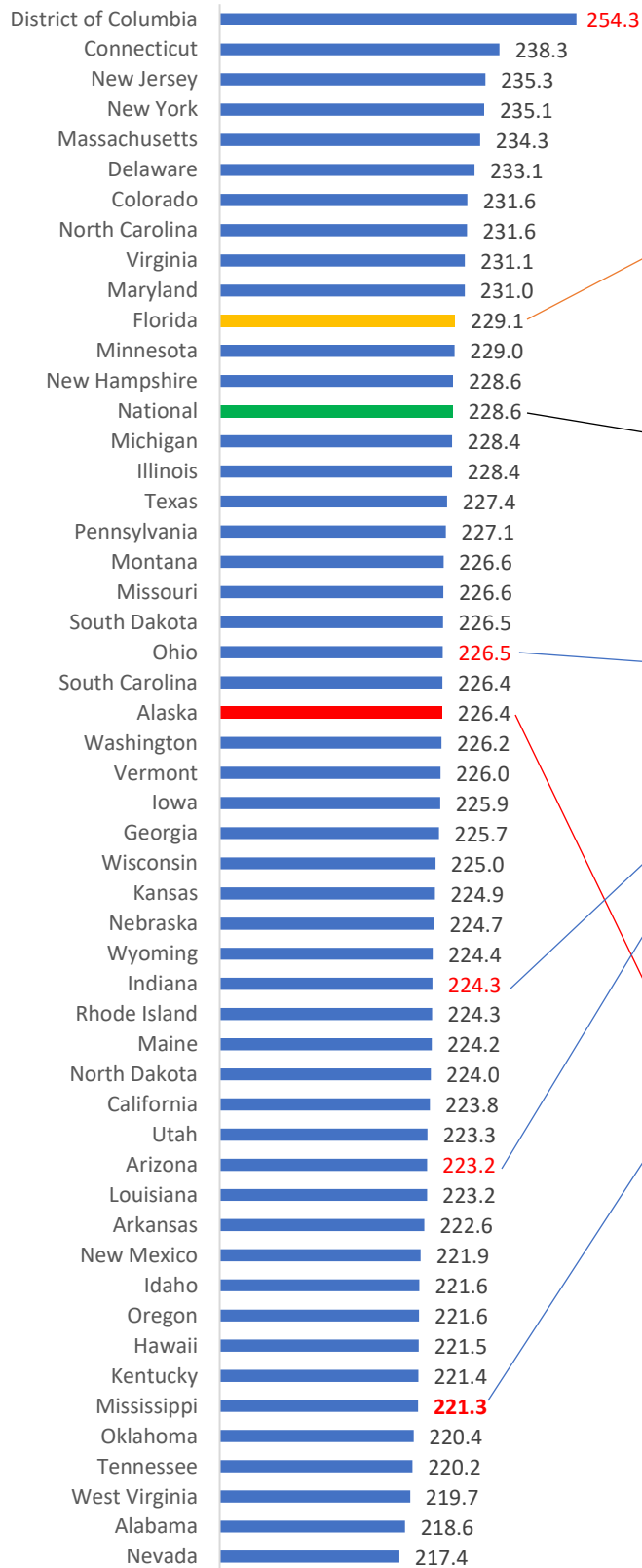
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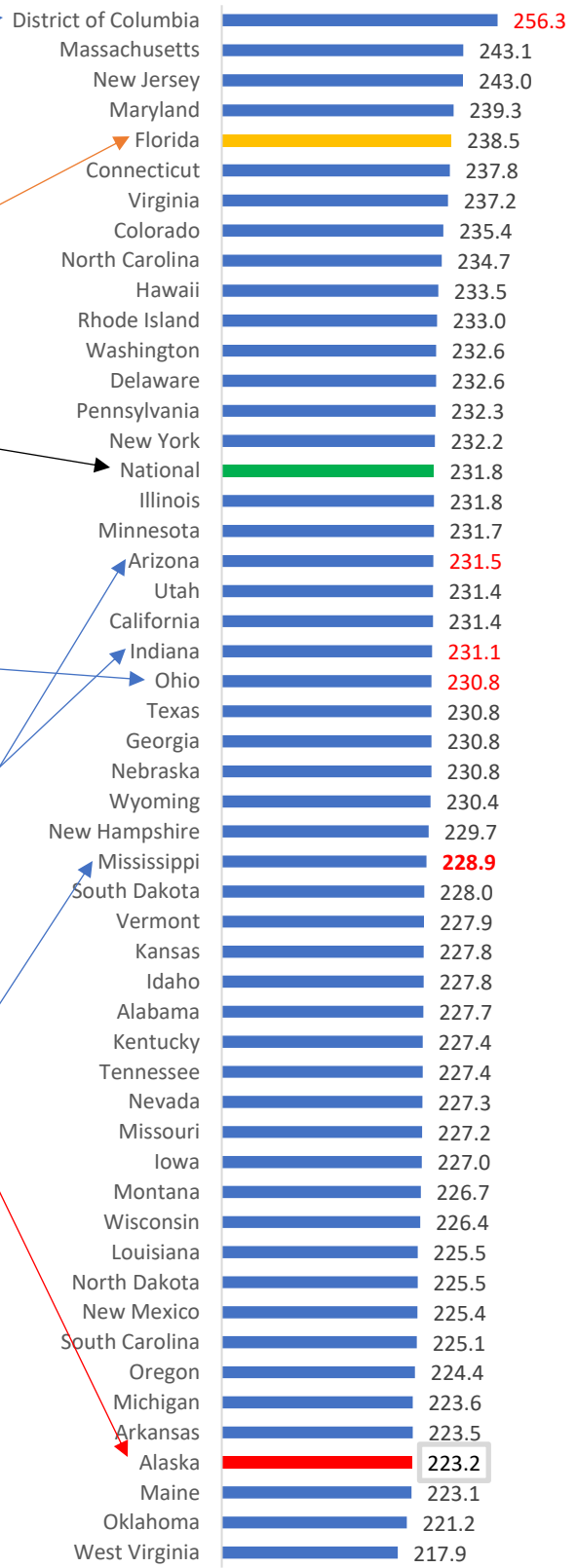
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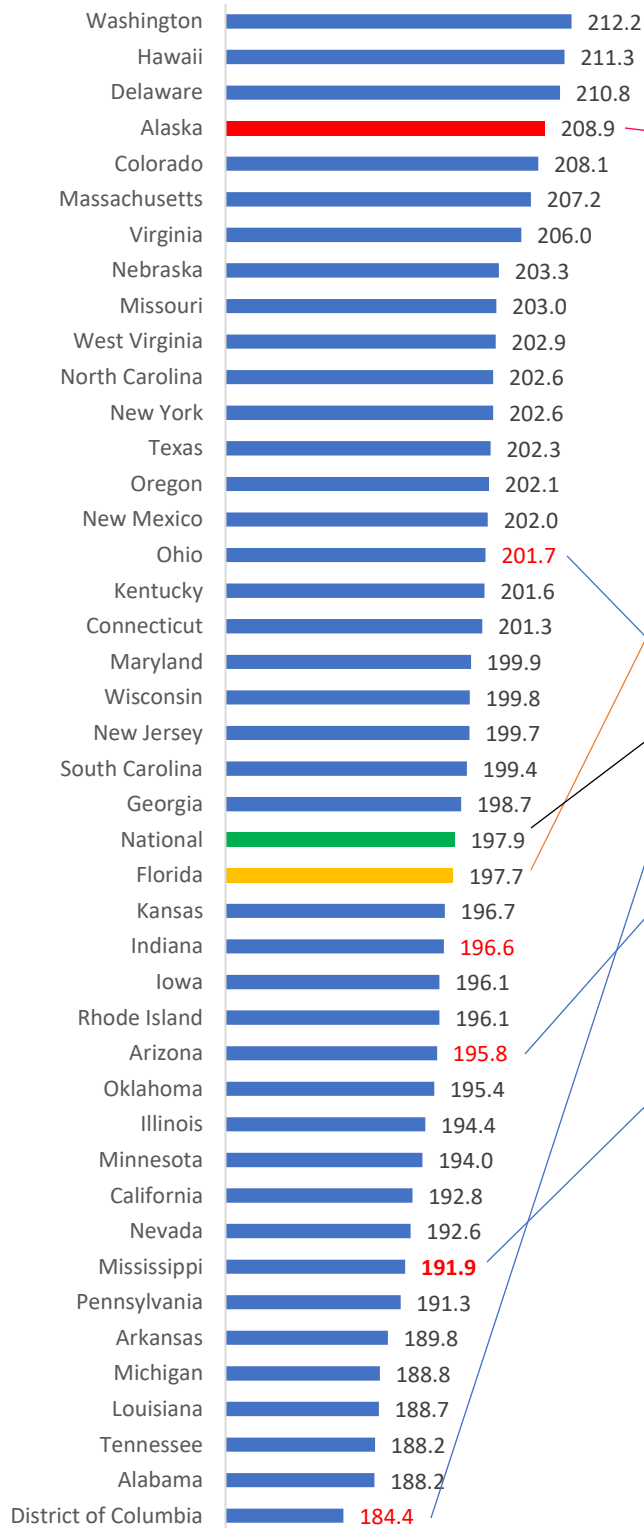
2003 NAEP 4th Grade Reading White



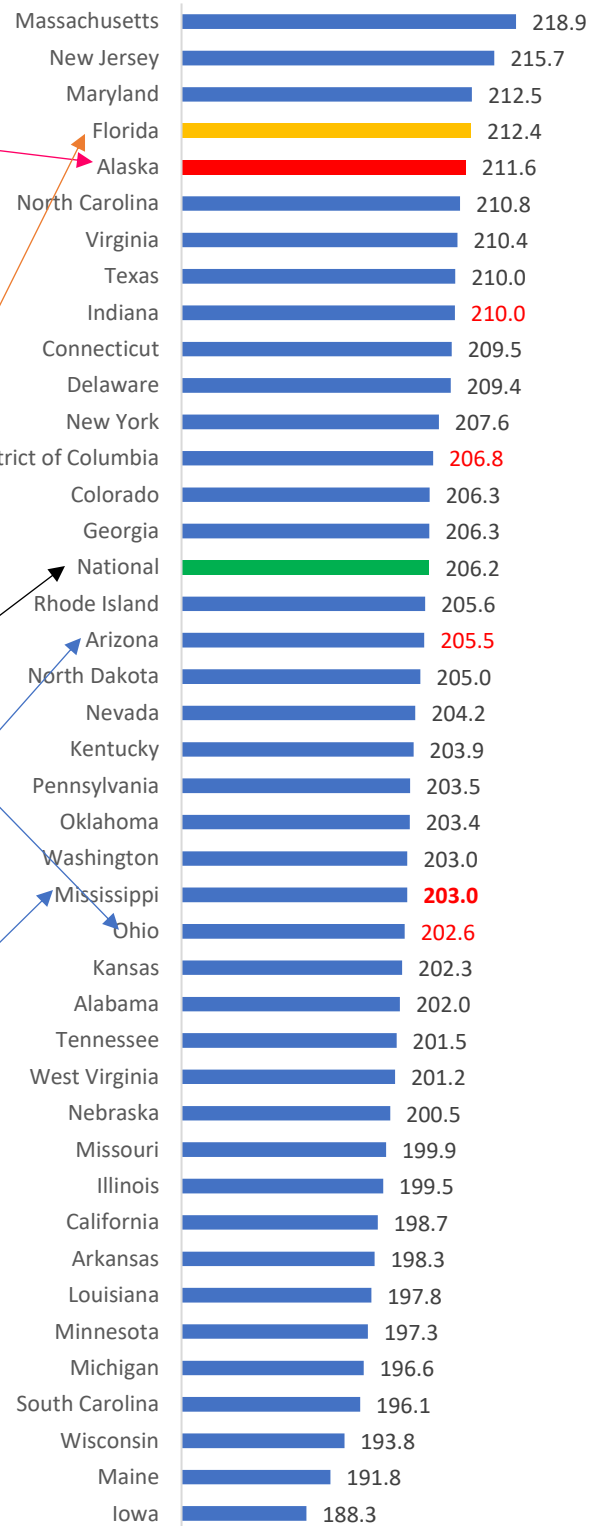
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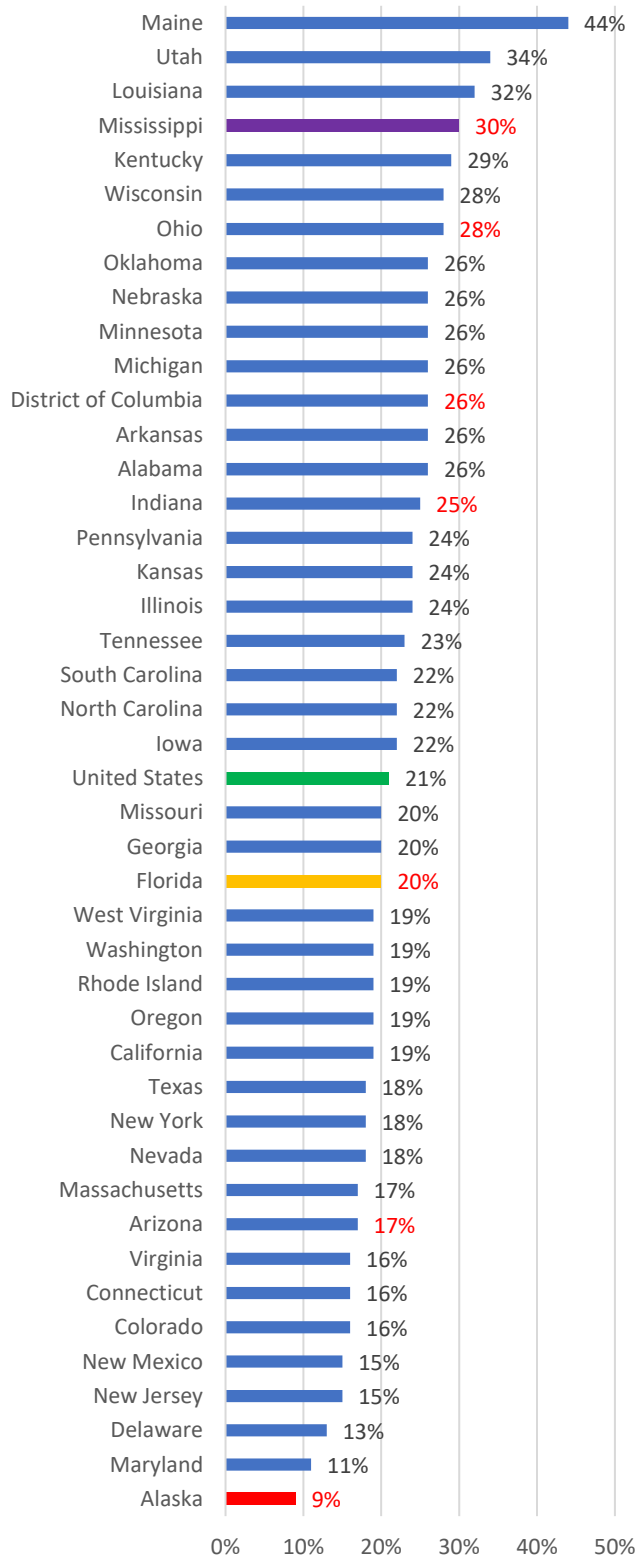
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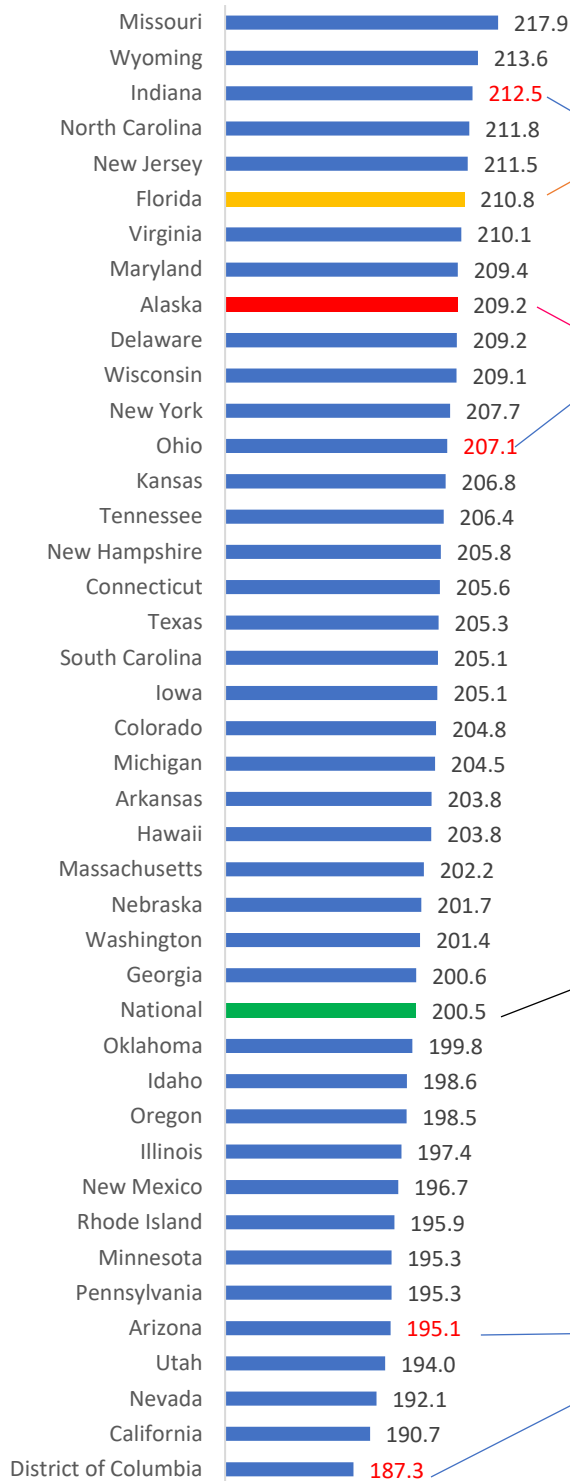
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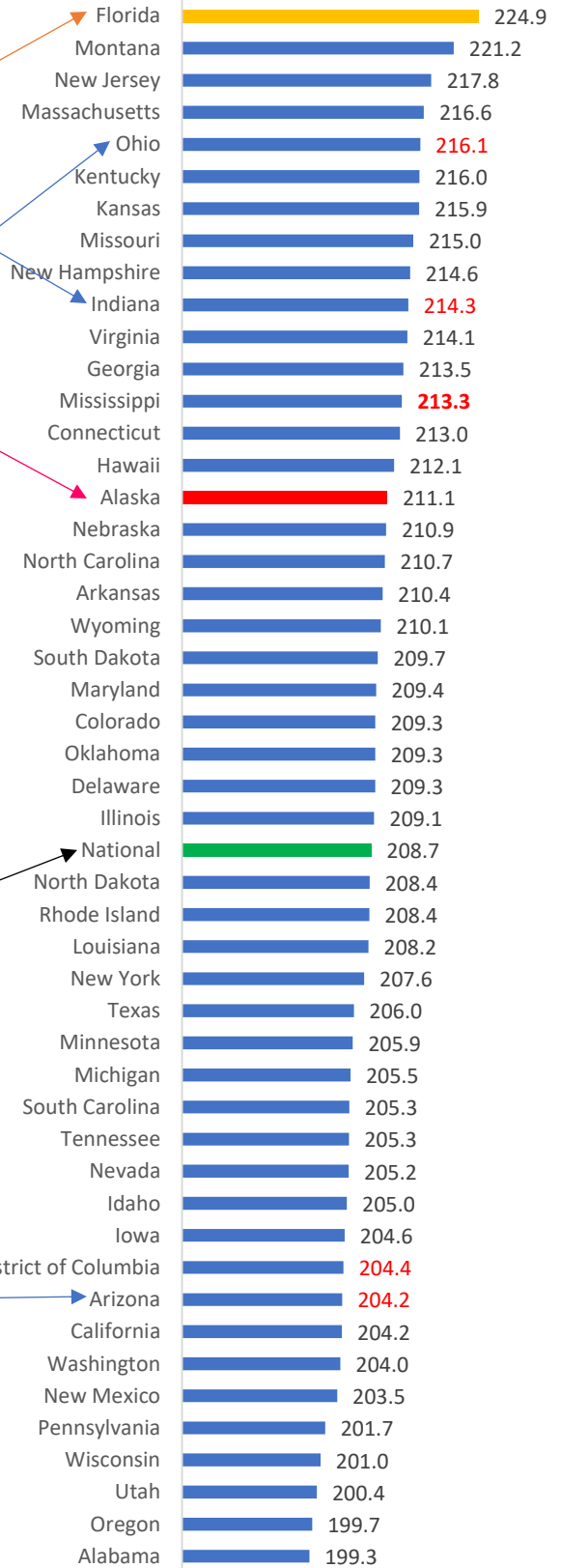
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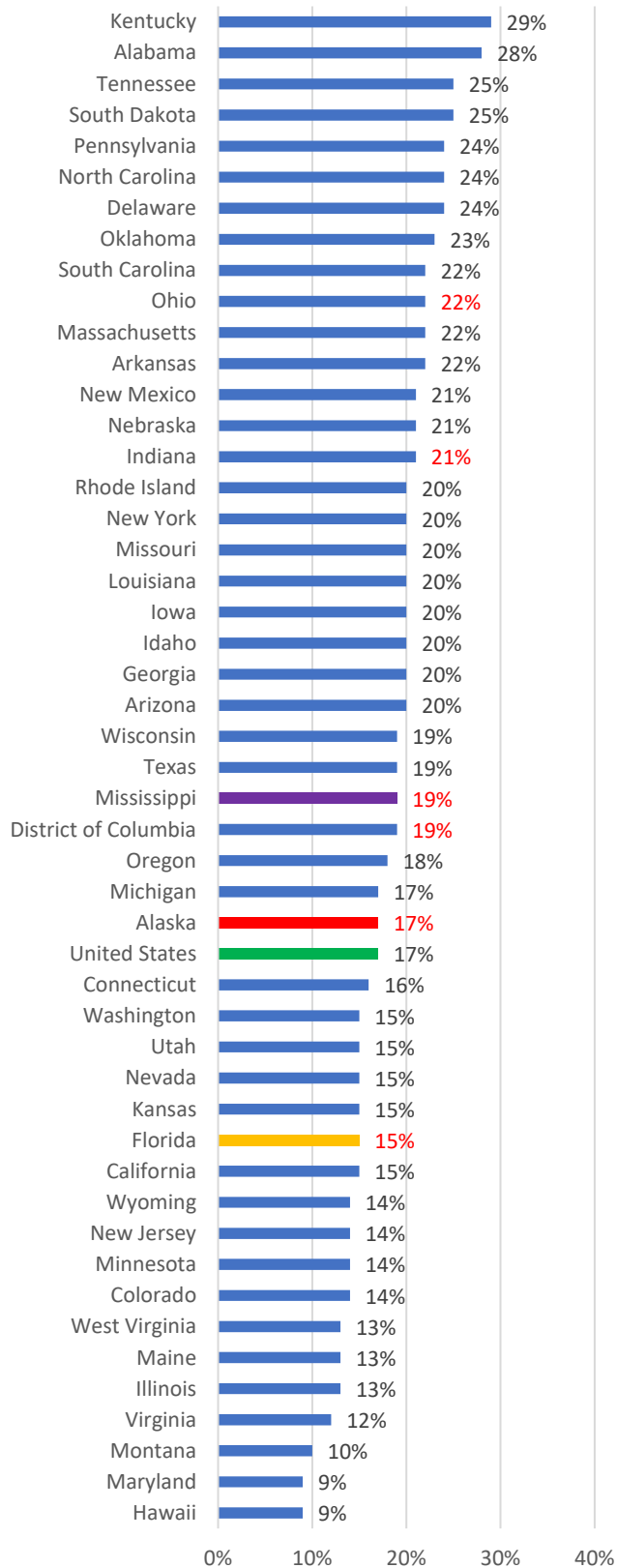
2003 NAEP 4th Grade Reading Hispanic



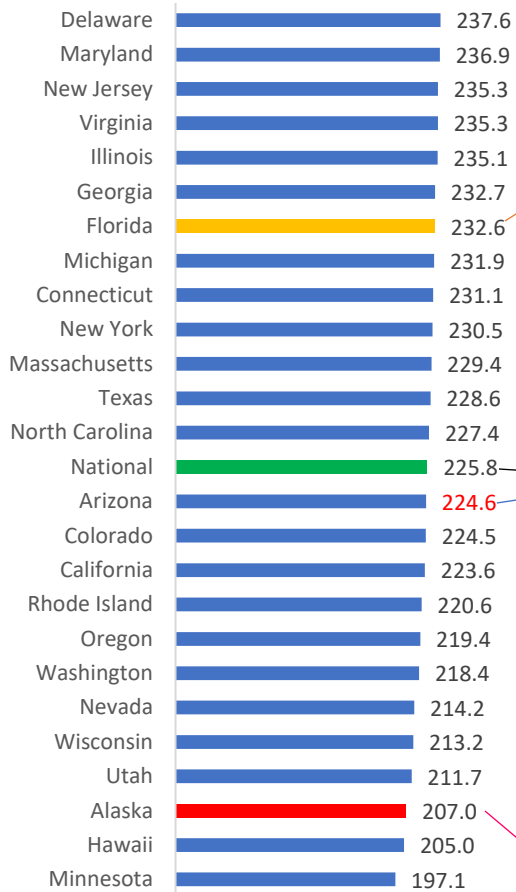
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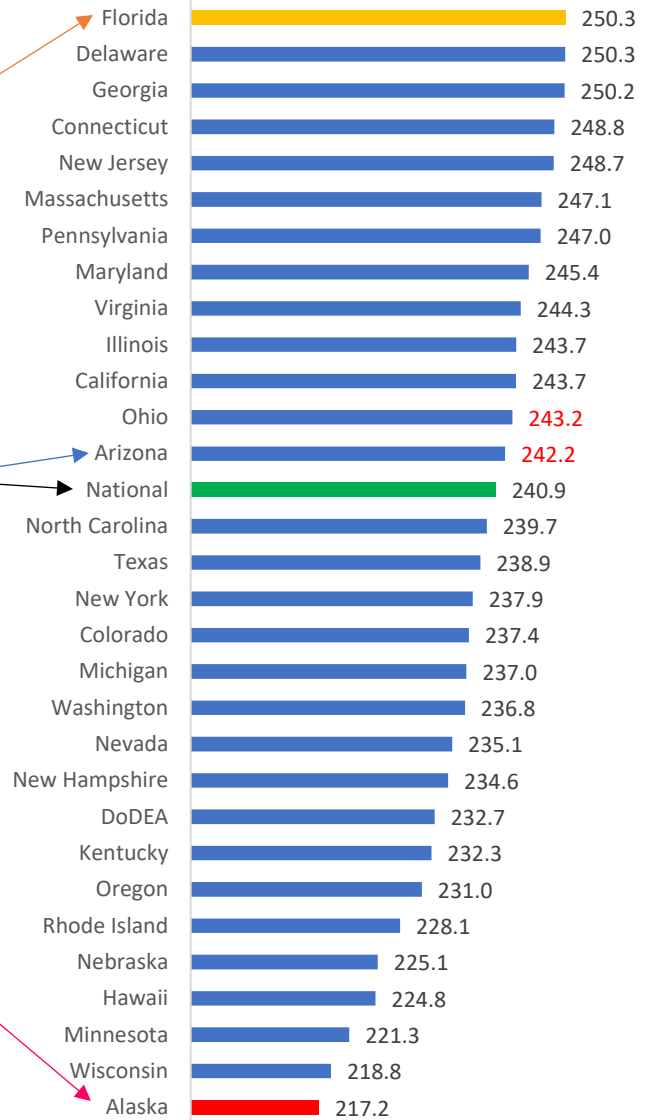
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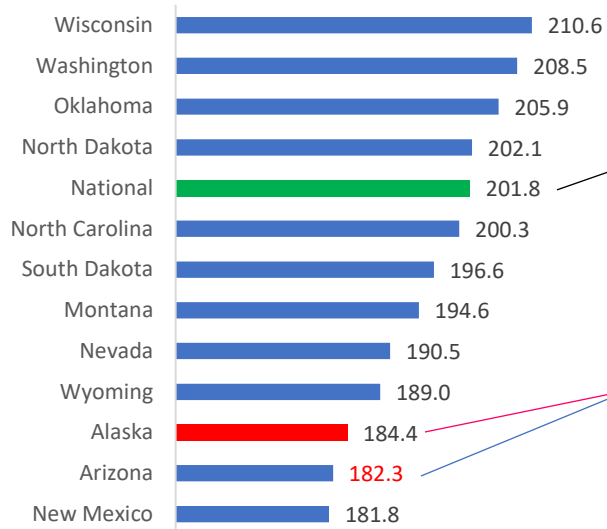
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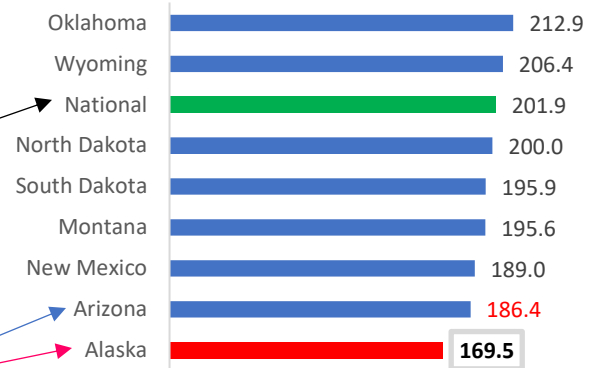
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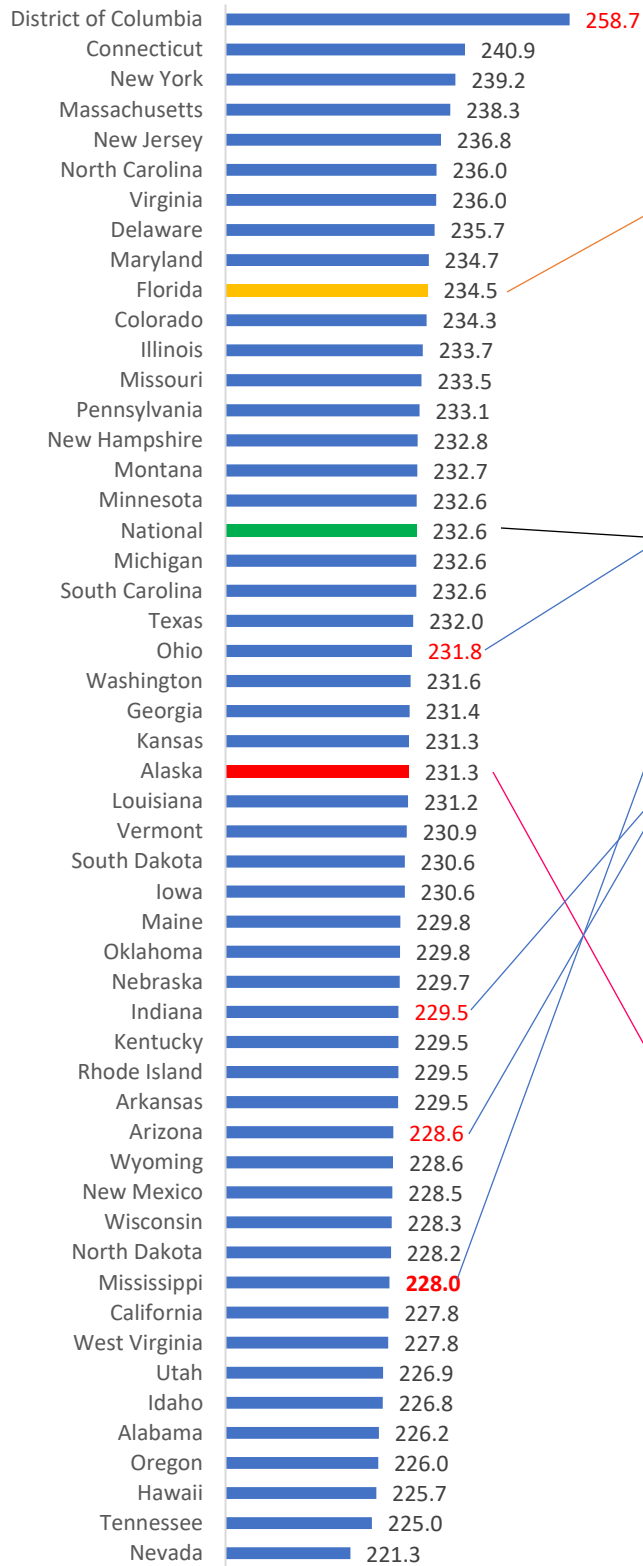
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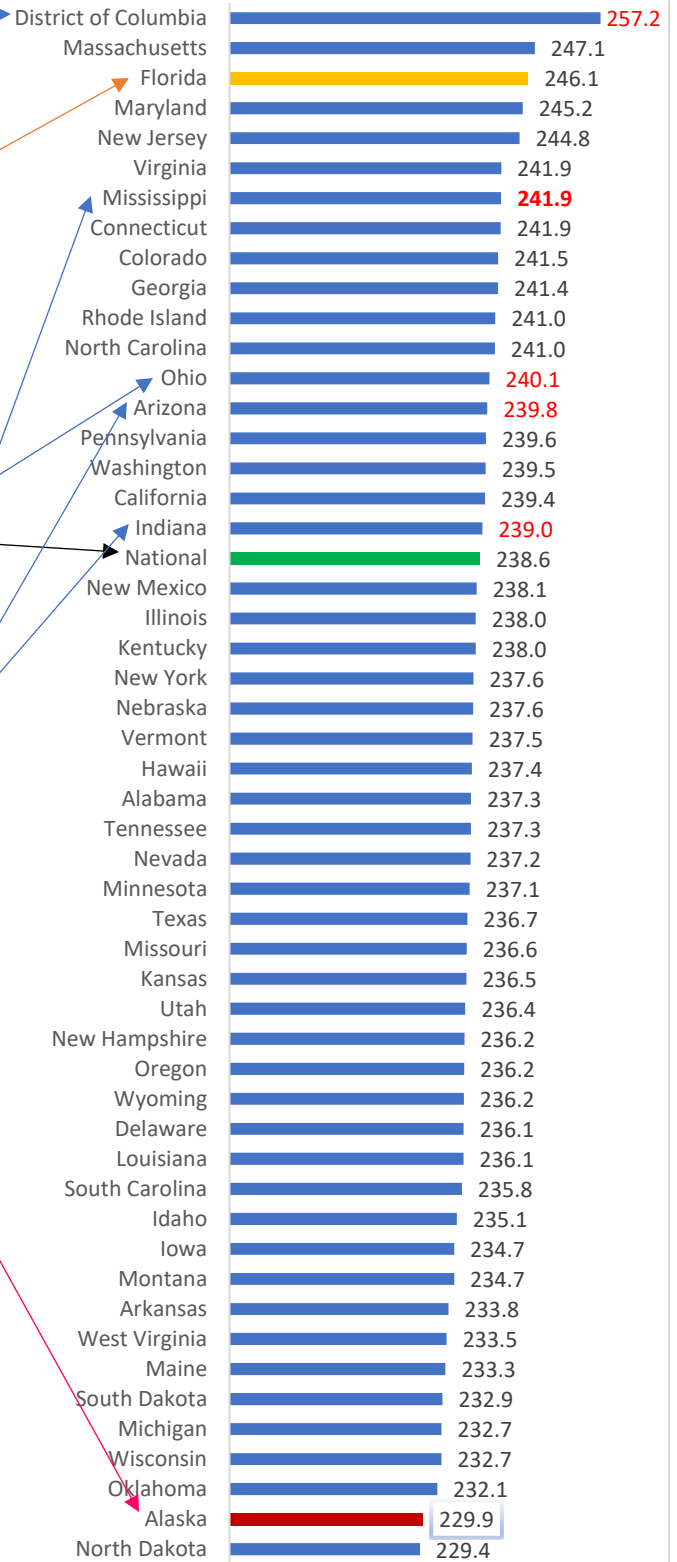
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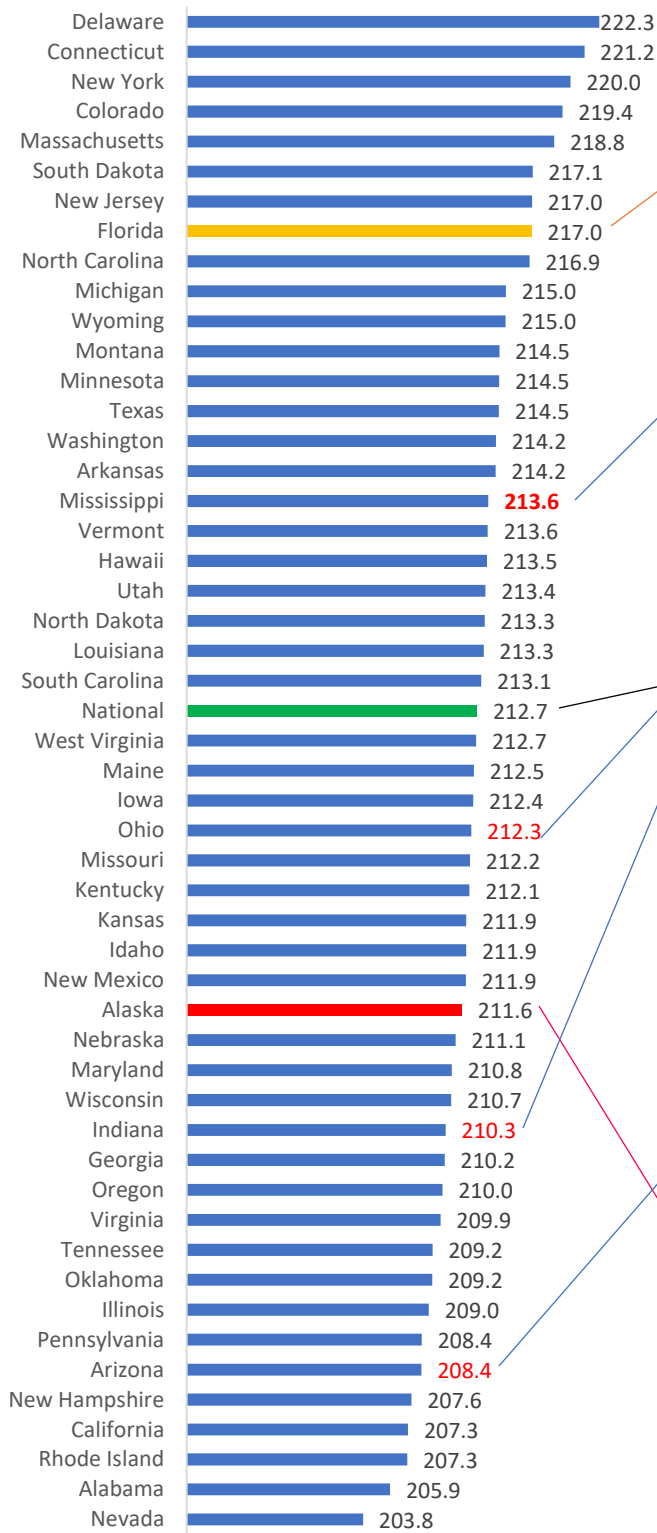
2003 NAEP 4thGrade Reading White Non-Free or Reduced Lunch



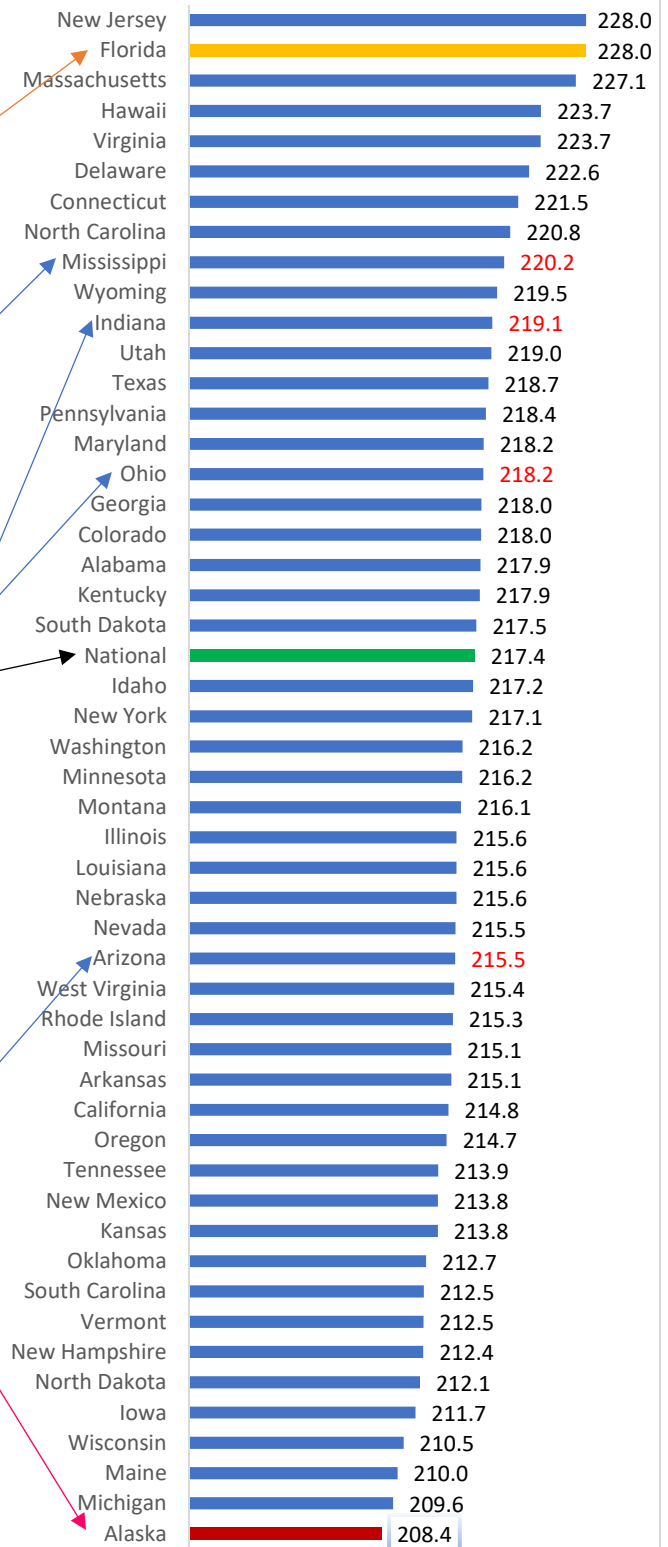
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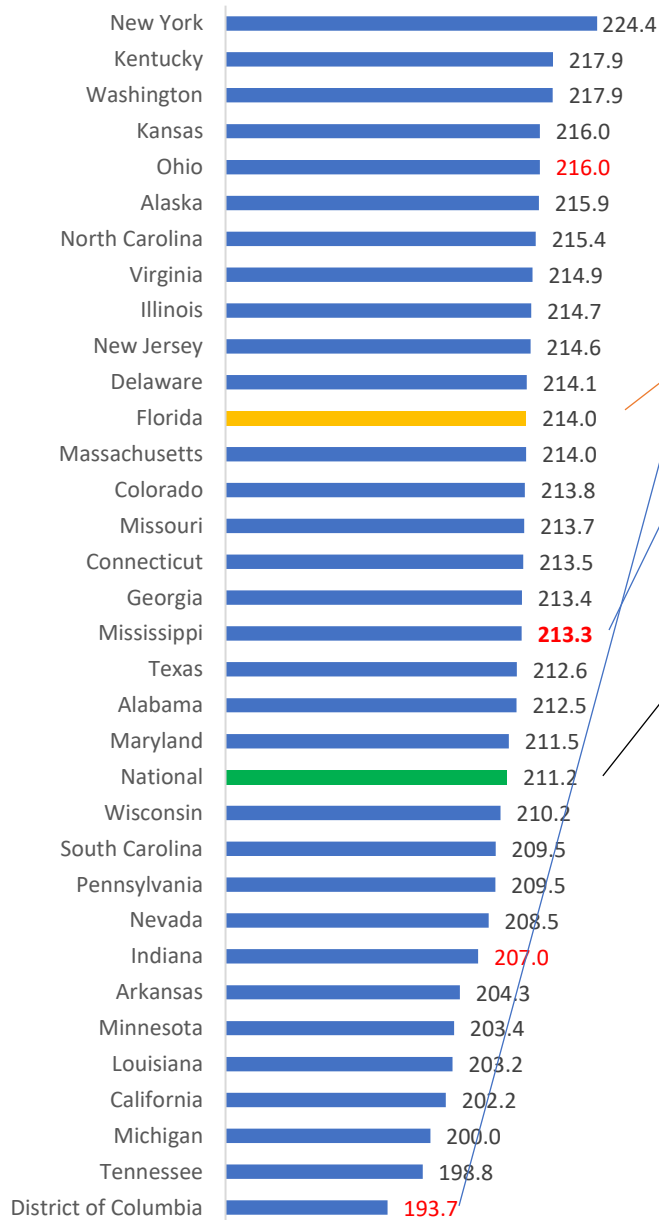
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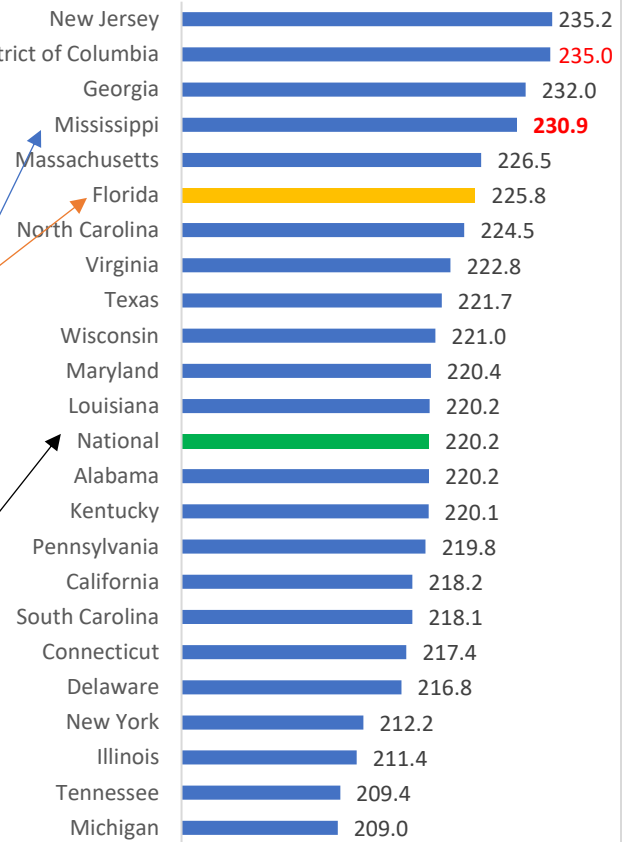
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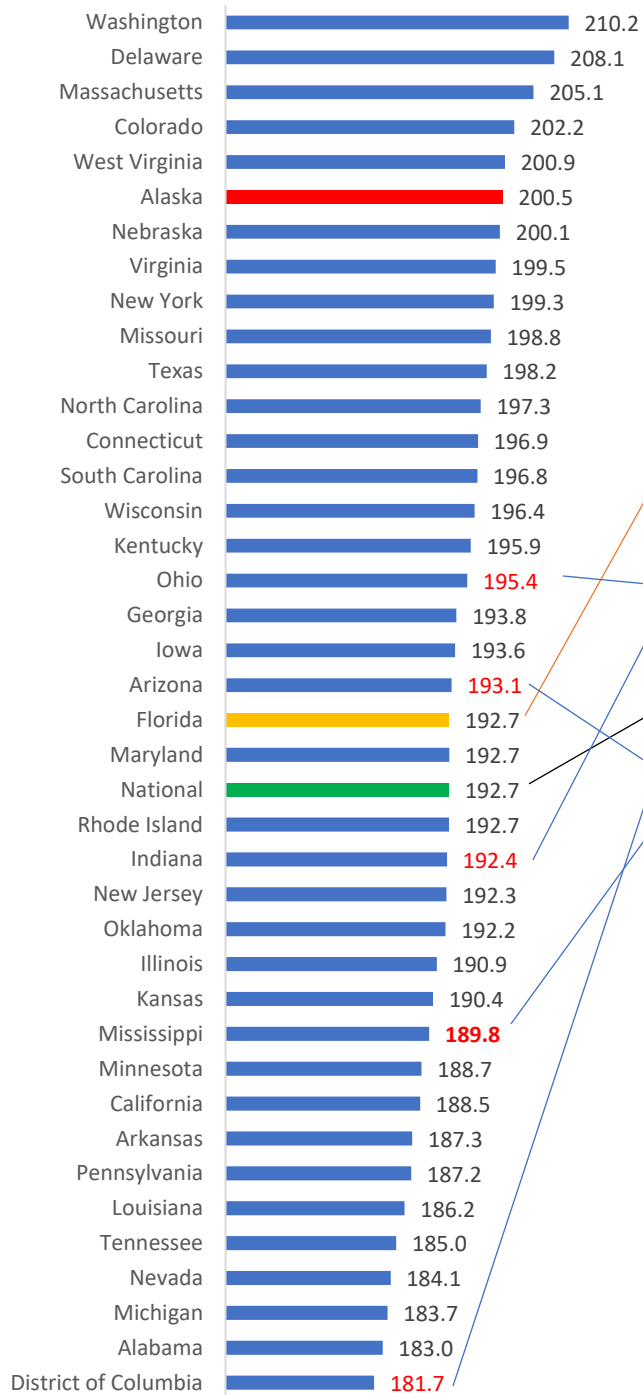
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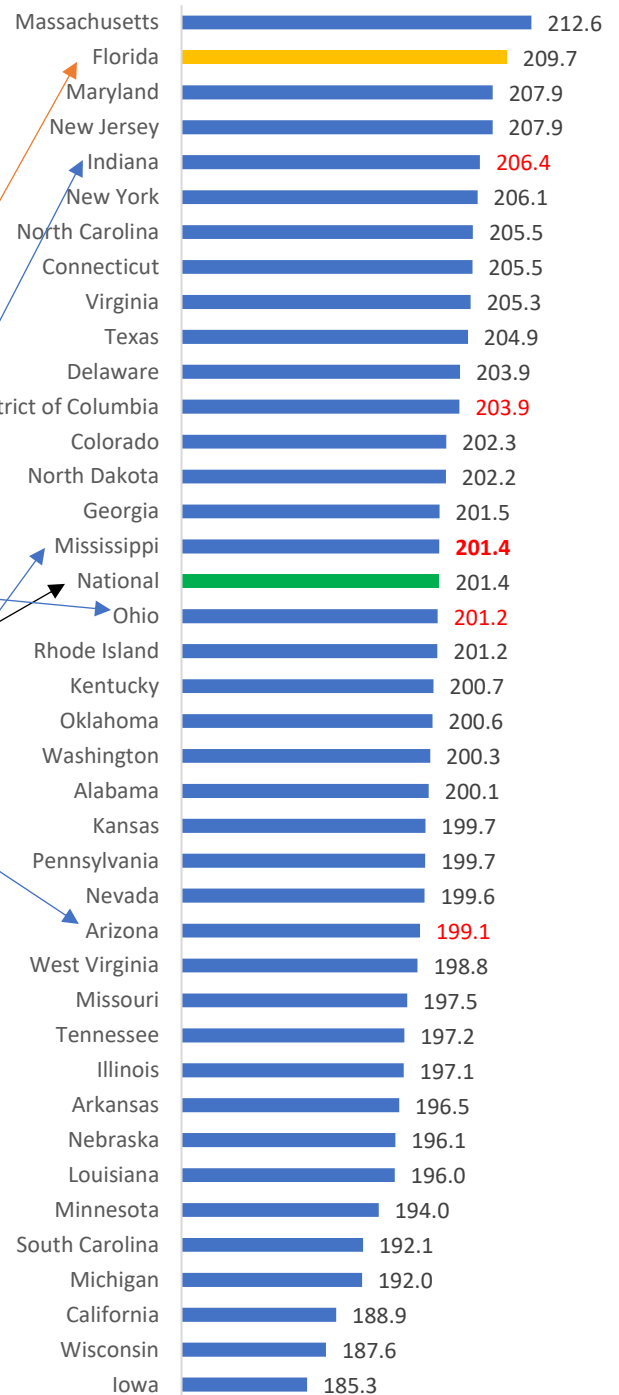
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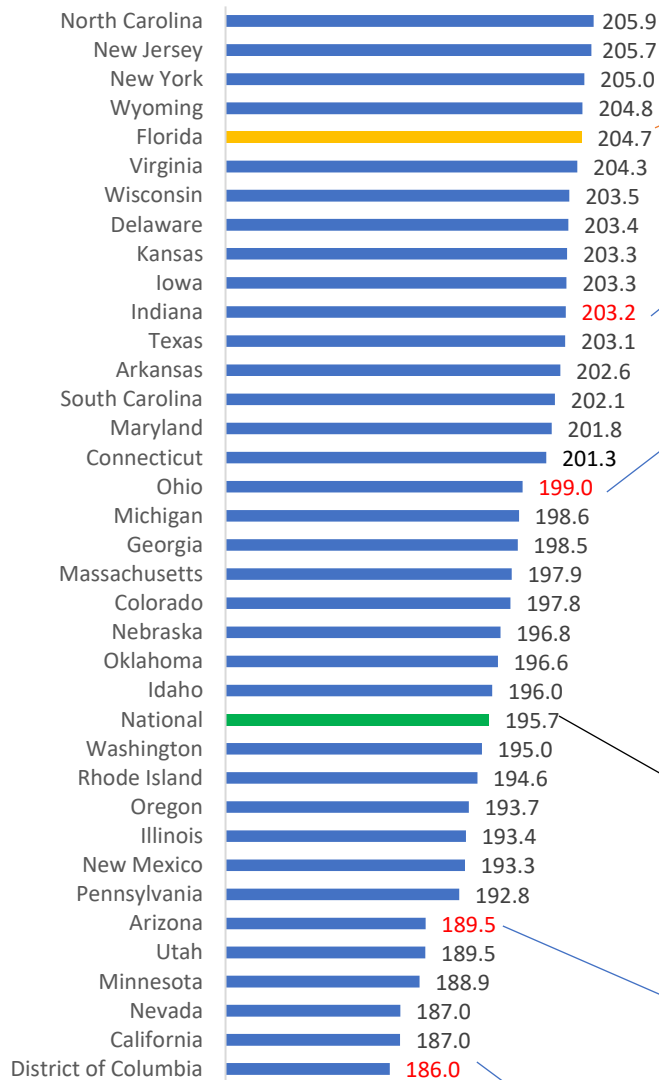
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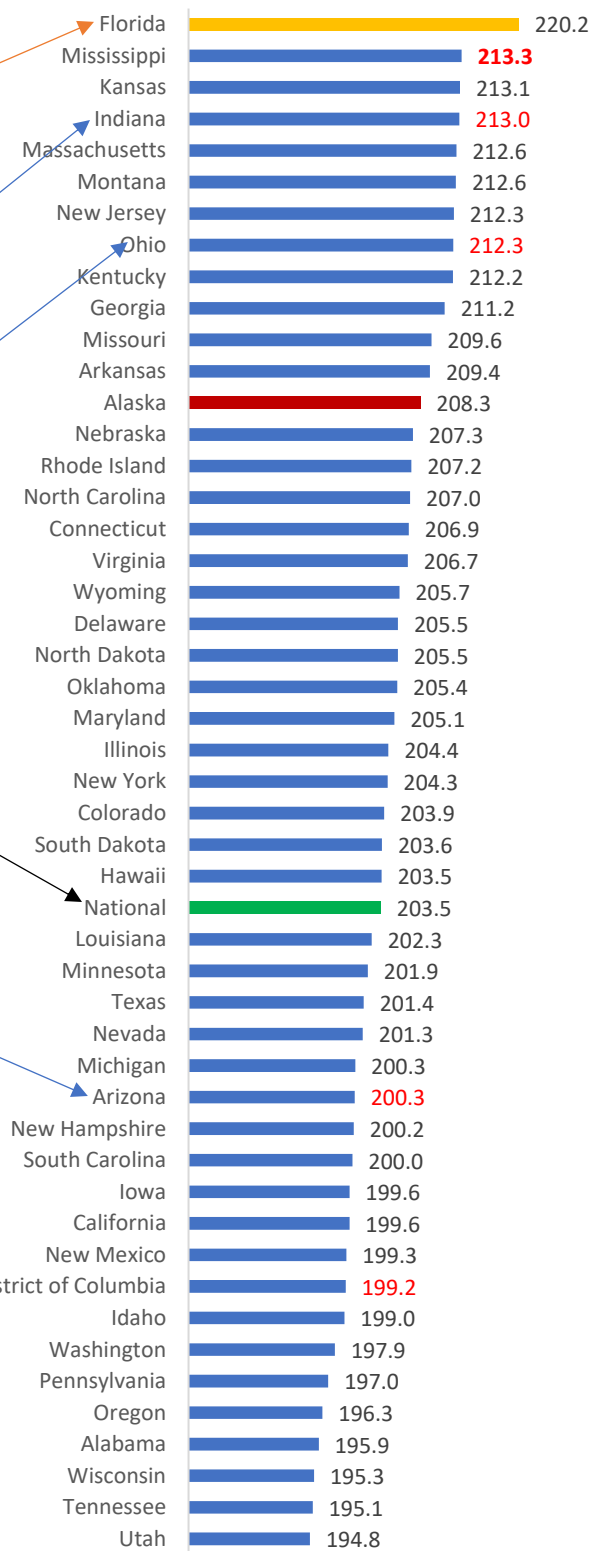
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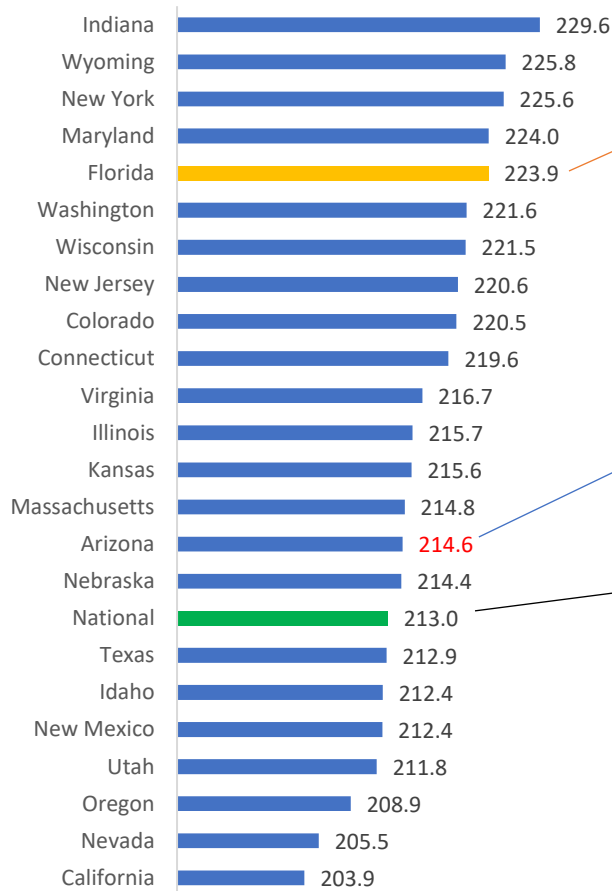
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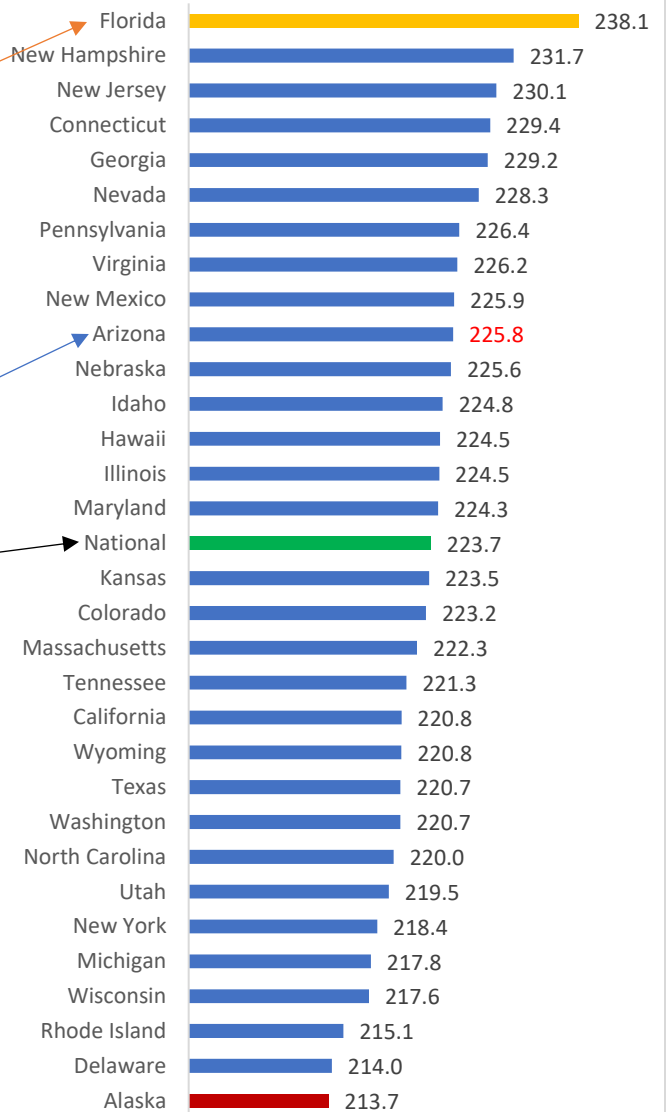
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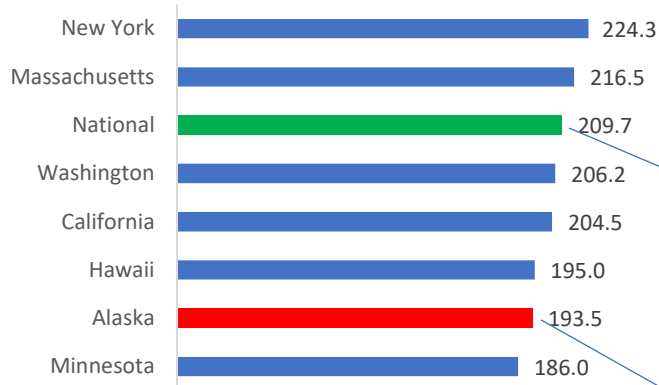
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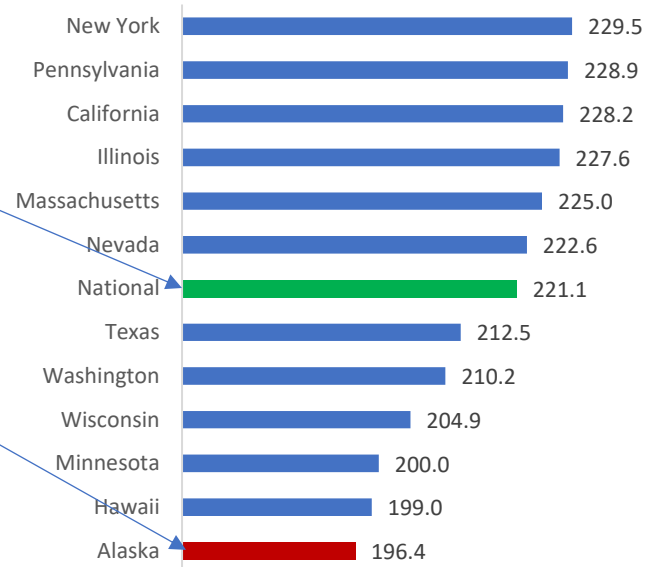
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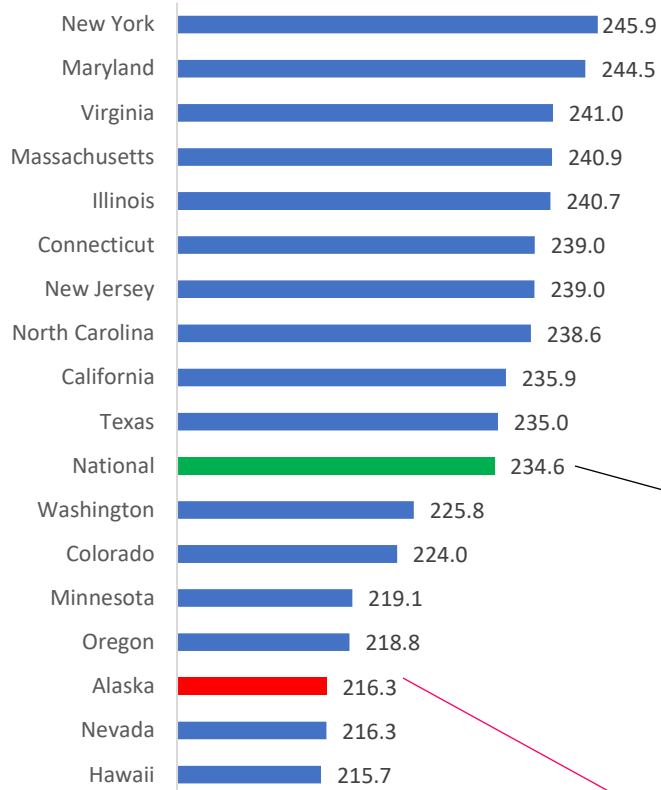
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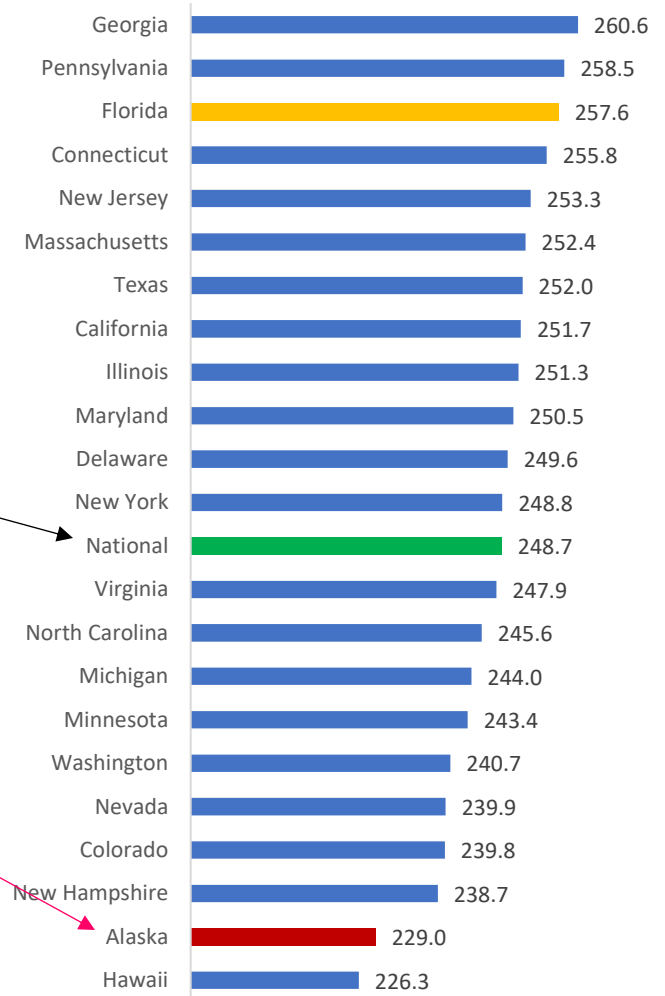
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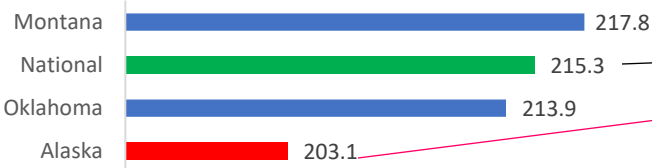
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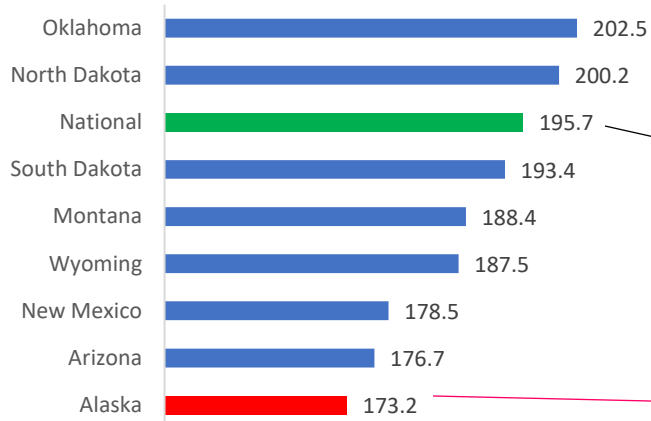
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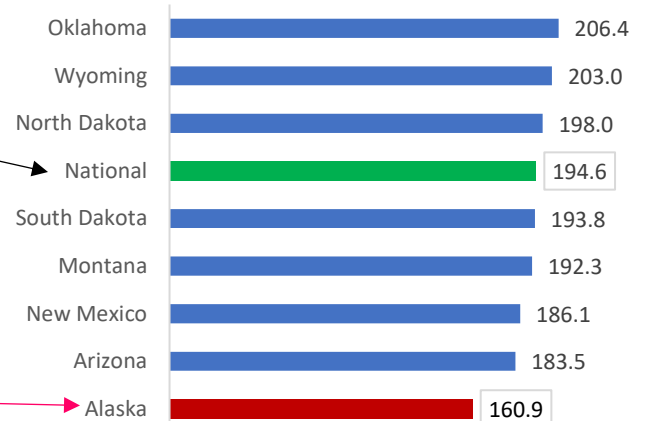
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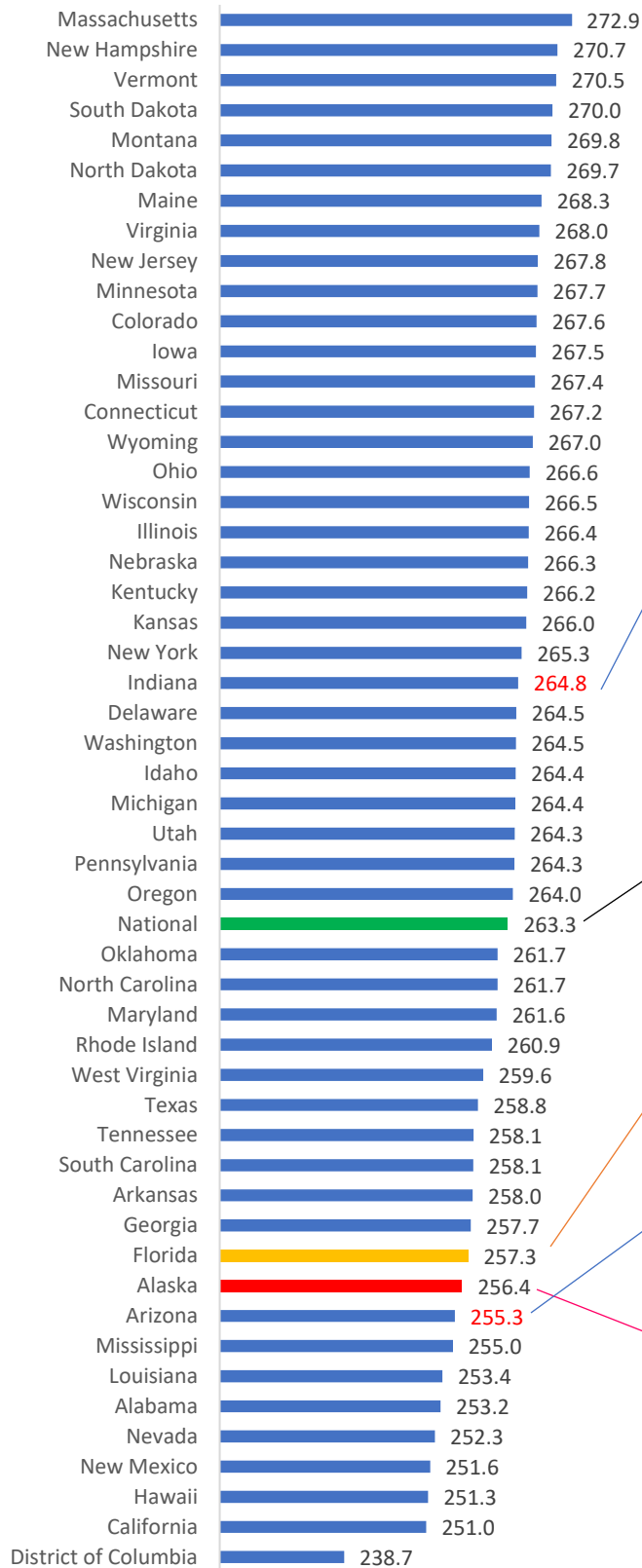
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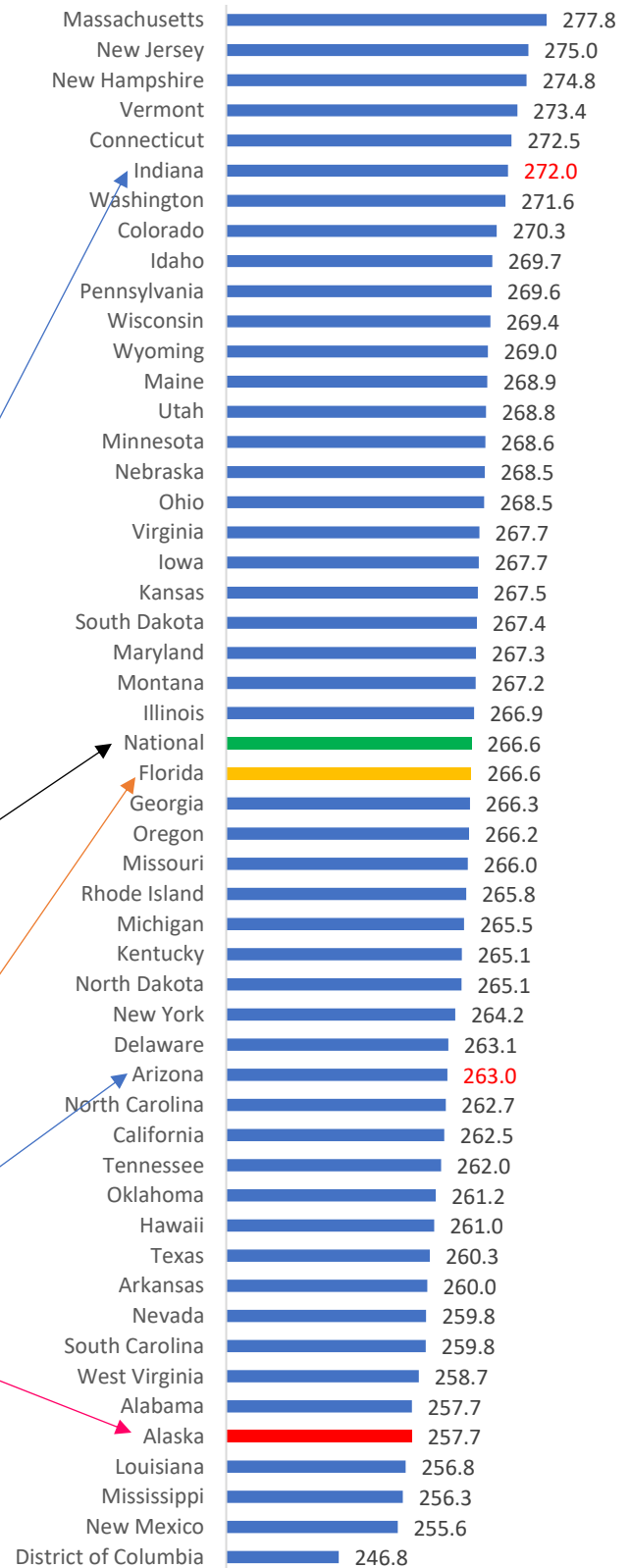
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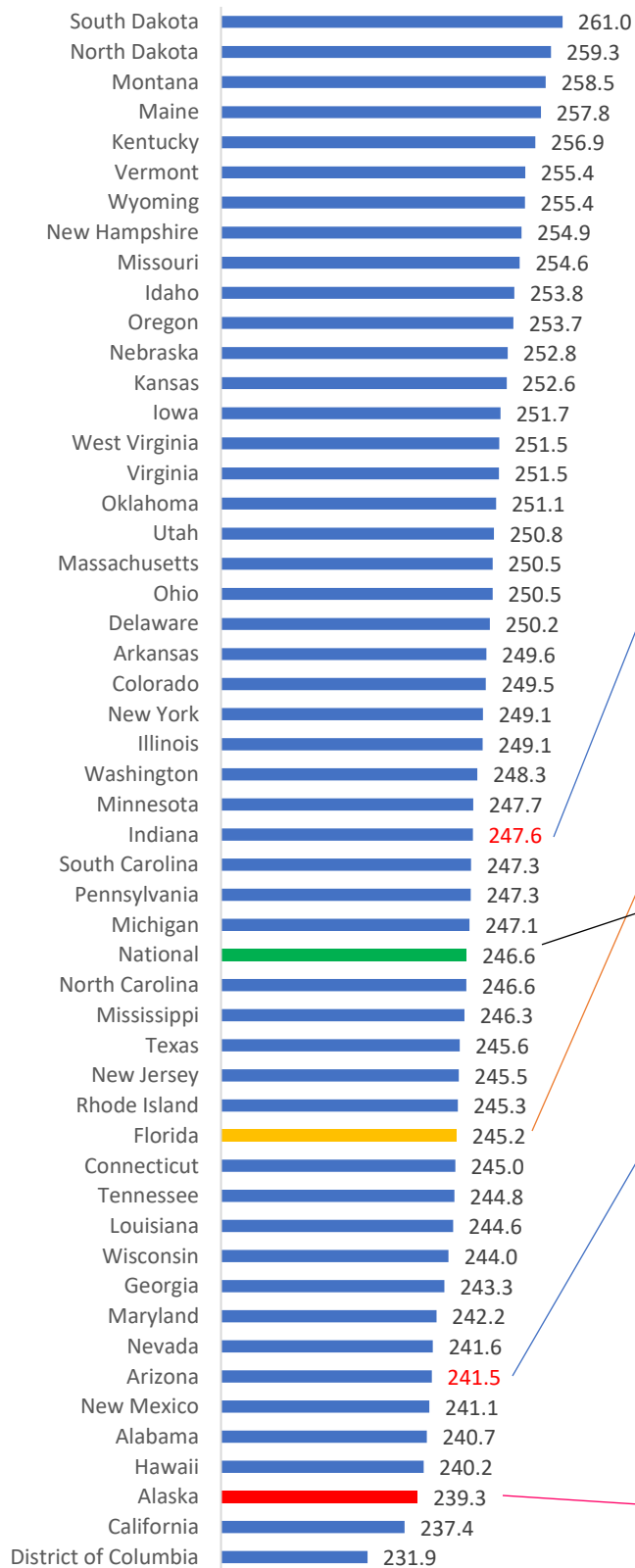
2003 NAEP 8th Grade Reading All Students



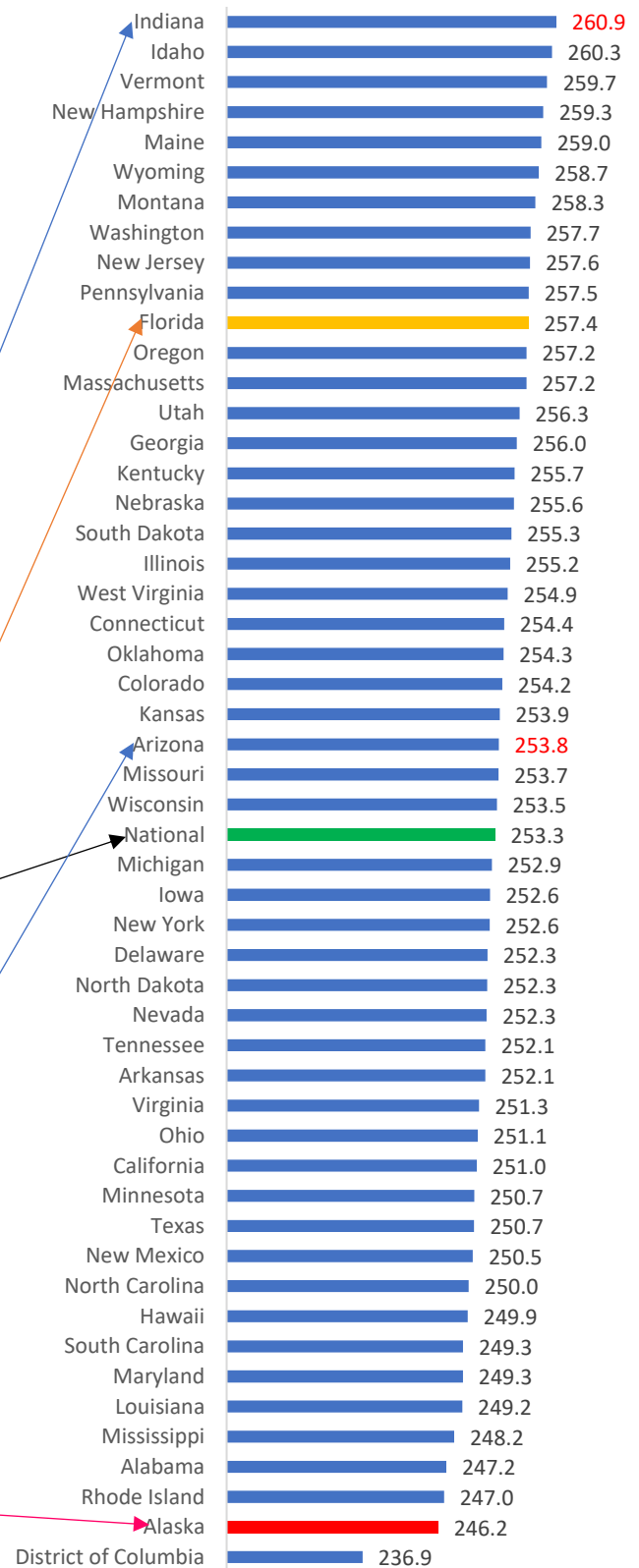
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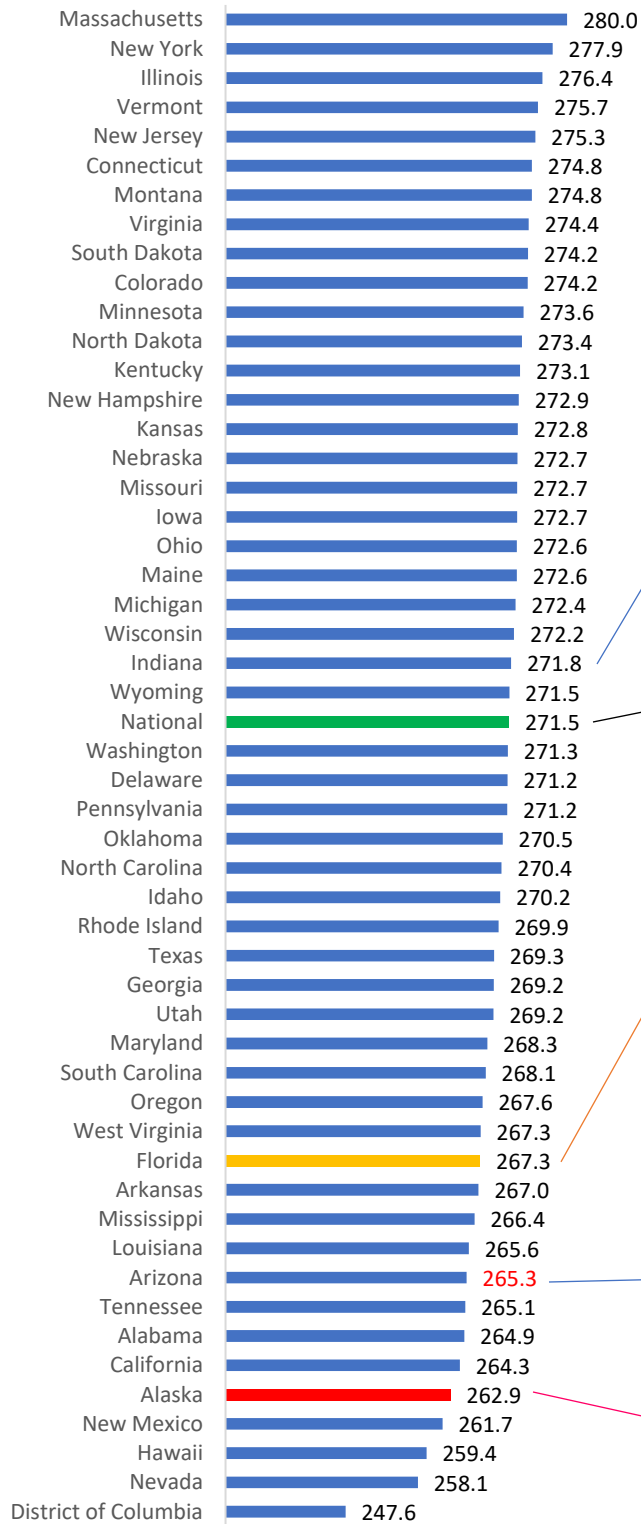
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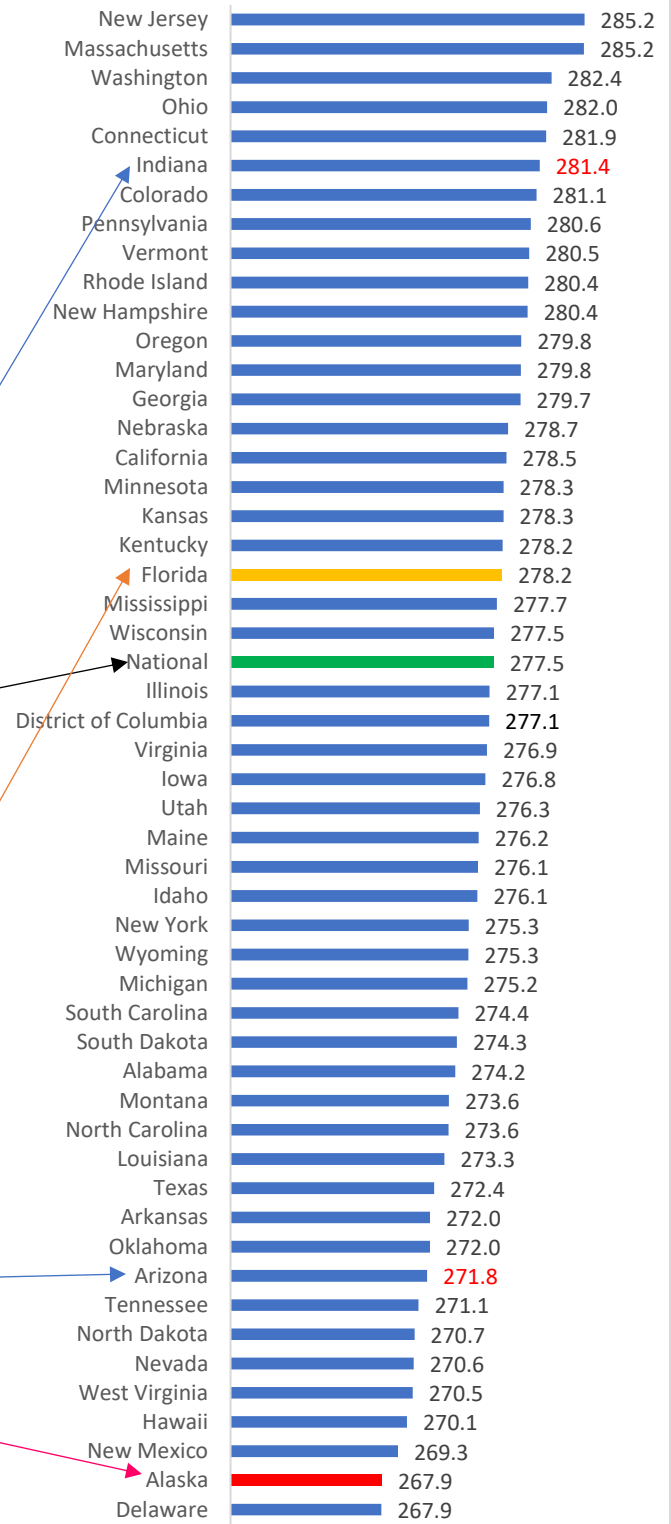
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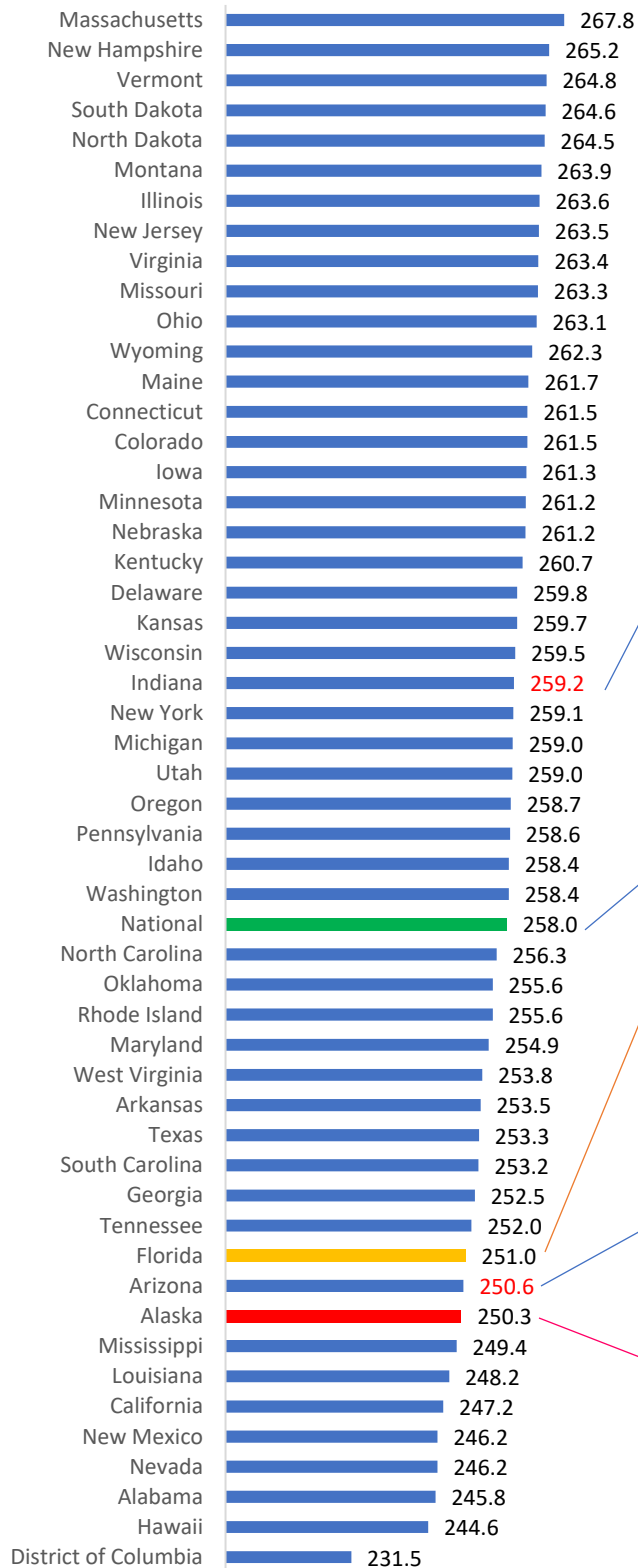
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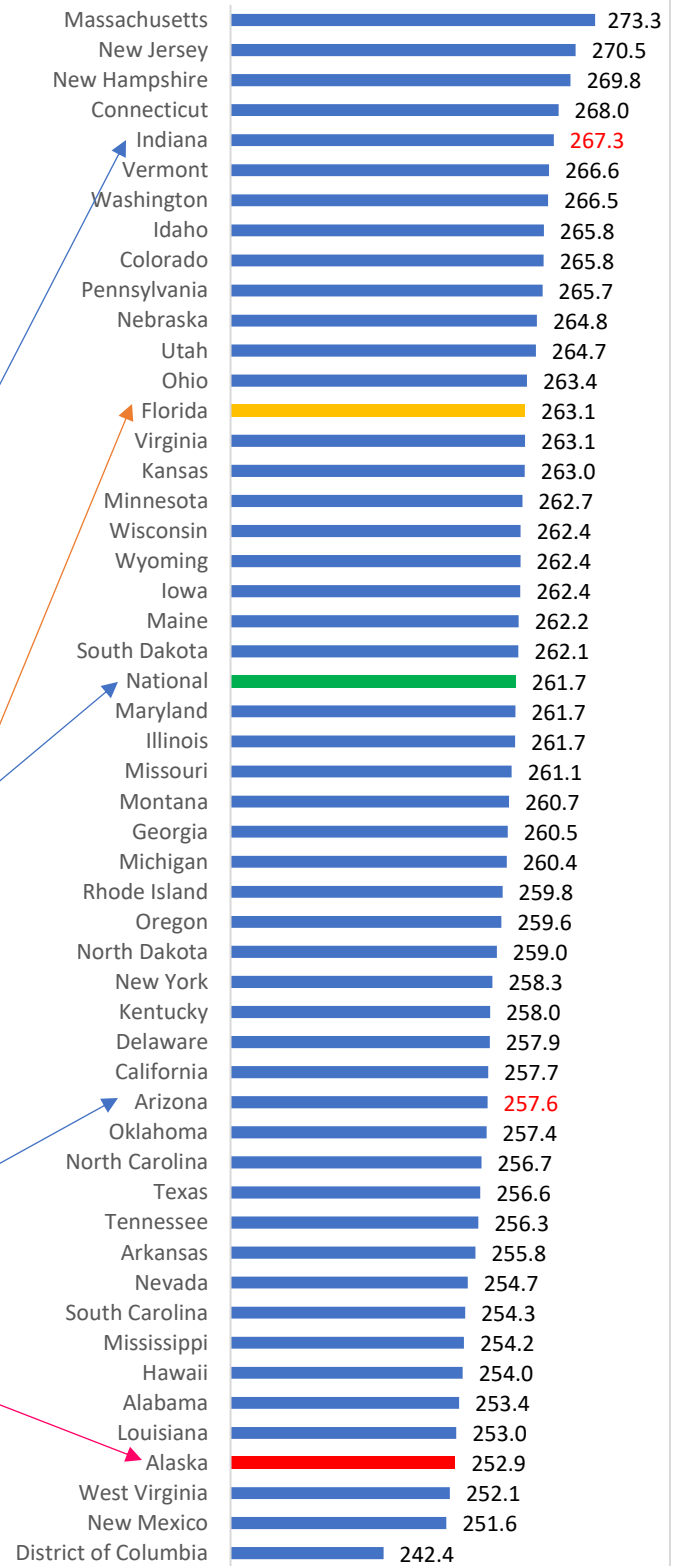
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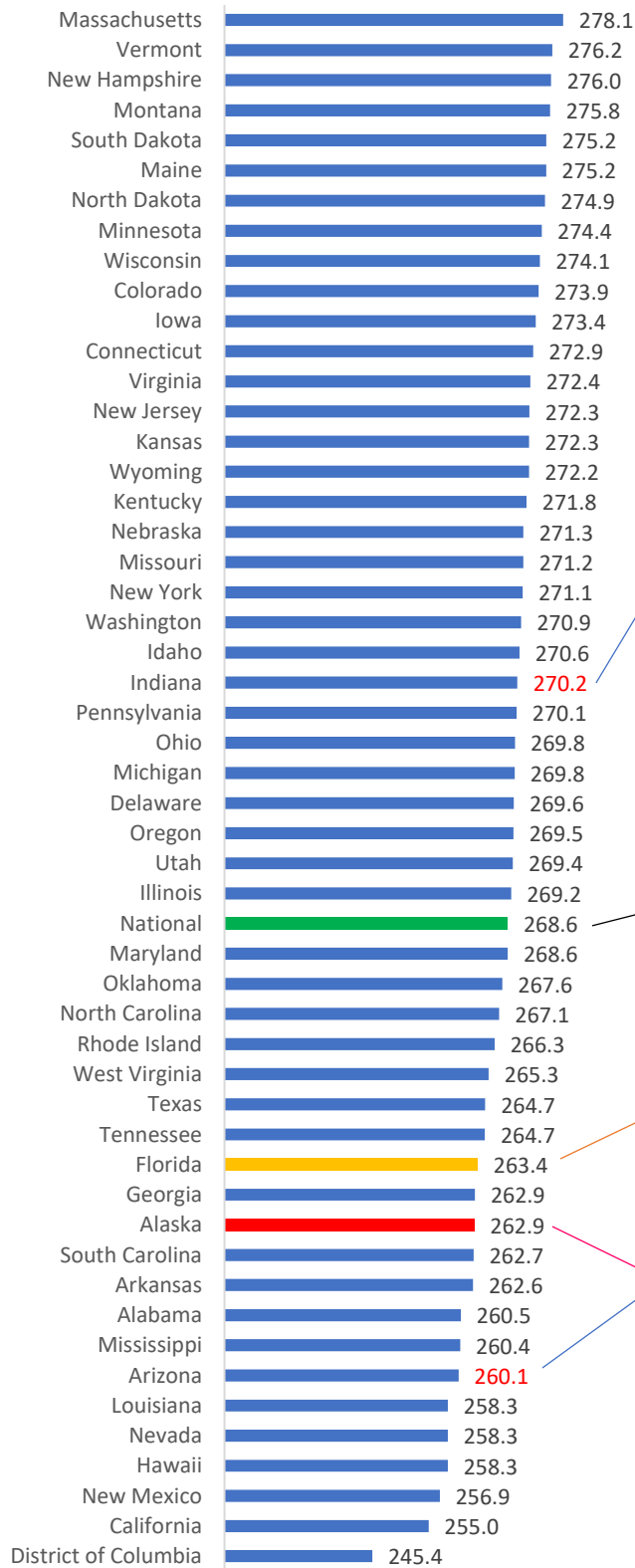
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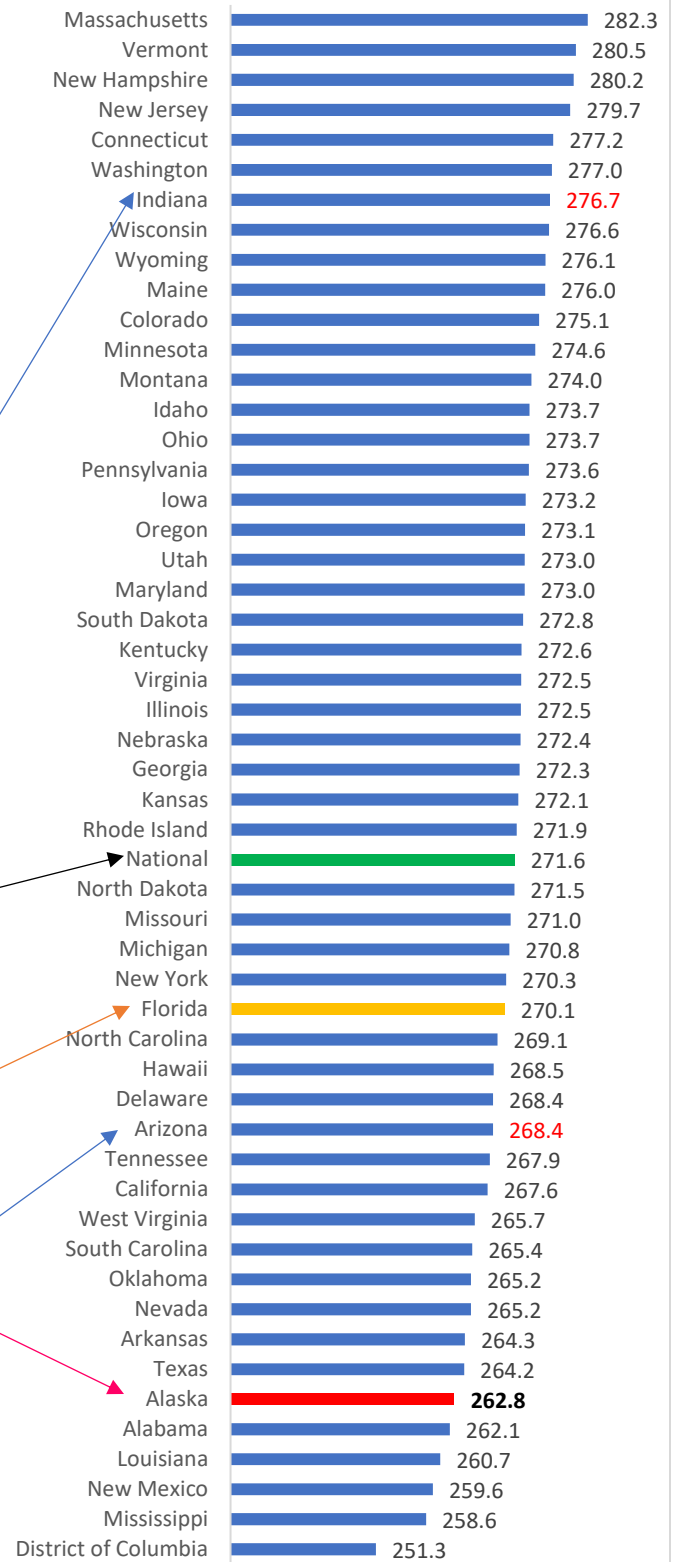
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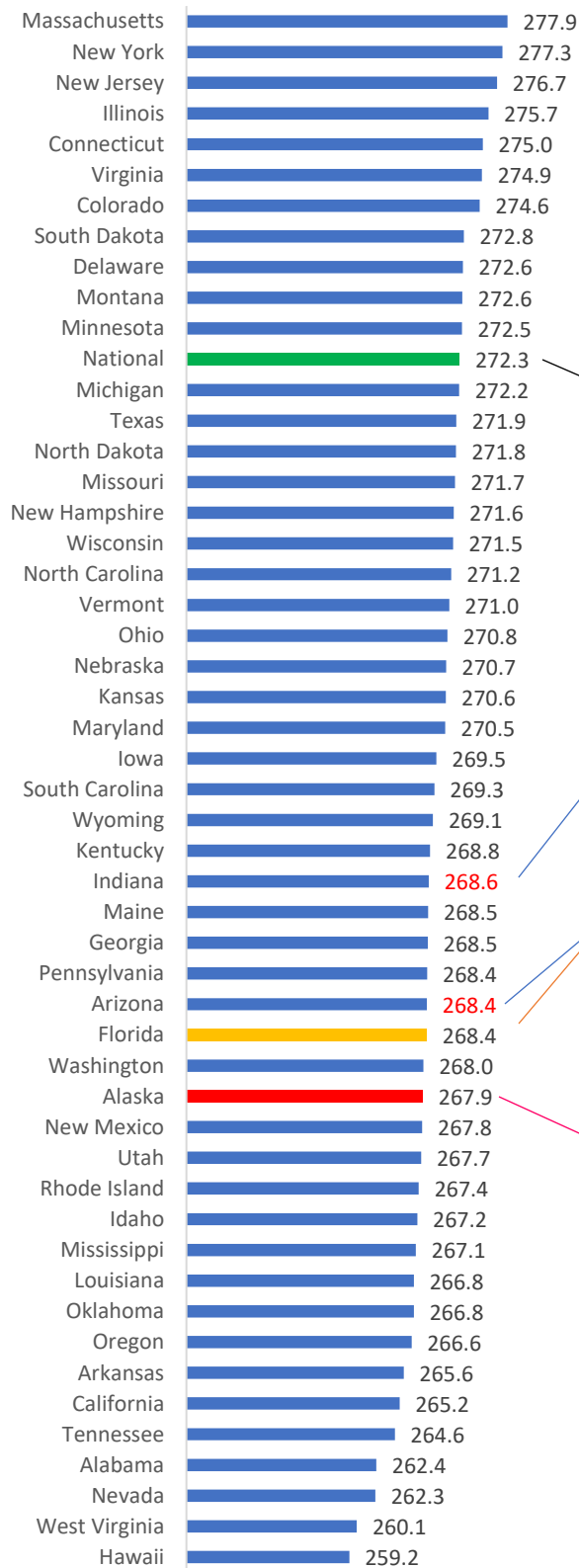
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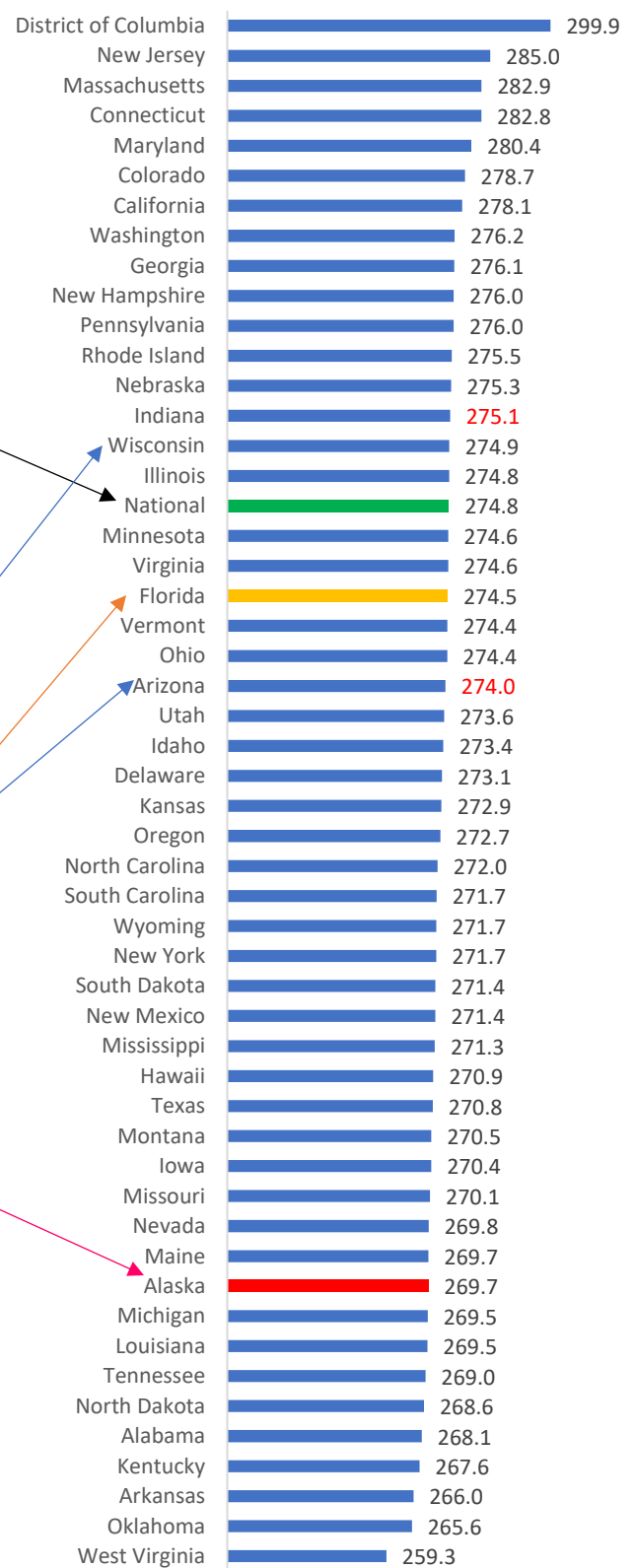
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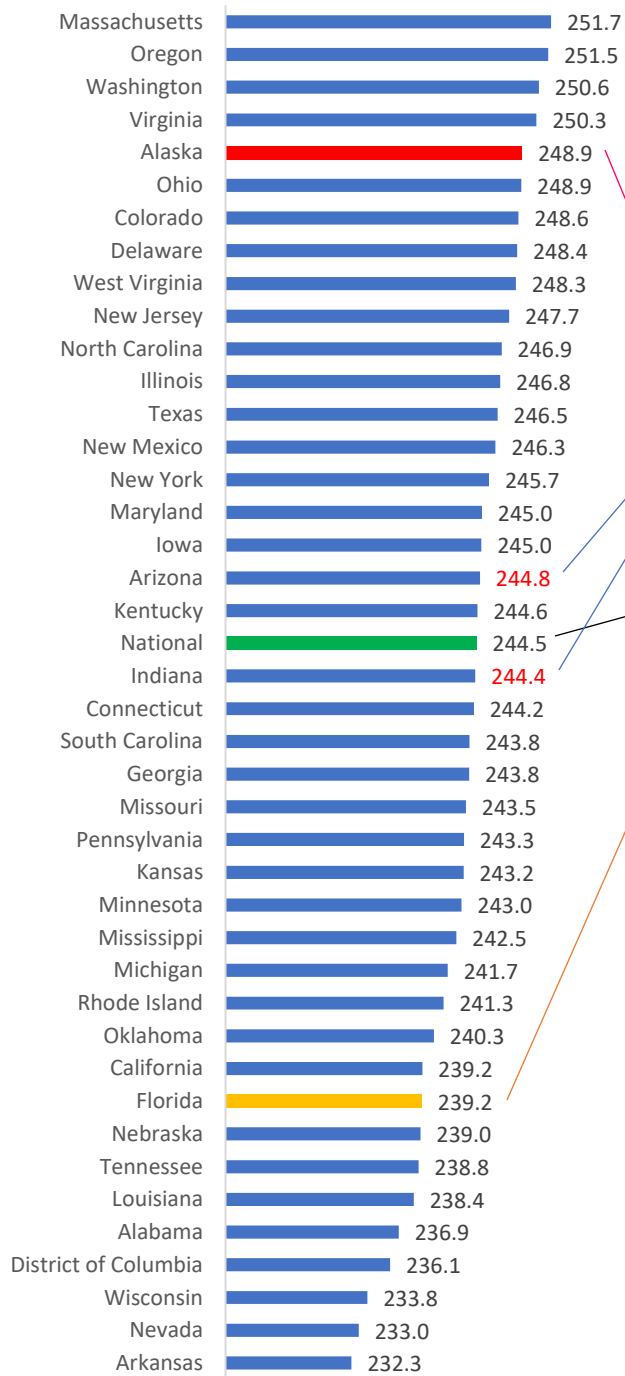
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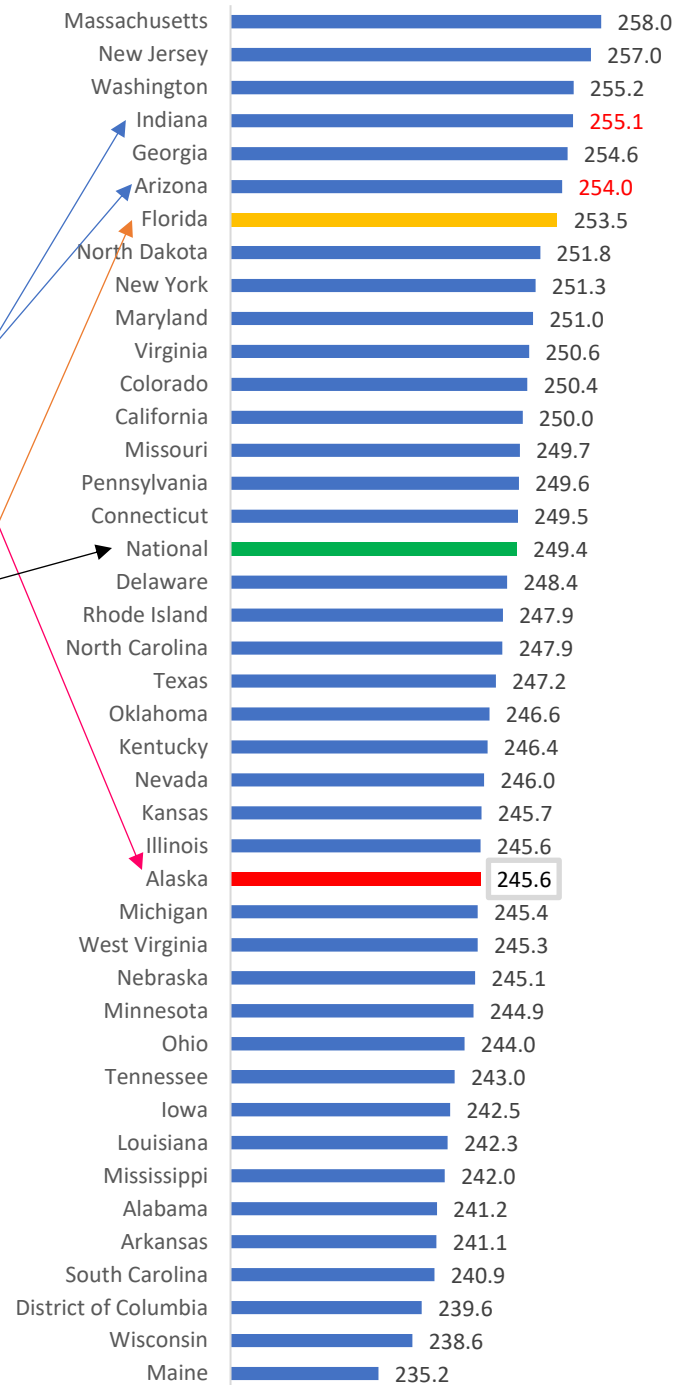
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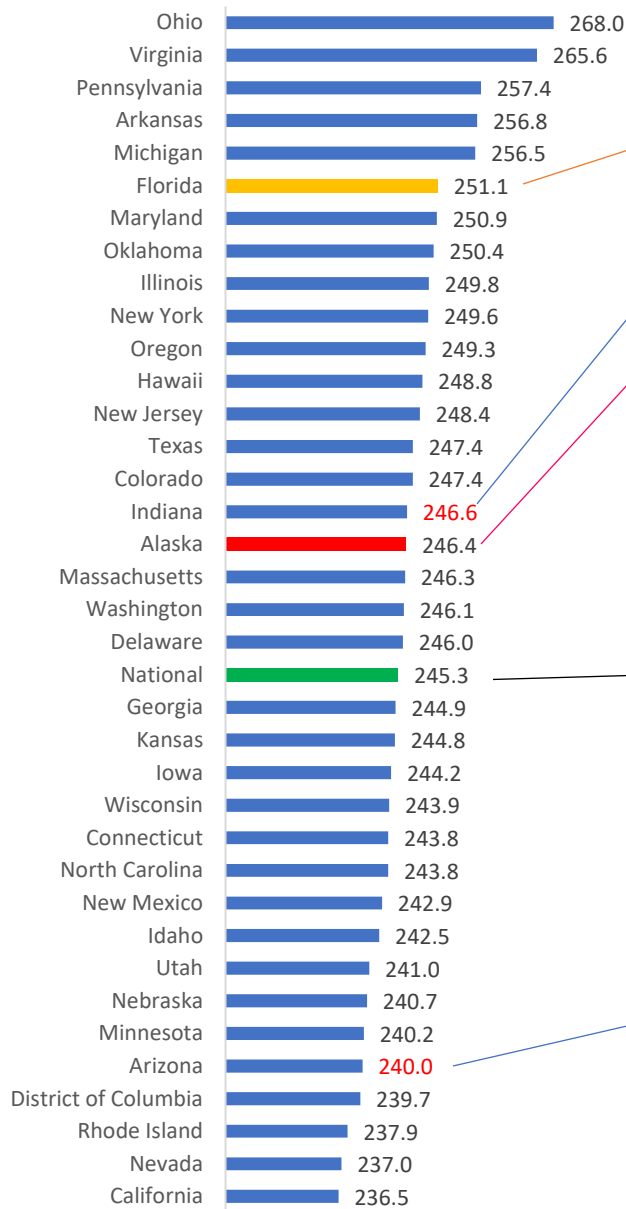
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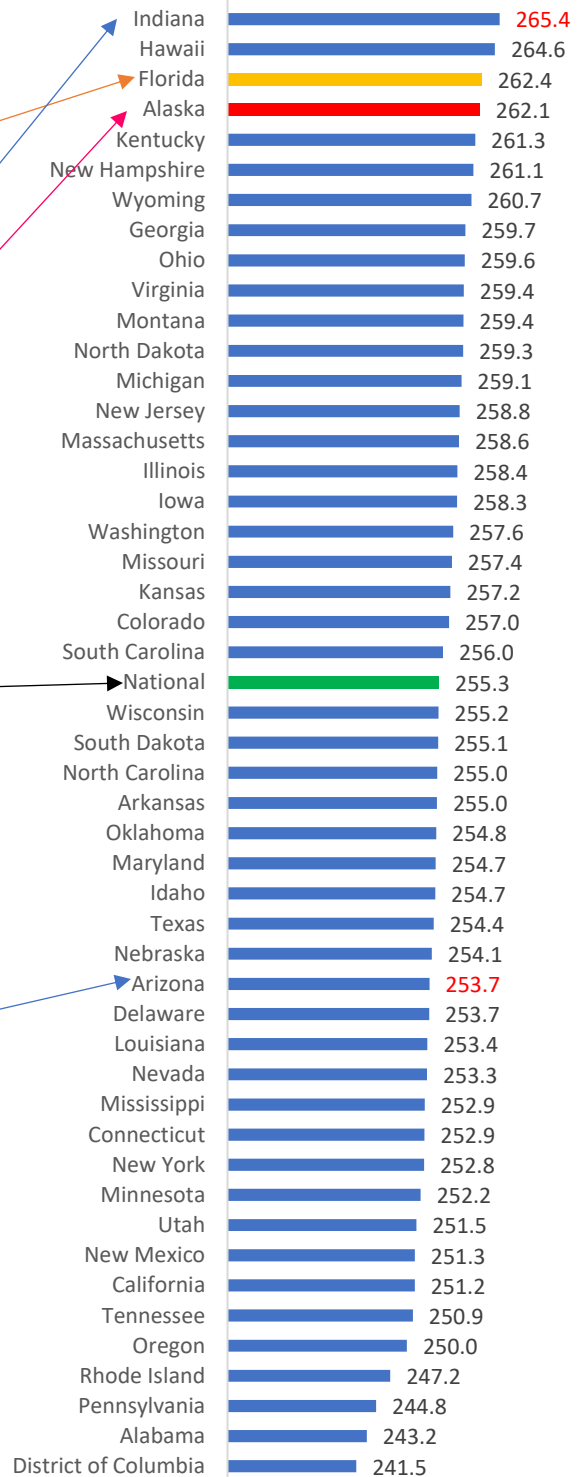
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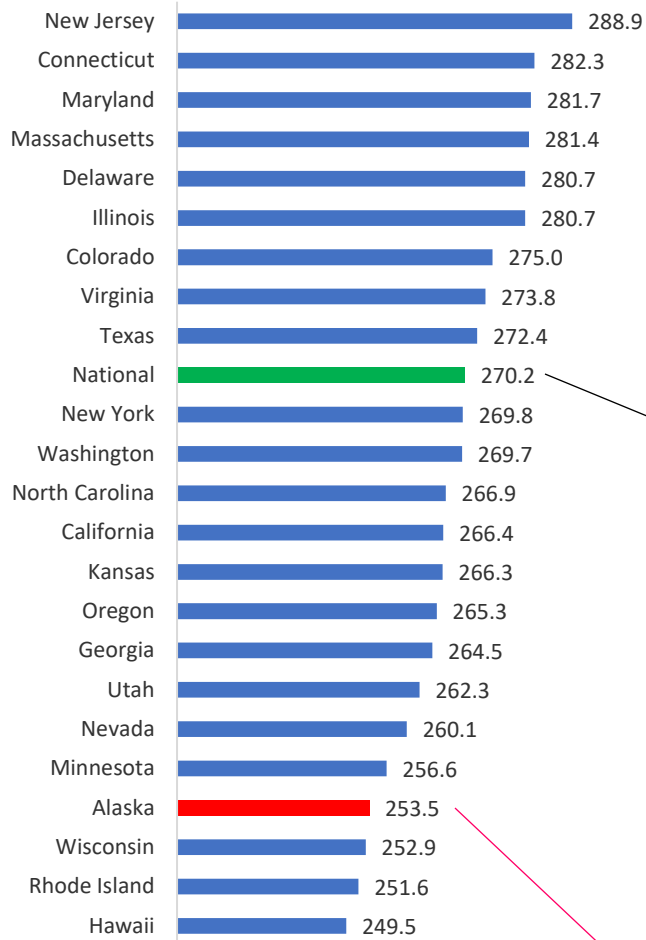
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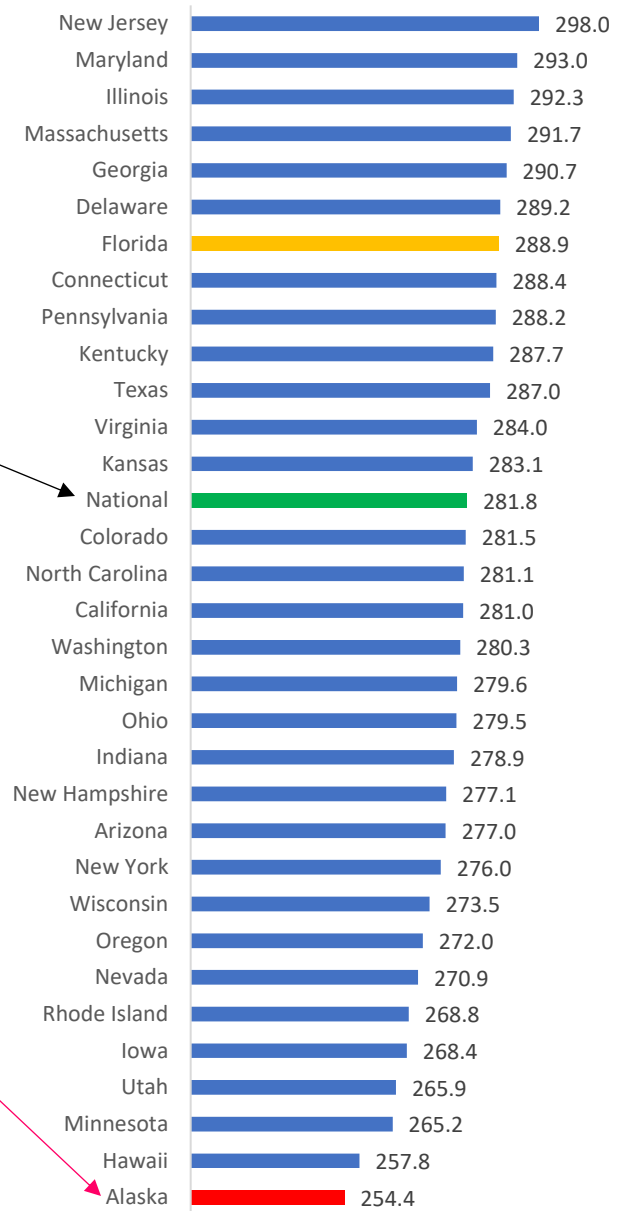
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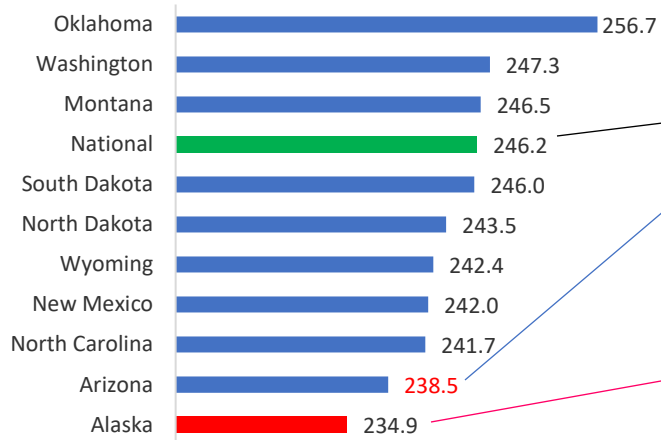
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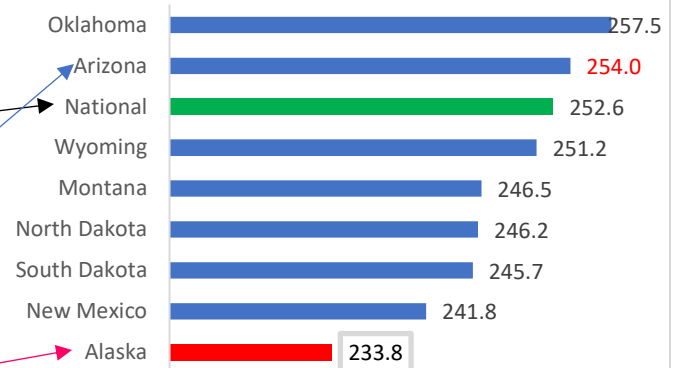
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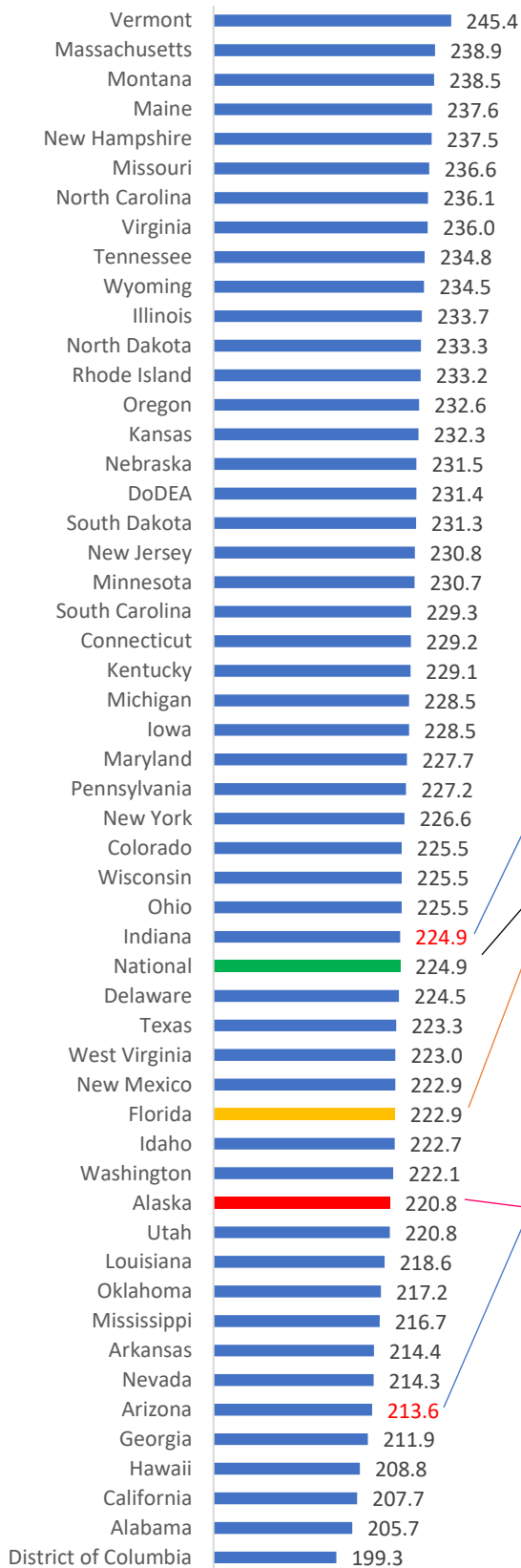
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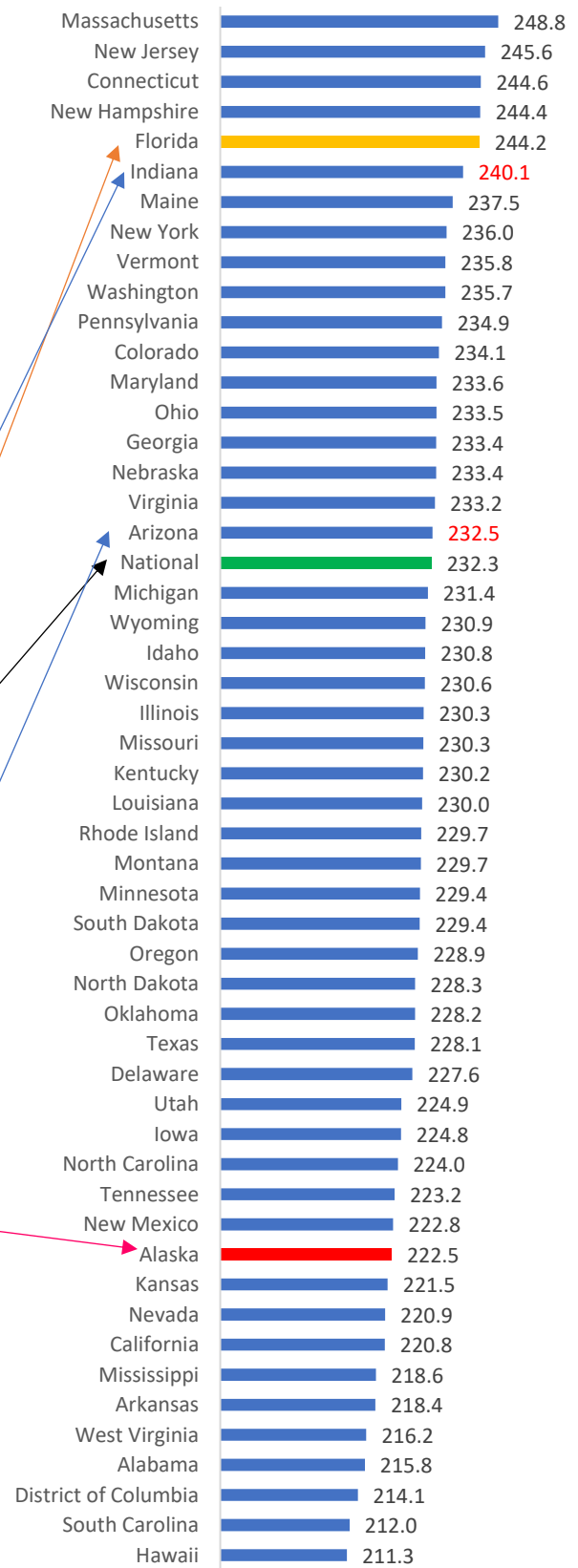
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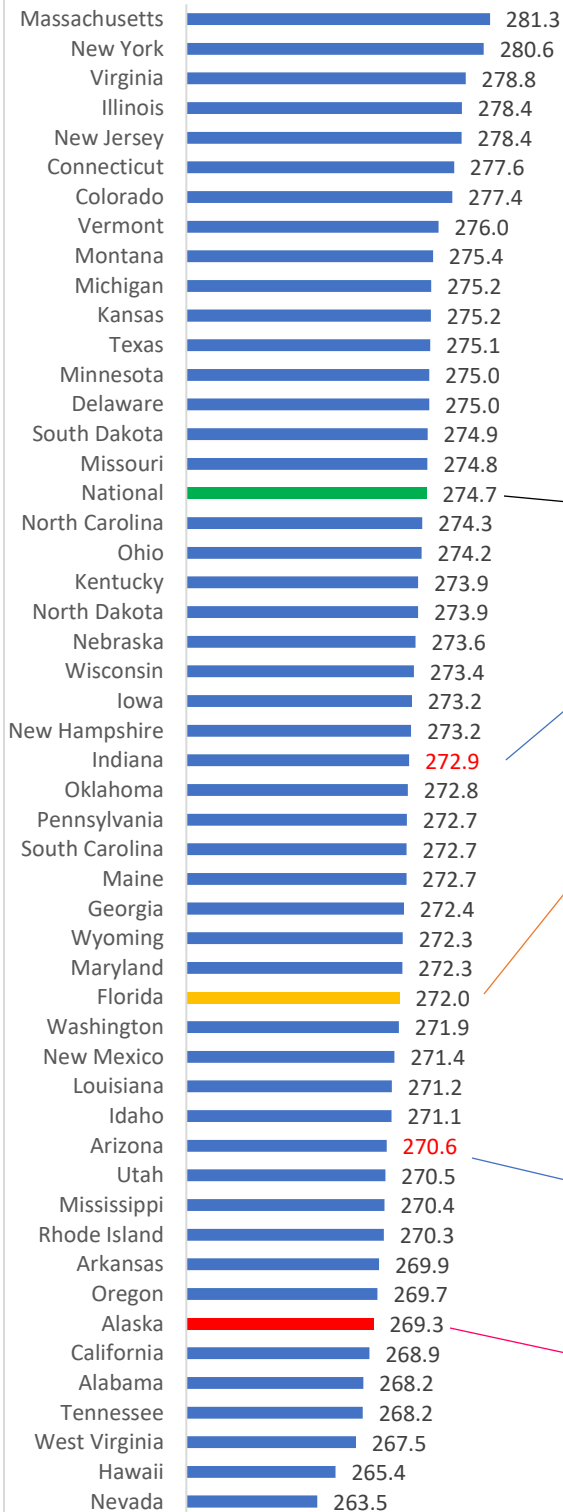
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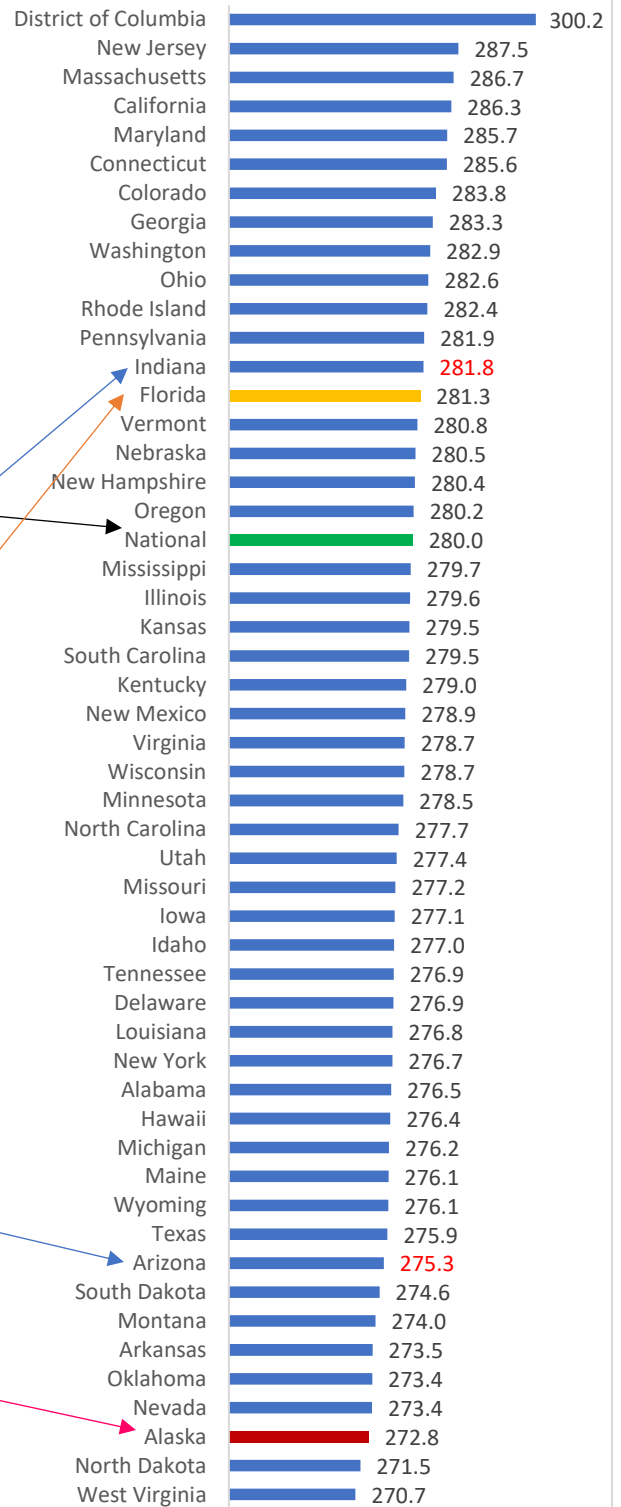
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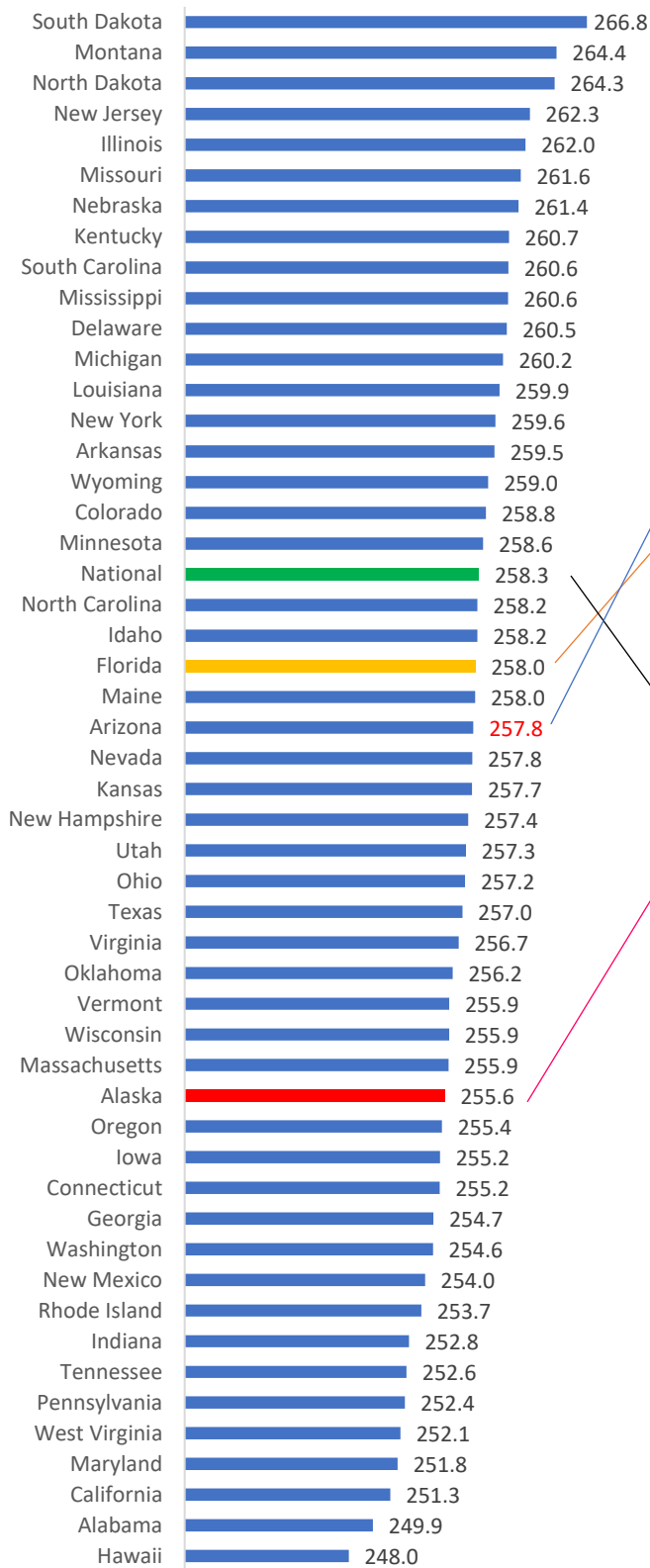
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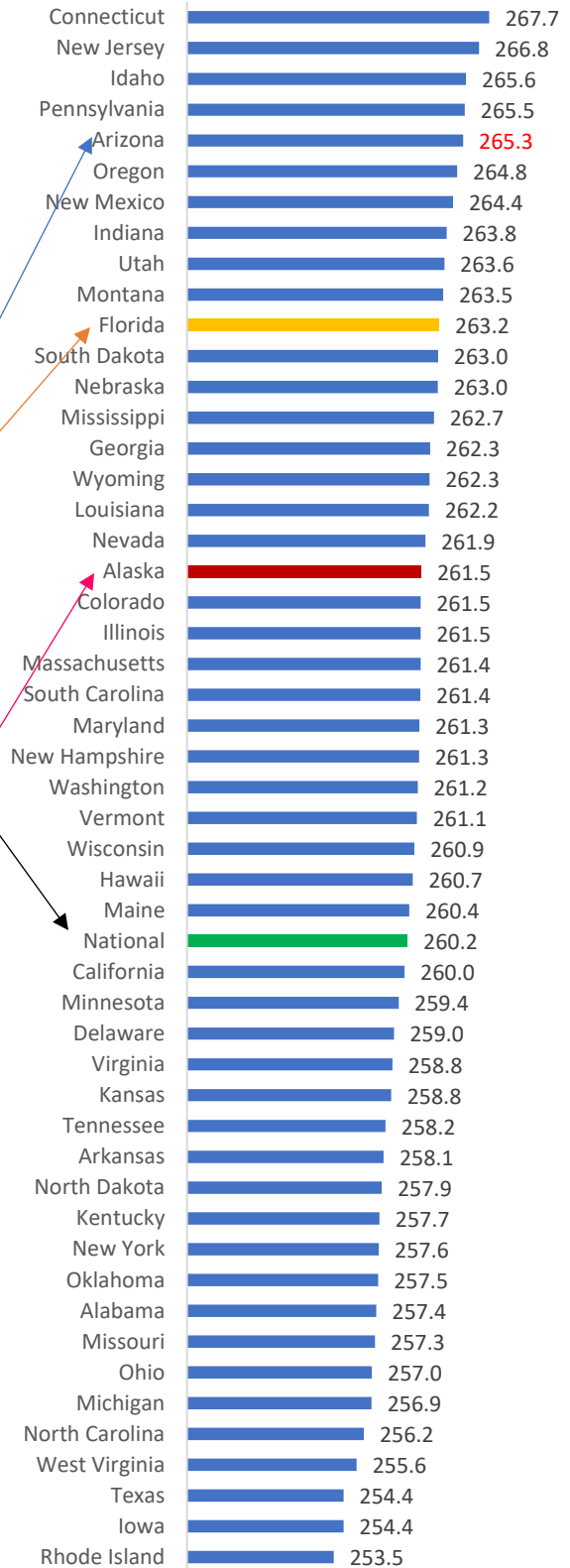
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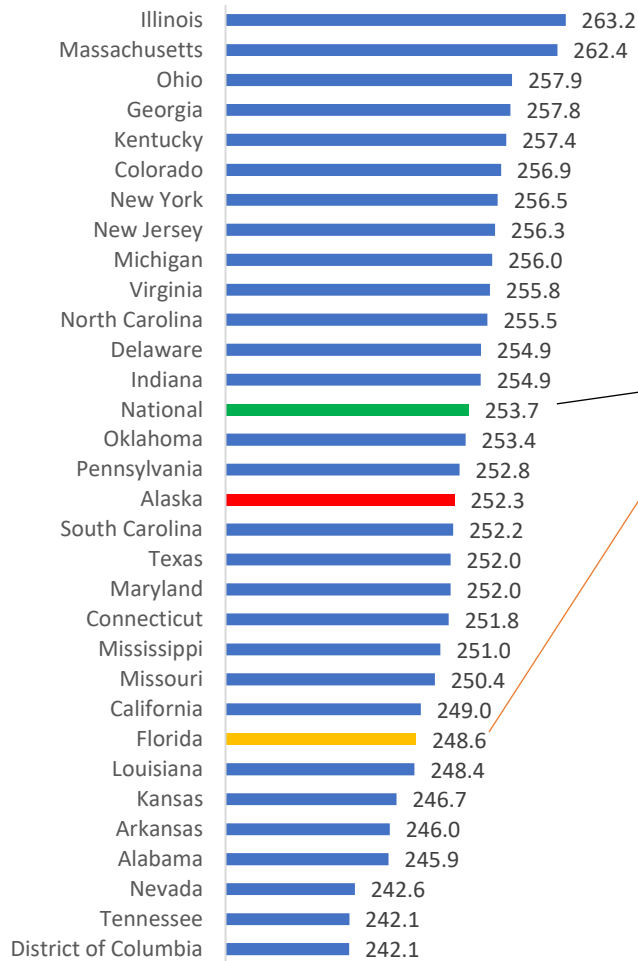
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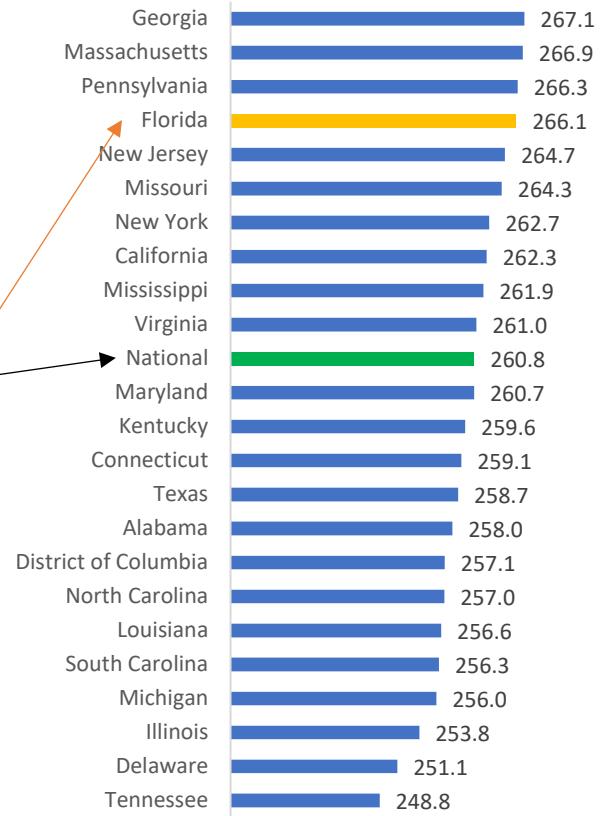
2017 NAEP 8th Grade Reading White Free or Reduced Lunch



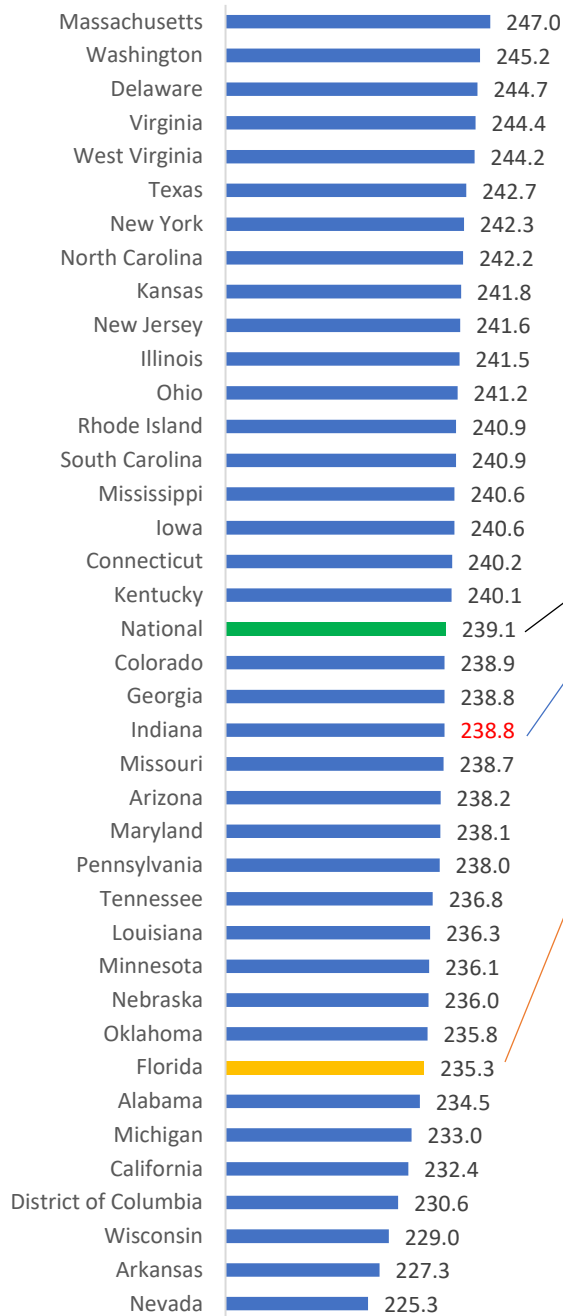
2003 NAEP 8th Grade Reading Black Non-Free or Reduced Lunch



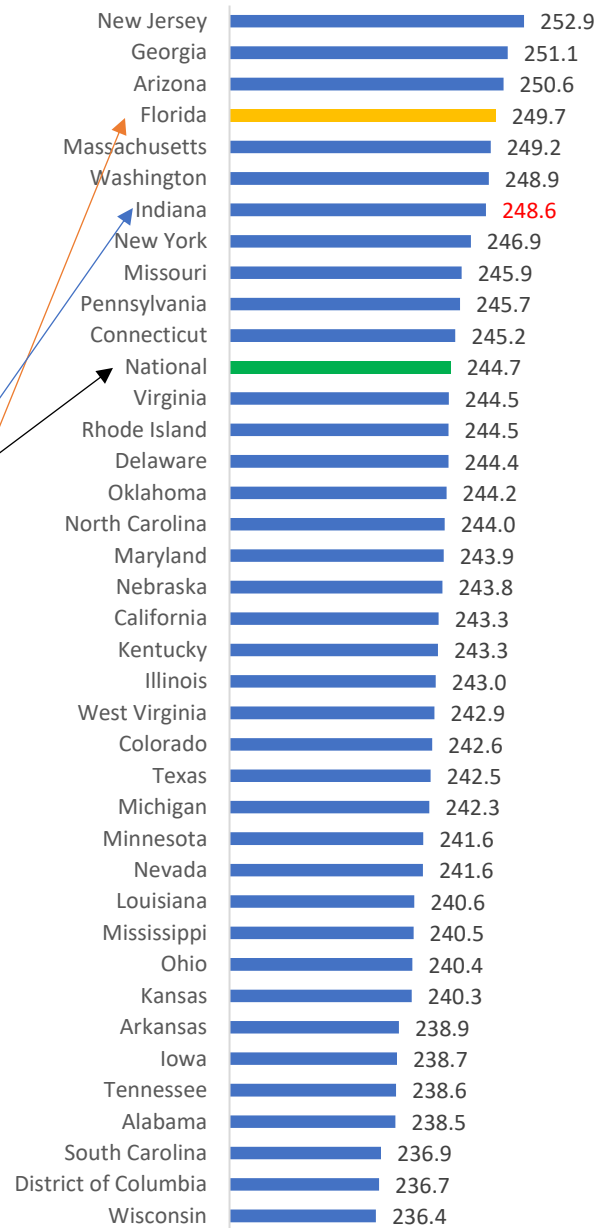
2017 NAEP 8th Grade Reading Black Non-Free or Reduced Lunch



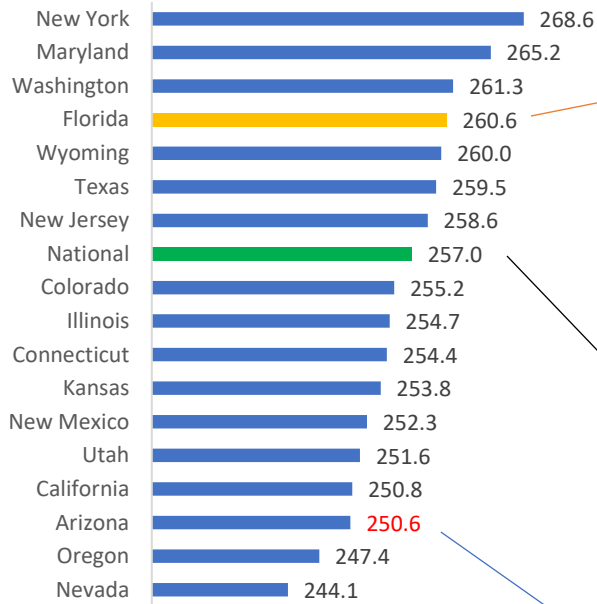
2003 NAEP 8th Grade Reading Black Free or Reduced Lunch



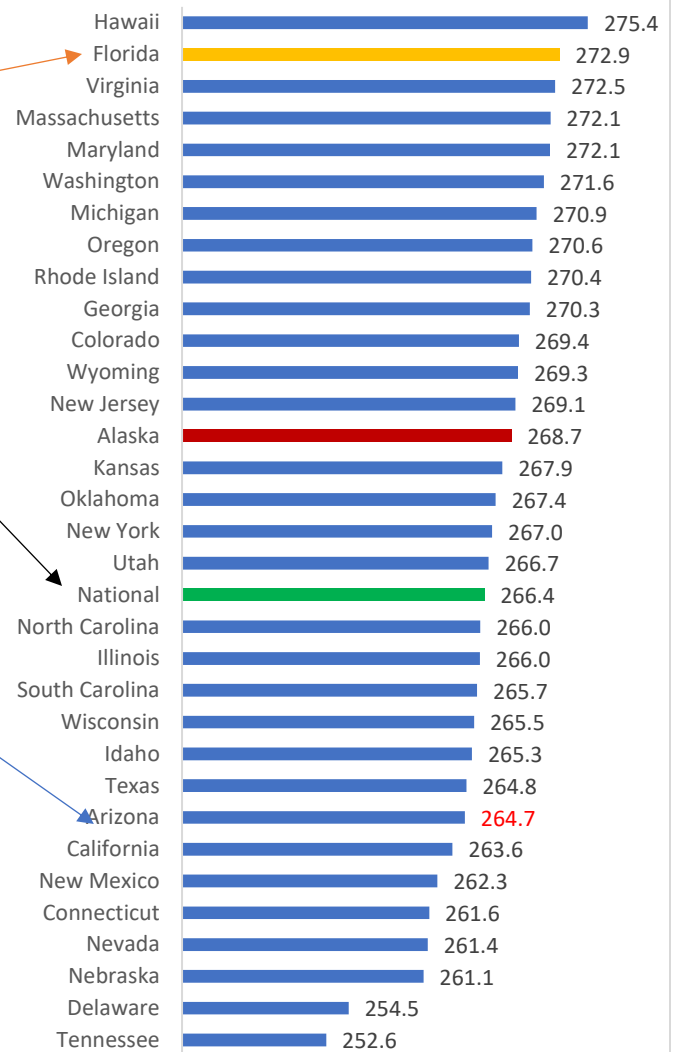
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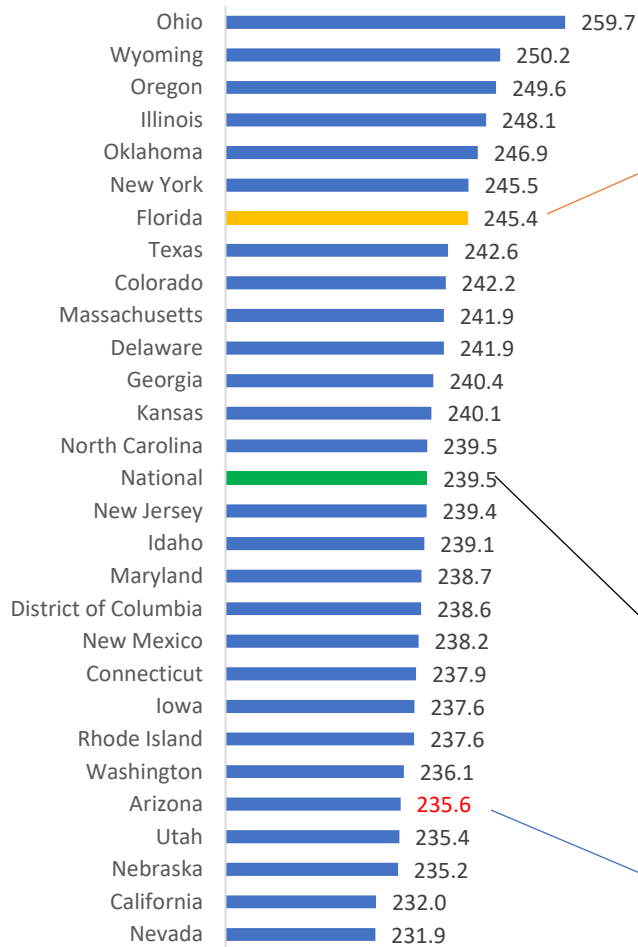
2003 NAEP 8th Grade Reading Hispanic Non-Free or Reduced Lunch



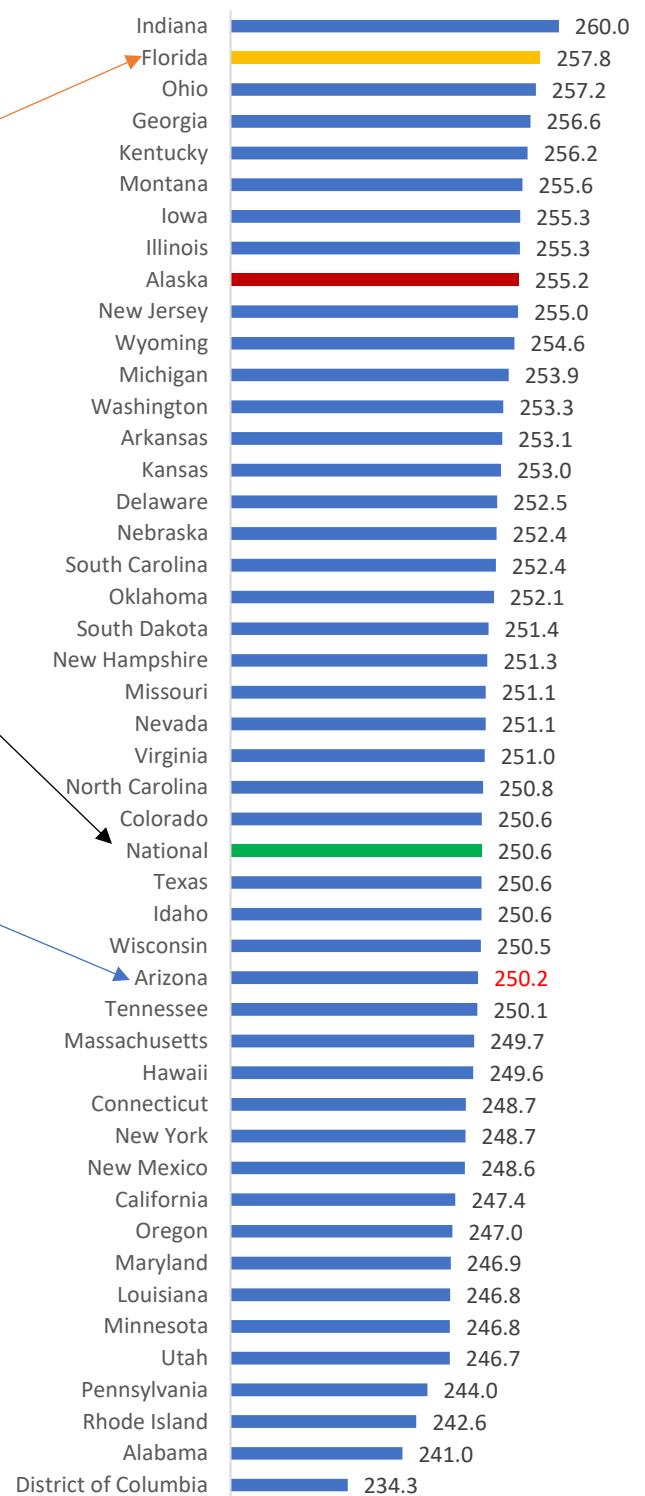
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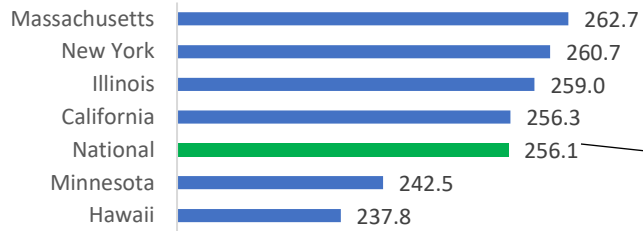
2003 NAEP 8th Grade Reading Hispanic Free or Reduced Lunch



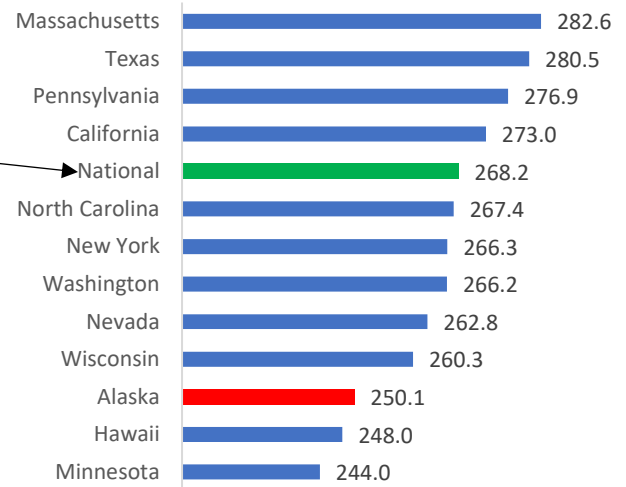
2017 NAEP 8th Grade Reading Hispanic Free or Reduced Lunch



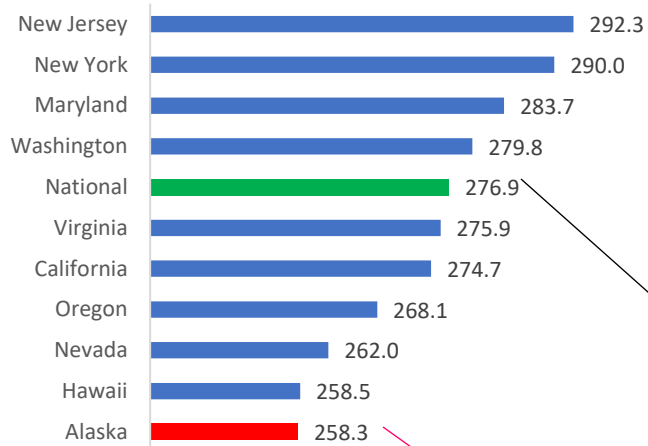
2003 NAEP 8th Grade Reading Asian Free or Reduced Lunch



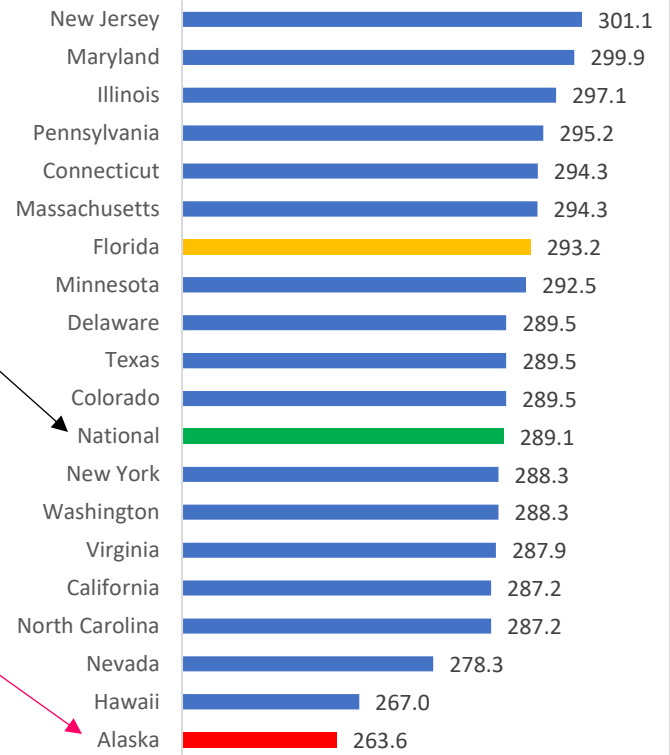
2017 NAEP 8th Grade Reading Asian Free or Reduced Lunch



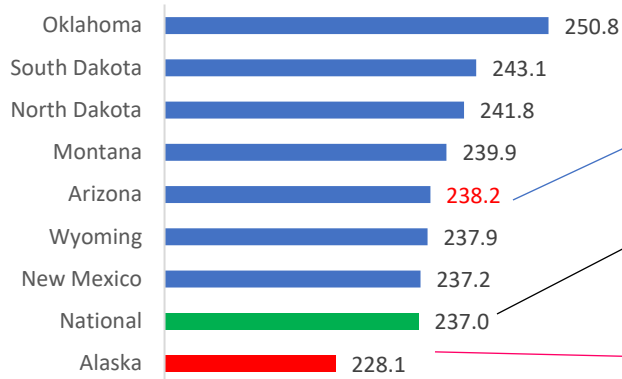
2003 NAEP 8th Grade Reading Asian Non-Free or Reduced Lunch



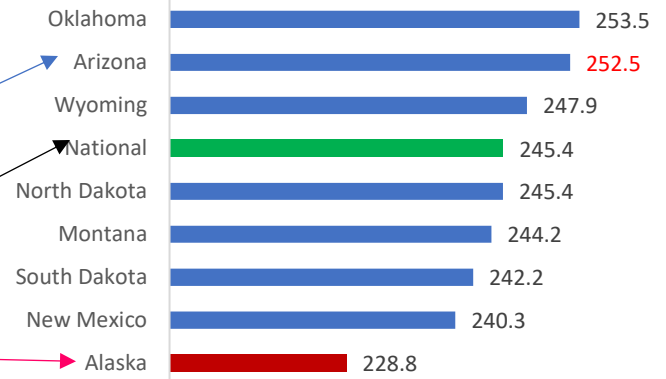
2017 NAEP 8th Grade Reading Asian Non-Free or Reduced Lunch



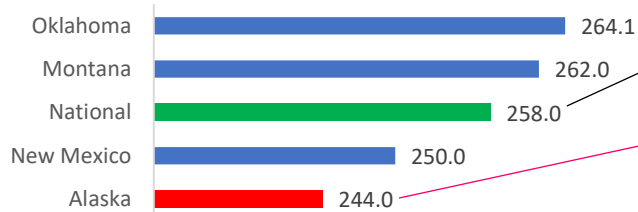
2003 NAEP 8th Grade Reading Native Free or Reduced Lunch



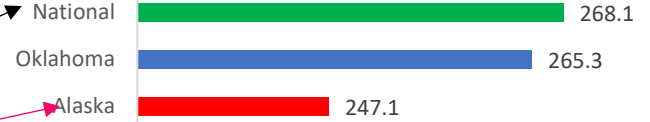
2017 NAEP 8th Grade Reading Native Free or Reduced Lunch



2003 NAEP 8th Grade Reading Native Non-Free or Reduced Lunch

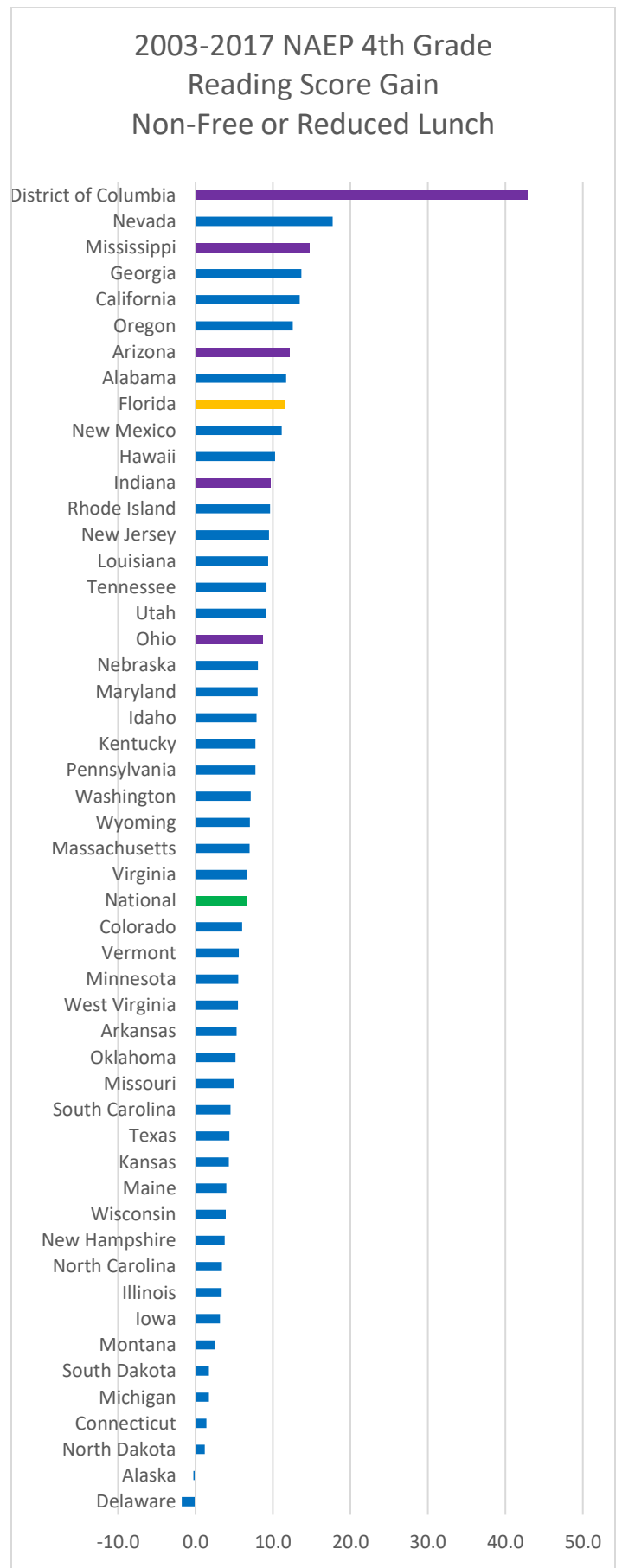
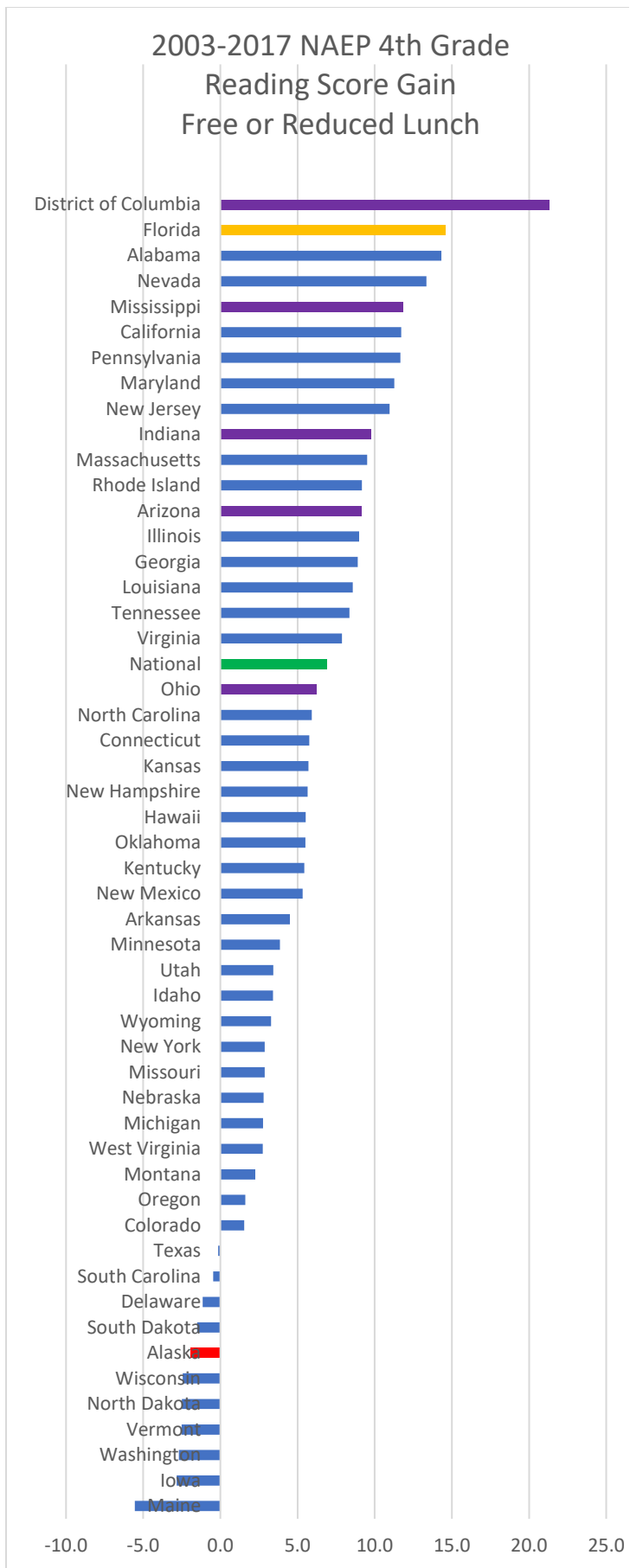


2017 NAEP 8th Grade Reading Native Non-Free or Reduced Lunch

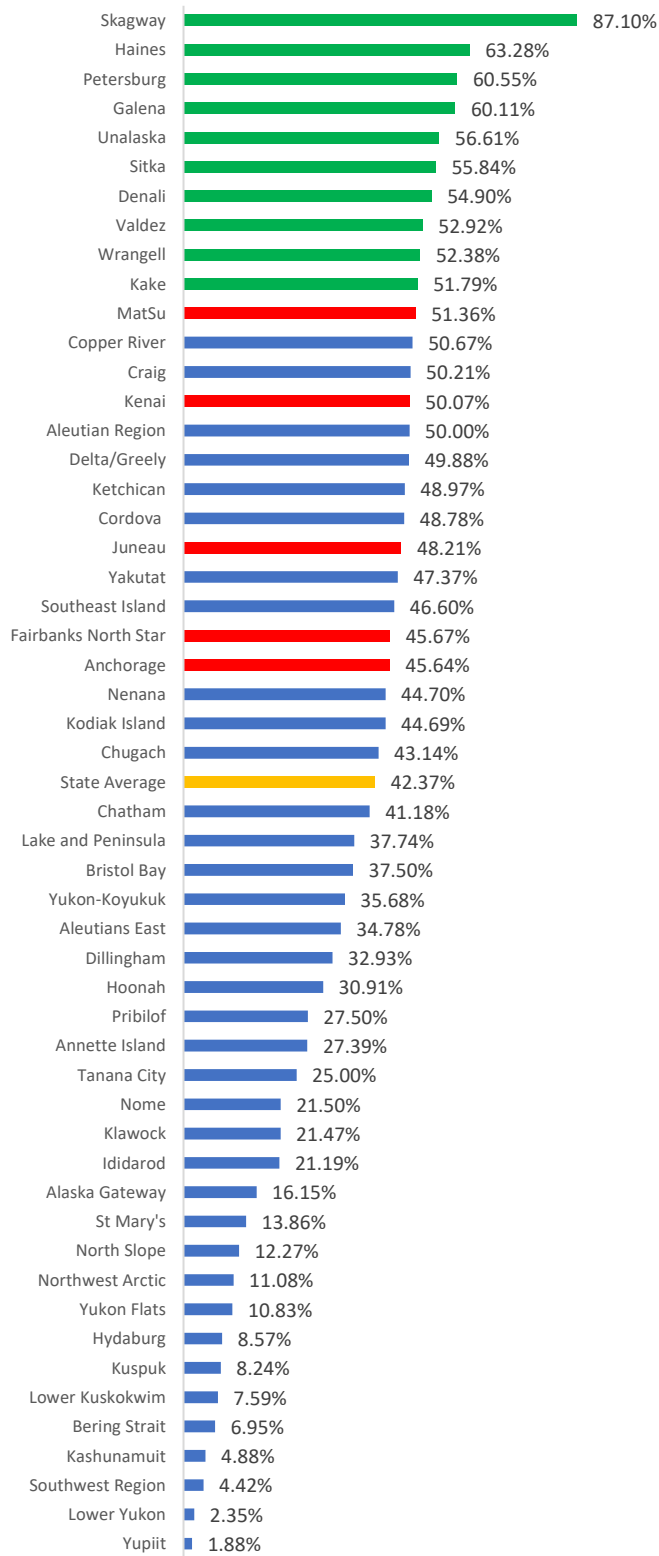


NAEP Test Scores/Score Changes 2003-2017									
	Alaska			Florida			US Average		
4th Grade Reading	2003	2017	Gain/(Loss)	2003	2017	Gain/(Loss)	2003	2017	Gain/(Loss)
All Students	211.5	207.0	(4.5)	218.0	228.8	10.8	218.2	221.9	3.7
Free or Reduced Lunch (FRL)	191.7	189.8	(1.9)	204.7	219.3	14.6	201.3	208.2	6.9
Non-Free or Reduced Lunch	223.9	223.6	(0.3)	231.1	242.7	11.6	229.4	235.9	6.5
Students with Disabilities	177.1	164.3	(12.8)	184.1	208.6	24.5	185.1	189.9	4.8
Male	205.2	203.1	(2.1)	213.8	226.1	12.3	214.6	219.1	4.5
Female	218.2	211.3	(6.9)	222.3	230.5	8.2	221.9	224.9	3.0
White	226.4	223.2	(3.2)	229.1	238.5	9.4	228.6	231.8	3.2
Black	208.9	211.6	2.7	197.7	212.4	14.7	197.9	206.2	8.3
Hispanic	209.2	211.1	1.9	210.8	224.9	14.1	200.5	208.7	8.2
Asian	207.1	217.2	10.1	232.6	250.3	17.7	225.8	240.9	15.1
Native	184.4	169.5	(14.9)	NA	NA	NA	201.8	201.9	0.1
White FRL	211.6	208.4	(3.2)	217.1	228.1	11.0	212.7	217.4	4.7
White Non-FRL	231.3	229.9	(1.4)	232.6	245.1	12.5	232.6	238.6	6.0
Black FRL	200.5	NA	NA	192.7	209.7	17.0	192.7	201.4	8.7
Black Non-FRL	NA	NA	NA	214.1	225.8	11.7	211.2	220.2	9.0
Hispanic FRL	NA	208.3	NA	204.7	220.2	15.5	195.7	203.3	7.6
Hispanic Non-FRL	NA	NA	NA	223.9	238.1	14.2	213.1	223.8	10.7
Asian FRL	193.5	196.4	2.9	NA	NA	NA	209.7	221.1	11.4
Asian Non-FRL	216.3	229.1	12.8	NA	257.6	NA	234.6	248.7	14.1
Native FRL	173.2	160.9	(12.3)	NA	NA	NA	195.7	194.6	(1.1)
Native Non-FRL	203.1	191.2	(11.9)	NA	NA	NA	215.3	230.9	15.6
Orange = Below US Average Green = Above US Average									

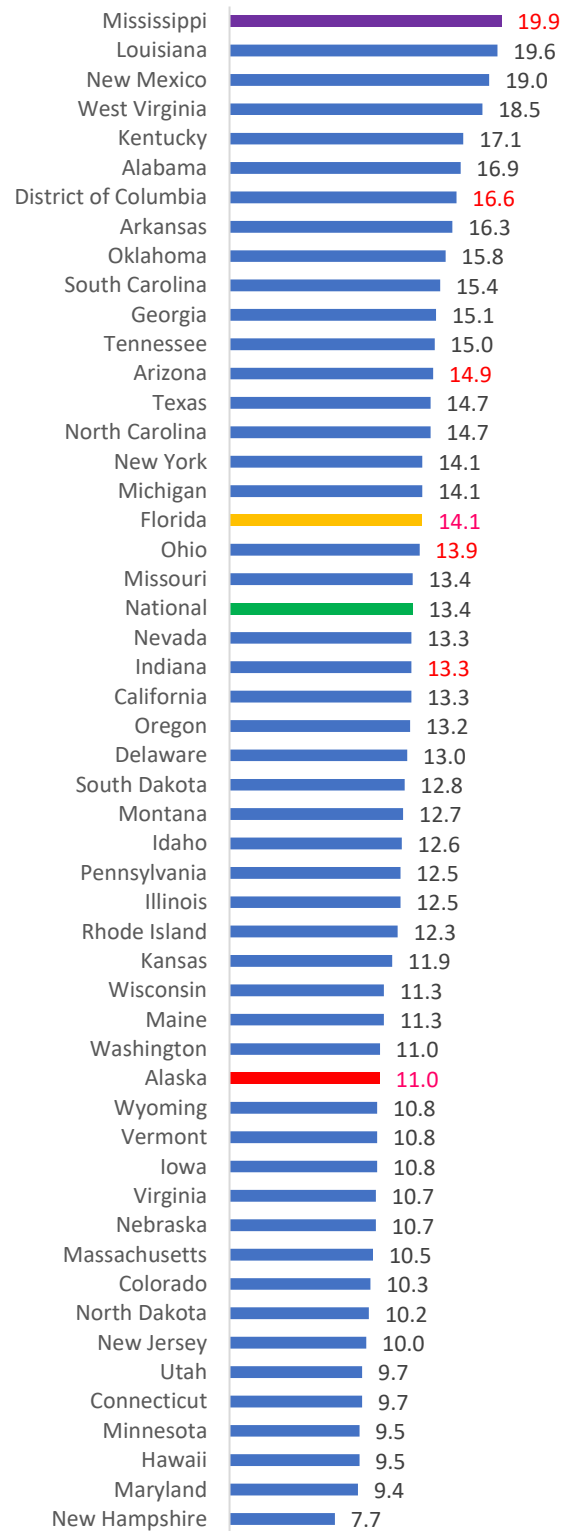
8th Grade Reading NAEP Test Scores/Score Changes 2003-2017									
	Alaska			Florida			US		
8th Grade Reading	2003	2017	Gain/(Loss)	2003	2017	Gain/(Loss)	2003	2017	Gain/(Loss)
All Students	256.4	257.7	1.3	257.3	266.6	9.3	263.3	266.6	3.3
Free or Reduced Lunch	239.3	246.2	6.9	245.2	257.4	12.2	246.6	253.3	6.7
Non-Free or Reduced Lunch	262.9	267.9	5.0	267.3	278.2	10.9	271.5	277.5	6.0
Male	250.3	252.9	2.6	251.1	263.2	12.1	258.1	261.8	3.7
Female	262.9	262.8	(0.1)	263.4	270.1	6.7	268.6	271.6	3.0
White	267.9	269.7	1.8	268.4	274.5	6.1	272.3	274.8	2.5
Black	248.9	245.6	(3.3)	239.2	253.5	14.3	244.5	249.4	4.9
Hispanic	246.4	262.1	15.7	251.1	262.4	11.3	245.3	255.3	10.0
Asian	253.4	254.4	1.0	NA	288.9	NA	270.2	281.8	11.6
Native	234.9	233.8	(1.1)	NA	NA	NA	246.2	252.6	6.4
Students With Disabilities	220.8	222.5	1.7	222.9	244.2	21.3	224.9	232.3	7.4
White FRL	255.6	261.5	5.9	258.1	263.3	5.2	258.3	260.2	1.9
White Non-FRL	269.3	272.8	3.5	272.1	281.3	9.2	274.3	280.1	5.8
Black FRL	NA	NA	NA	235.3	249.7	14.4	239.1	244.7	5.6
Black Non-FRL	252.3	NA	NA	248.6	266.1	17.5	253.7	266.1	12.4
Hispanic FRL	NA	255.2	NA	245.4	257.8	12.4	239.5	250.6	11.1
Hispanic Non-FRL	NA	268.7	NA	260.6	272.9	12.3	257.1	266.1	9.0
Asian FRL	NA	250.1	NA	NA	NA	NA	256.1	268.2	12.1
Asian Non-FRL	258.3	263.6	5.3	NA	293.2	NA	276.9	289.1	12.2
Native FRL	228.1	228.8	0.7	NA	NA	NA	237.1	245.4	8.3
Native Non-FRL	244.1	247.2	3.1	NA	NA	NA	258.1	268.2	10.1
Orange = Below US Average Green = Above US Average									



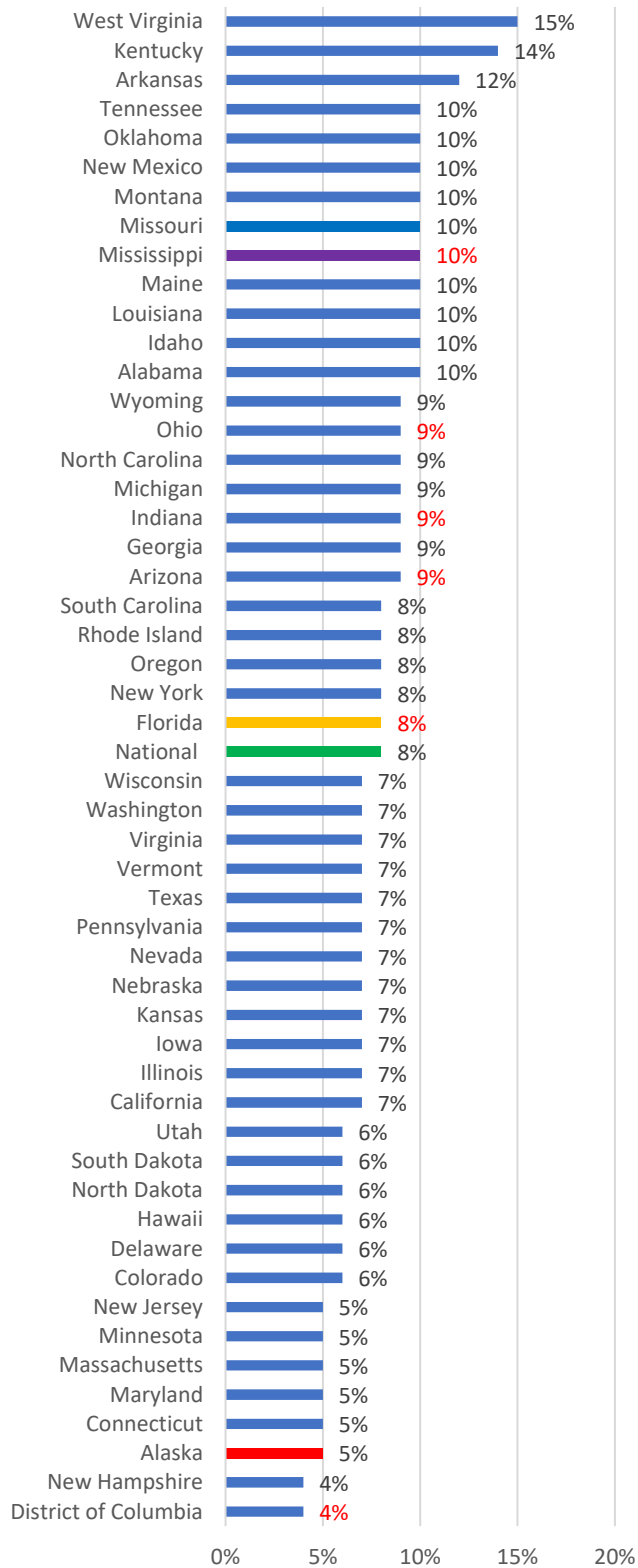
Alaska School Districts Language Arts Proficiency 2018 PEAKS



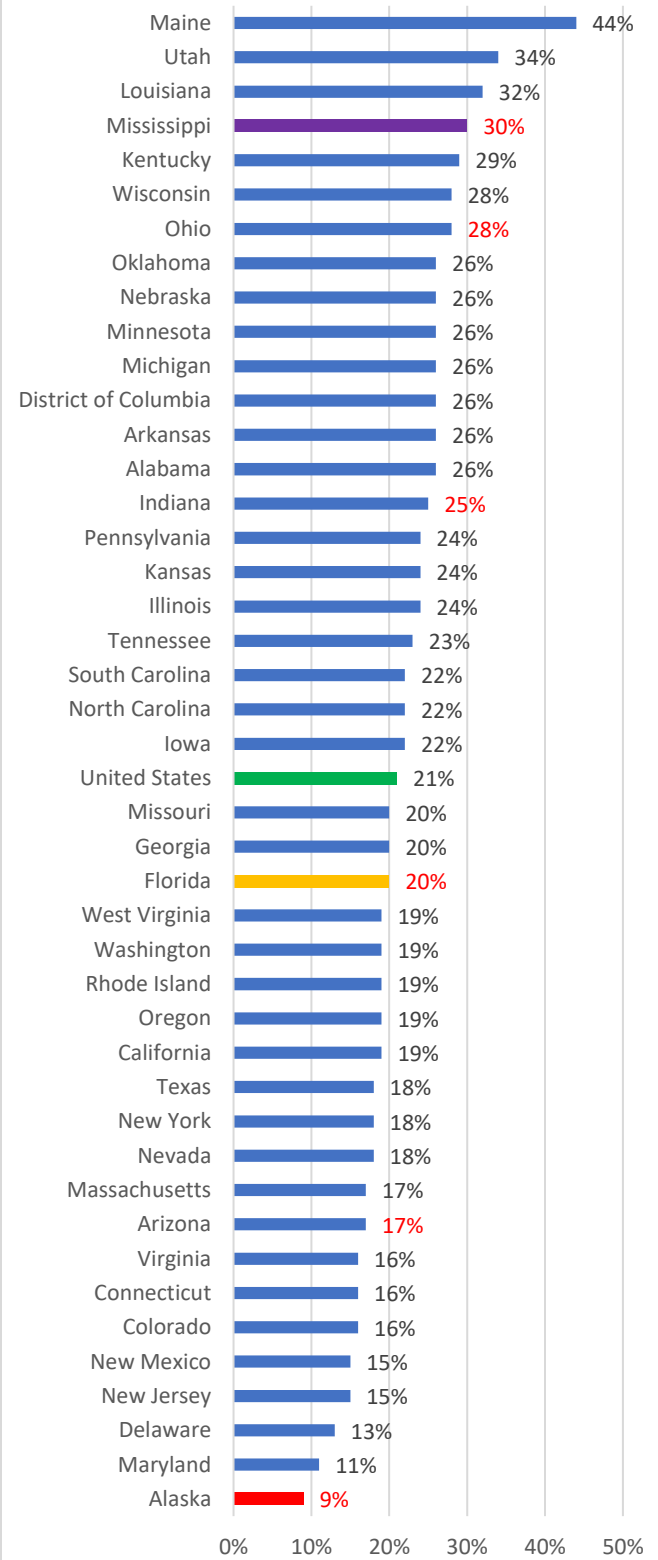
2017 State Poverty Rates



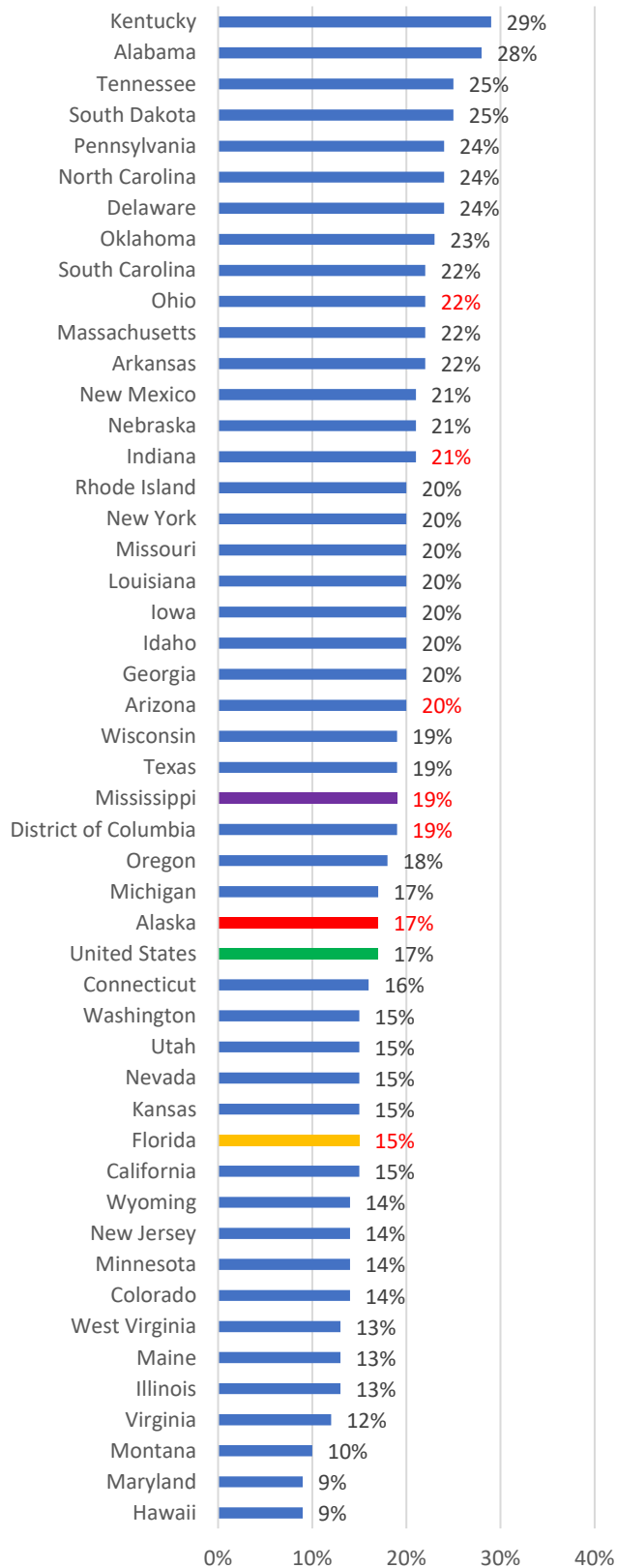
2017 Poverty Rate White



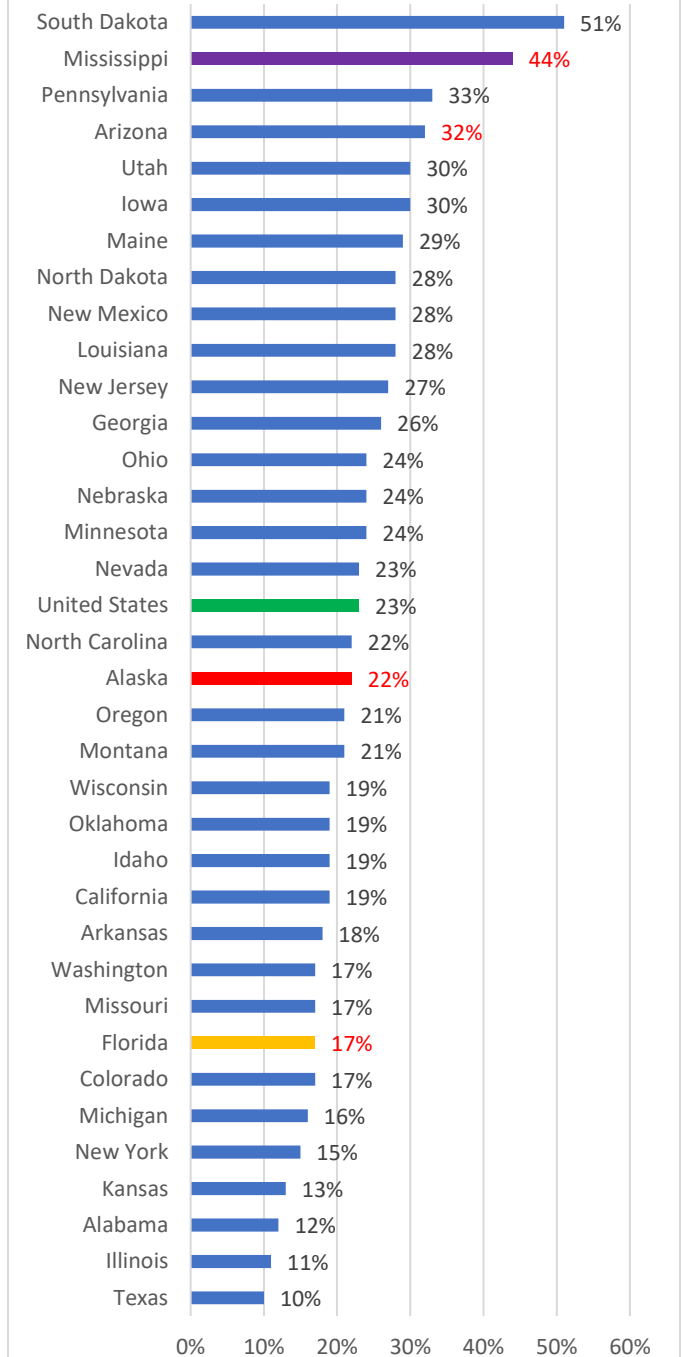
2017 Poverty Rate Black



2017 Poverty Rate Hispanic



2017 Poverty Rate Native



**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 8A

◆ **ISSUE**

The board is being asked to adopt the proposed amendments to regulation 4 AAC 04.140 Content Standards. The amendments (1) add computer science standards as a new content area, (2) remove the technology content standards from the *Alaska Standards: Content and Performance Standards for Alaska Students (2016)* and publish them separately as the updated *Alaska Digital Literacy Standards*, and (3) remove the science standards from the *Alaska Standards: Content and Performance Standards for Alaska Students (2016)* and publish them separately as the updated *Science Standards for Alaska*.

BACKGROUND

Computer Science Standards

- Currently, 25 U.S. states have adopted K-12 computer science standards. Ten other states (including Alaska) are actively pursuing the adoption of computer science standards.
- Knowledge of computer science principles is an increasingly critical workforce-readiness skill. Well over 500,000 jobs are currently unfilled in computer science-related fields in the U.S., with over 800 of those in Alaska. Those well-paying jobs represent existing opportunities for Alaskan students across the employment landscape, including cybersecurity, fisheries management, mining, oil and natural gas development, education, and government management. *Source: Code.org*
- Proposed amendments to 4 AAC 04.140 establish computer science content standards for use by school districts in Alaska. Adopting the *Alaska Computer Science Standards* would not require the establishment of a computer science program in schools, but would create a unified foundation for school districts with existing programs and for those that choose to develop programs.
- Process for developing draft computer science standards:
 - In April 2018, a committee of volunteer stakeholders was recruited by DEED to develop draft standards appropriate for Alaska. Committee members represented urban and rural schools districts, education partners, and industry. Volunteers were divided into writing and reading committees that worked over the subsequent seven months to write and refine the draft standards.
 - The draft standards were developed by reviewing adopted standards from other states, the *Computer Science Teachers Association's (CSTA) Interim K–12 Computer Science Standards*, and the *Advanced Placement (AP) Computer Science Curriculum*.
 - The draft standards are platform-agnostic, align with college and career expectations and anticipate emerging developments in computer science.

Digital Literacy Standards

- Since the last revision of Alaska’s technology standards in 2006, the landscape of technology has significantly changed the functions of society and the delivery of learning opportunities. Student and educators will benefit from renewed standards that reflect a current vision for leveraging technology for learning, expression, digital citizenship and communication.
- Process for developing draft digital literacy standards:
 - In August 2018, a committee of volunteer stakeholders reviewed available standards for appropriateness in the Alaska education context.
 - The draft standards were created based on the *International Society for Technology in Education Standards for Students* (2016).
 - The draft standards include technology use and digital citizenship principles, organized by grade bands.
 - The draft standards are platform-agnostic, align with college and career expectations, and anticipate emerging developments in technology.

K-12 Science Standards

- The last time science standards were reviewed was in 2006. To meet the demands of postsecondary education and the requirements for challenging standards for science (Every Student Succeeds Act), a committee of educators reviewed and revised the science standards.
- Proposed amendments to 4 AAC 04.140 update science content standards for use by school districts in Alaska.
- Process for developing draft science standards:
 - In April 2018, a committee of volunteer stakeholders was recruited by DEED to develop draft standards appropriate for Alaska. Committee members represented urban and rural schools districts, education partners and industry. Volunteers were divided into writing and reading committees that worked over the subsequent seven months to write and refine the draft standards.
 - The draft standards were developed by reviewing adopted standards from other states, the *Framework for K-12 Science Education*, *Next Generation Science Standards*, and science standards recently adopted by districts in Alaska.
- Behind this cover memo are the proposed *Alaska Computer Science Standards*, *Alaska Digital Literacy Standards*, and *Science Standards for Alaska*.
- Deb Riddle, Division Operations Manager, will be present via teleconference to brief the board.

◆ **OPTIONS**

Adopt the proposed regulations.

Amend the regulations and adopt the amended regulations.

Seek more information.

◆ **ADMINISTRATION'S RECOMMENDATION**

Adopt the proposed regulations.

◆ **SUGGESTED MOTION**

I move the State Board of Education & Early Development adopt the amendments to 4 AAC 04.140 Content Standards to establish computer science standards and publish them as the *Alaska Computer Science Standards*, update the technology standards and rename and publish them as the *Alaska Digital Literacy Standards*, and update the science standards and rename and publish them as the *Science Standards for Alaska*.

4 AAC 04.030 is amended to read:

4 AAC 04.030. Subjects. A goal of the state public school system is to provide a working knowledge of

- (1) English/language arts;
- (2) mathematics;
- (3) science;
- (4) geography;
- (5) history;
- (6) skills for a healthy life;
- (7) government and citizenship;
- (8) [FINE] arts;
- (9) computer science and digital literacy[TECHNOLOGY]; [AND]
- (10) world languages;[.]
- [(11) library/information literacy; and
- (12) cultural standards.

(Eff. 6/24/93, Register 126; ____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.060 AS 14.07.165
AS 14.07.020

4 AAC 04.140(a) is amended to read:

(a) The content standards for English/language arts and mathematics, as set out in the department's publication *Alaska English/Language Arts and Mathematics Standards*, revised as of June 2012, are adopted by reference. The standards for science, as set out in the

department's publication, *Science Standards for Alaska*, revised as of March 2019, are adopted by reference. The standards for computer science, as set out in the department's publication, *Alaska Computer Science Standards*, revised as of March 2019, are adopted by reference. The standards for digital literacy, as set out in the department's publication, *Alaska Digital Literacy Standards*, revised as of March 2019, are adopted by reference. The content standards for [SCIENCE,] geography, government and citizenship, history, Alaska history, skills for a healthy life, arts, world languages, [TECHNOLOGY,] and employability, as set out in the department's publication *Alaska Standards: Content and Performance Standards for Alaska Students*, revised as of March **2019** [2016], are adopted by reference.

(Eff. 3/2/2000, Register 153; am 11/10/2005, Register 176; am 5/18/2006, Register 178; am 8/18/2010, Register 195; am 10/16/2012, Register 204; am 9/29/2016, Register 219;

____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
AS 14.03.120 AS 14.07.060

Editor's note: Copies of the publications *Alaska English/Language Arts and Mathematics Standards*; *Science Standards for Alaska*; *Alaska Computer Science Standards*; *Alaska Digital Literacy Standards*; *Alaska Standards: Content and Performance Standards for Alaska Students*; and *Alaska Physical Education Standards*, adopted by reference in 4 AAC 04.140, may be obtained by writing to the Department of Education and Early Development, 801 West 10th Street, Suite 200, P.O. Box 110500, Juneau, Alaska 99811-0500 or at www.eed.state.ak.us/standards/.

4 AAC 04.180 is amended to read:

4 AAC 04.180. Student cultural standards. The cultural standards for students in the state, as set out in the department's publication entitled *Alaska Standards: Content and Performance Standards for Alaska Students*, [AS] revised as of March **2019** [2006], are adopted by reference. (Eff. 5/14/2000, Register 154; am 11/10/2005, Register 176; am 5/18/2006, Register 178; ____/____/____, Register ____)

Authority: AS 14.03.015 AS 14.07.020 AS 14.07.165
AS 14.03.120 AS 14.07.060

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 8B

◆ ISSUE

The board is being asked to adopt the proposed amendment of the accreditation regulation that incorporates two new AdvancED published documents, *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems* in place of the outdated *Standards for Quality Schools* currently adopted by reference.

◆ BACKGROUND

- Under 4 AAC 04.300, the department recognizes school accreditation status as determined by the Northwest Accreditation Commission, a division of AdvancED (currently referred to in the regulation as AdvancED Northwest, but updated in the amended regulation), based upon its established accreditation process.
- AdvancED has recently updated its accreditation protocols starting with the 2017/2018 school year. The previous document, *Standards for Quality Schools*, adopted by reference in current regulation (4 AAC 04.300(b)), has in practice been replaced by *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems*.
- The proposed amended regulation updates the materials adopted by reference in 4 AAC 04.300 to be *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems* as published by AdvancED in 2017. The “Editor’s note” is also being updated to reflect current contact information.
- The proposed regulation can be found behind this cover memo. The two publications to be adopted by reference, *AdvancED Performance Standards for Schools* and *AdvancED Performance Standards for School Systems* are included with item 5D on the work session agenda.
- Brad Billings, Administrator for School Improvement, will be present to brief the board.

◆ OPTIONS

Adopt the proposed regulations.

Amend the regulations and adopt the amended regulations.

Seek more information.

◆ ADMINISTRATION’S RECOMMENDATION

Adopt the proposed regulations.

◆ SUGGESTED MOTION

After considering all public comment, I move that the State Board of Education and Early Development adopt proposed amendments to 4 AAC 04.300, Standards for state accreditation of schools.

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Michael Johnson, Commissioner

Agenda Item: 9A

◆ **ISSUE**

The board is being asked to approve the Fairbanks North Star Borough School District's renewal application of Watershed Charter School for a period of ten years, terminating on July 1, 2029.

◆ **BACKGROUND**

- On January 15, 2019, the Fairbanks North Star Borough School District's Board of Education approved Watershed Charter School for a period of ten years.
- Behind this memo is an executive summary of the charter school application and the local board approval. DEED's review team found the application compliant with all state requirements.
- Karen Melin, Deputy Commissioner, will be present to brief the board.

◆ **OPTIONS**

Approve Watershed Charter School's application for a period of ten years.

Seek more information.

Deny the application.

◆ **ADMINISTRATION'S RECOMMENDATION**

Approve Watershed Charter School's application for a period of ten years.

◆ **SUGGESTED MOTION**

I move the State Board of Education & Early Development approve Watershed Charter School's application for a period of ten years, terminating on July 1, 2029.

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Michael Johnson, Commissioner

Agenda Item: 9B

◆ **ISSUE**

The board is being asked to approve the Lower Kuskokwim School District's renewal application of Ayaprun Elitnaurvik for a period of ten years, terminating on July 1, 2029.

◆ **BACKGROUND**

- On January 24, 2019, the Lower Kuskokwim School District's Board of Education approved Ayaprun Elitnaurvik for a period of ten years.
- Behind this memo is an executive summary of the charter school application and the local board approval. DEED's review team found the application compliant with all state requirements.
- Karen Melin, Deputy Commissioner, will be present to brief the board.

◆ **OPTIONS**

Approve Ayaprun Elitnaurvik's application for a period of ten years.

Seek more information.

Deny the application.

◆ **ADMINISTRATION'S RECOMMENDATION**

Approve Ayaprun Elitnaurvik's application for a period of ten years.

◆ **SUGGESTED MOTION**

I move the State Board of Education & Early Development approve Ayaprun Elitnaurvik's application for a period of ten years, terminating on July 1, 2029.

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 10

◆ **ISSUE**

The board is scheduled to elect its officers for school year 2019–2020.

◆ **BACKGROUND**

- According to the board’s bylaws, the board will select its officers at the last regular meeting of the board each school year. The June meeting is the final regular meeting of the school year.
- The officers are: Chair, First Vice-Chair, and Second Vice-Chair.
- The current officers were appointed in June 2017 and February 2019 and are:
 - Chair – James Fields
 - First Vice-Chair – Keith Hamilton
 - Second Vice-Chair – Lorri Van Diest
- Nominations will be taken, and votes may be cast either by secret or open ballot.
- The term of each new office is July 1, 2019, through June 30, 2020, or, if necessary, until the election of its successor.
- According to board bylaws, a board member may serve successive terms as an officer without limit.
- A copy of the appropriate section of the bylaws follows this cover memorandum.

◆ **OPTIONS**

Elect officers for the 2019-2020 school year.

Take no action.

◆ **ADMINISTRATION’S RECOMMENDATION**

Elect officers for the 2019–2020 school year.

◆ **SUGGESTED MOTIONS**

I move the State Board of Education & Early Development elect _____ as Chair to serve from July 1, 2019, to June 30, 2020.

I move the State Board of Education & Early Development elect _____ as First Vice-Chair to serve from July 1, 2019, to June 30, 2020.

I move the State Board of Education & Early Development elect _____ as Second Vice-Chair to serve from July 1, 2019, to June 30, 2020.

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 11

◆ ISSUE

The board is being asked to select subcommittee assignments.

◆ BACKGROUND

- The board is involved in many subcommittees and other assignments.
- A copy of the board's subcommittee/appointment roster follows this memo.

◆ OPTIONS

Select members to be on subcommittees listed.

Seek further information on subcommittees listed.

◆ ADMINISTRATION'S RECOMMENDATION

Select members to be on subcommittees listed. Subcommittee assignments do not require a formal motion.

**State Board of Education & Early Development
Sub-Committee Assignments**

NAME	Appointment (Begin/End)	Reappointment (Begin/End)	District Seat	Board Leadership/Dates	ACPE (1 member) Meets Quarterly	Governor's Council on Disabilities & Special Education (1 member) Quarterly	Public School Trust Fund Advisory Committee (3 members) Meets 1 x yr.	Technical Advisory Committee (Assessment & Accountability - 1 member)	College of Rural & Community Development (1 member)	Education Commission of the States - ECS (1 member) Meets 2-3 x yr.	MEHS Advisory	CTE Committee	Military Compact	Joint Sub-Committee with BOR
Dr. Keith Hamilton	3/1/2015 3/1/2020		Public-At-Large		X					alt 6/5/15				
Lorri Van Diest	1/29/2018 3/1/2020		3rd Judicial District						X			X		
James Fields	3/22/2013 3/1/2018	3/1/2018 3/1/2023	REAA				12/6/2013			6/5/2015			6/5/2015	
Barbara Thompson	3/01/2014 3/1/2019		Public-At-Large			X	3/13/2014	3/13/2014				6/17/2016		
Sandra Kowalaski	3/01/2014 3/1/2019		2nd Judicial District								3/13/2014			X
Tiffany Scott	3/2/2018 3/1/2019		4th Judicial District				X				X			
Rebecca Himschoot	3/2/2016 3/1/2021		1st Judicial District			X						X		X
LTC Spencer Van Meter	5/8/2016		Military Advisor											
Tanis Lorrington		n/a	Student Advisor					Page 1						

ACPE=Alaska Commission on Postsecondary Education

**To: Members of the State Board of
Education & Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 12

◆ **ISSUE**

The board is being asked to set its meeting calendar for school year 2019-2020.

◆ **BACKGROUND**

- According to board bylaws, the board will adopt a calendar indicating the planned date and location of each regular meeting for the next school year at the last regularly scheduled meeting of each school year. The June meeting is the last meeting of the school year.
- Under AS 14.07.125, meetings shall be held in Juneau unless a majority of the members of the board change the place of a meeting.
- The Commissioner has scheduled work sessions with the board on July 24, 2019, August 21, 2019, October 23, 2019, February 26, 2020, and April 22, 2020, at 3 p.m.
- The department presents the following meeting schedule. The board may choose to change any part of the proposal.

Board Calendar Suggested Dates

Date	Location	Meeting Type
July 24, 2019	Audio Conference	Work session – Commissioner’s Report
August 21, 2019	Audio Conference	Work session – Commissioner’s Report
September 18-19, 2019	Anchorage or Juneau	Regular quarterly
October 23, 2019	Audio Conference	Work session – Commissioner’s Report
December 4, 2019	Audio Conference	Regular quarterly
January 20-21, 2020	Juneau or Audio Conference	Special – legislative and budget report
February 26, 2020	Audio Conference	Work session -- Commissioner’s report
March 25-26, 2019	Juneau	Regular quarterly
April 22, 2020	Audio Conference	Work session -- Commissioner’s report
June 10-11, 2019	Anchorage or Juneau	Regular quarterly

- The board should decide if it wants to have a retreat as part of one of its meetings.
- Calendars for school year 2019-2020 follow this cover memo.
- The board reserves the right, with proper notice, to change its meeting dates, locations, and times or add meetings as necessary to conduct the business of the agency.

♦ **OPTIONS**

Set the meeting dates for school-year 2019–2020.

Take no action.

♦ **ADMINISTRATION’S RECOMMENDATION**

Set the meeting dates for school-year 2019-2020.

♦ **SUGGESTED MOTION**

I move the State Board of Education & Early Development adopt the following calendar and meeting locations for the 2019–2020 school year:

Board Calendar Dates		
Date	Location	Meeting Type
July 24, 2019	Audio Conference	Work session – Commissioner’s Report
August 21, 2019	Audio Conference	Work session – Commissioner’s Report
September 18-19, 2019	Anchorage	Regular quarterly
October 23, 2019	Audio Conference	Work session – Commissioner’s Report
December 4, 2019	Audio Conference	Regular quarterly
January 20-21, 2020	Juneau	Special – legislative and budget report
February 26, 2020	Audio Conference	Work session -- Commissioner’s report
March 25-26, 2019	Juneau	Regular quarterly
April 22, 2020	Audio Conference	Work session -- Commissioner’s report
June 10-11, 2019	Anchorage	Regular quarterly

2019 STATE HOLIDAY CALENDAR

JANUARY

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State Holidays

Date	Holiday
01/01	New Year's Day
01/21	MLK Jr.'s Birthday
02/18	Presidents' Day
03/25	Seward's Day
05/27	Memorial Day
07/04	Independence Day

Holiday

State calendar maintained by the Division of Finance, Department of Administration
<http://doa.alaska.gov/calendars.html>

Biweekly employees please refer to appropriate collective bargaining unit agreement for more information regarding holidays

State Holidays

Date	Holiday
09/02	Labor Day
10/18	Alaska Day
11/11	Veterans' Day
11/28	Thanksgiving Day
12/25	Christmas Day

2020 STATE HOLIDAY CALENDAR

JANUARY

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DECEMBER

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State Holidays

Date	Holiday
01/01	New Year's Day
01/20	MLK Jr.'s Birthday
02/17	Presidents' Day
03/30	Seward's Day
05/25	Memorial Day
07/04	Independence Day (observed 7/3)

Holiday

State calendar maintained by the Division of Finance, Department of Administration
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Biweekly employees please refer to appropriate collective bargaining unit agreement for more information regarding holidays.

State Holidays

Date	Holiday
09/07	Labor Day
10/18	Alaska Day
11/11	Veterans' Day
11/26	Thanksgiving Day
12/25	Christmas Day

**To: Members of the State Board of
Education and Early Development**

Date: June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 13

◆ ISSUE

The board is being asked to appoint two members to the Mt. Edgecumbe High School Advisory Board.

◆ BACKGROUND

- Mt. Edgecumbe High School has a cycle that opens two Advisory Board seats each year. This year, the Sitka Community Representative and a Parent Representative were open. Mt. Edgecumbe High School collected applications of interest and have made a recommendation for appointment.
- Mt. Edgecumbe High School received many qualified applications for the position of Parent Representative. The Mt. Edgecumbe Superintendent and administrative team has put forth the recommendation to appoint Janet Woods. Formally from the Yukon Flats School District, Janet not only has a background in education but also has served on many boards in the past. As stated in her application, she would like to be an active member on the board and she references her experience in providing board direction through planning, goal setting and evaluating progress toward achieving goals. Being from rural Interior, Janet Woods is from a region not currently represented on the board and her interest and skills in board planning will be welcome as Mt. Edgecumbe begins a new strategic planning cycle next year.
- Lois Rhodes has served on the Mt. Edgecumbe Advisory Board as the Sitka Community representative for many years. She was the only candidate, which is likely a result of the confidence the community has in her serving this role. She brings much appreciated insight and actively participates on subcommittees as needed. The Mt. Edgecumbe Superintendent and administrative team happily recommend her for continued service on the board.
- Behind this cover memo are the applications received by the Mt. Edgecumbe High School.
- Janelle Vanasse, Superintendent, will be present via teleconference to brief the board.

OPTIONS

Approve the appointments.

Reject the appointments.

Seek more information.

ADMINISTRATION'S RECOMMENDATION

Approve the appointments.

◆ SUGGESTED MOTION

I move the State Board of Education and Early Development appoint Janet Woods to the Parent Representative Seat and Lois Rhodes as the Sitka Community Representative on the Mt. Edgecumbe High School Advisory Board.



MEMORANDUM

To: State Board of Education & Early
Development

Date: June 7, 2019

Thru: Commissioner Michael Johnson

Telephone: (907) 465-2857

From: Director Tamara Van Wyhe

Subject: June 2019 DEED Standing Report

Accountability and Data

- Collaborated with Sam Wilson from the Health and Safety team to provide two district webinars on the Suspension/Expulsion data collection launch for 2018-2019. The two-week collection window opens on May 15.
- Collaborated with Colleen Shivers from the Special Education team to provide a district training webinar on the SPED Supplemental Workbook data collection launch for 2018-2019.
- The team has been filling data requests for legislators, public requests as well as a significant request for AASB.
- The team is preparing for the Summer OASIS data collection, which includes pieces of data that drive the ESSA accountability system, the System for School Success.
- Planning and preparations for the 2019 school designations are underway.
- Continued work on documentation on all primary tasks is underway to create a guide for all data related work for the team. Karen Lipson is working hard to make sure her replacement has sufficient guidance to complete her work when she retires.
- Karen Lipson will retire on June 30, 2019. Her contributions to the data team have been significant. We will miss her terribly.

Assessment program

- PEAKS
 - The assessment windows for the PEAKS and Alaska Science Assessments were open from March 25 through April 26, 2019 (computer-based) and April 1 through April 12, 2019 (paper-based).

- During the testing window, the Assessments team provided technical assistance and guidance to districts as well as monitoring to ensure a secure, standardized administration.
- A meeting with the Technical Advisory Committee and a planning meeting with the test vendor (DRC) will take place from June 11 to June 14, 2019.
- WIDA
 - The assessment window for WIDA ACCESS for ELLs took place from February 1 through March 29, 2019.
 - The Assessments team provided support, guidance, and monitoring during the assessment window.
- Alternate Assessment for students with the most significant cognitive disabilities
 - The testing window for the Alternate Assessment (DLM) took place from March 18 through May 3, 2019.
- NAEP
 - Testing for the National Assessment of Educational Progress (NAEP) took place from January 28 through March 15, 2019. During this time, the Assessments team monitored assessments and facilitated communication and logistics between schools and the NAEP field staff.
 - From March 19 to March 21, 2019, the NAEP State Coordinator attended the NAEP Assessment Literacy Workshop. The workshop covered assessment literacy topics such as interpreting and contextualizing assessment results; how NAEP is developed and scored; and information about upcoming 2020 NAEP assessments.
- Alaska Developmental Profile (ADP)
 - Preparations for the 2019 ADP are underway. Kindergarten students will be observed for this assessment in the fall of 2019.

Career and Technical Education program

- The Career and Technical Education (CTE) team (DEED/CTE) has begun the planning process to facilitate changes due to Perkins reauthorization.
 - Transition plan to incorporate changes in the law is due May 2019. DEED/CTE has convened:
 - A statewide advisory council to gather feedback from key stakeholder groups, including industry, tribal, postsecondary education, and parents.
 - Working groups of CTE practitioners to provide immediate feedback and guidance on elements of the state Transition Plan.
 - Both of these groups are meeting monthly via WebEx to:
 - Gather stakeholder feedback
 - Keep the CTE community informed
 - Involve a diverse group of stakeholders in crafting the state's vision and goals for CTE
 - The Transition Plan was submitted to the US Department of Education in May.
 - The new 4-year State Perkins V Plan, which is more detailed than the Transition Plan, is due to the US Department of Education in April 2020. DEED/CTE will continue to

refine state CTE goals based on community input. Monthly WebEx meeting will continue through FY20.

- Two competitive grant Requests for Proposals closed April 26, 2019, and are now in departmental review. The first targets postsecondary partners providing access to dual-credit opportunities for secondary CTE students in key workforce areas. The second targets Local Education Authorities (LEAs) to provide access and equity to underrepresented genders in Non-Traditional Occupations (NTO).
- The Educators Rising Career and Technical Education Program of Study (CTEPS) continues to gather statewide interest and grow. DEED/CTE in conjunction with UAF K-12 Outreach is looking for ways to make this program more accessible—especially to rural and small schools.
- DEED/CTE continues to support a robust plan for workforce development in Alaska by:
 - Partnering with the Department of Labor & Workforce Development (DOLW&D) on the Alaska Liquid Natural Gas pipeline project
 - Partnering with DOLW&D on Registered Apprenticeships
 - Leveraging the Alaska Workforce Investment Board to benefit CTE instruction
 - Developing rural economies
 - Developing 21st century businesses that leverage Alaska's global position
- DEED/CTE has been holding regular webinars for districts to assist in reducing the administrative burden of the Carl D. Perkins program.
- DEED/CTE continues to support secondary/postsecondary alignment and dual-credit projects in high-demand sectors of the state economy, such as the Alaska Area Health Education Center (AHEC) Behavioral Health program and the Mariner Credentialing program at AVTEC.
- DEED/CTE funded more than \$250,000 in CTE teacher professional development over FY19. Districts leveraged these funds to provide both content-specific and pedagogical professional development to CTE instructors.

Child Nutrition Programs

- Updates to USDA's Trade Mitigation Program: Child Nutrition Programs is working with USDA to distribute allocated commodities to Food Banks and pantries operating the Emergency Food Assistance Program (TEFAP) in Alaska. Currently in phase 4, to date we have received \$723,362 in commodities through trade mitigation for TEFAP programs and \$97,461 in additional commodities for school programs for SY19-20 so far. These numbers are subject to change depending on successful procurement by USDA and additional funding at a later date. Trade mitigation provided additional administrative funding we were able to provide to food banks in Alaska.
- Alaska Child Nutrition Programs received funding from USDA in the amount of \$92,086 to disperse in competitive equipment grants for school nutrition programs; this is the sixth year USDA has provided this funding for state agencies to be competitively awarded to school food authorities.
- Congress began holding hearings for Child Nutrition Reauthorization in April; the nutrition programs are approximately 3 years overdue to be reauthorized. It is anticipated that reauthorization will occur this federal fiscal year.

- Child Nutrition Programs will be submitting a waiver to USDA to extend the Administrative Review cycle from 3-years to 5-years based on risk assessments for school districts and other program operators; USDA is promoting the submission of waivers to relieve the district-level administrative burden of program monitoring.

Early Learning Programs

- Pre-Elementary programs, including (state) Head Start and Early Learning Programs in Moore districts are currently being re-evaluated based on the governor's proposed budget.
- The Preschool Development Grant for Birth to Five (PDG 0-5) has been awarded to Alaska initiating a project that begins with a comprehensive needs assessment, which will then feed into a robust statewide strategic planning process. Both activities address the identified needs of families and focus on aligning expectations and language among parents, Early Childhood Education (ECE) programs, and elementary schools. In addition, parent knowledge will be expanded about ECE options, ECE programs will have opportunities to share best practices, and invest in system-wide quality initiatives to ensure that Alaska's birth to five year old children are given the opportunity to be successful and working towards the goals of Alaska's Education Challenge. For information concerning opportunities under this grant, persons are encouraged to contact Don Enoch at 465-2972.
- School districts and Head Starts are starting to submit their end-of-the year report tied to their Pre-Elementary Approval to Operate. Closing date is June 30th.
- Parents as Teachers - Through 3 different programs in 5 sites, 76 families with 166 children received services from home-visiting staff for a total of 442 visits during the second quarter.
- Best Beginnings now has an e-newsletter to help parents prepare their children for school success by building their child's communication, language, and literacy skills.

ESEA/ESSA Federal Programs

- The ESEA Federal Programs team hosted their annual ESEA Consolidated Application Technical Workshop April 9-11, 2019. This workshop provided technical assistance to district personnel on the fiscal and programmatic provisions under ESSA. Over 100 district staff including Superintendents, Federal Programs Directors, and various district personnel attended this workshop.
- With the assistance of stakeholders from across Alaska, the Migrant Education Program has finalized its statewide [Comprehensive Needs Assessment](https://education.alaska.gov/ESEA/TitleI-C/docs/cna_final_report.pdf) (education.alaska.gov/ESEA/TitleI-C/docs/cna_final_report.pdf) and [Service Delivery Plan](https://education.alaska.gov/ESEA/TitleI-C/docs/migrant_service_delivery_plan.pdf) (education.alaska.gov/ESEA/TitleI-C/docs/migrant_service_delivery_plan.pdf). School districts will begin implementing the strategies identified in the Service Delivery Plan with their Title I, Part C funds in FY20.
- To help districts carry out ESSA's requirement to help ensure the educational stability of students in Foster Care, DEED has [created a webpage](https://education.alaska.gov/esea/TitleI-A/foster-care) (https://education.alaska.gov/esea/TitleI-A/foster-care) of information for districts, including state-specific guidance and templates, a crosswalk between school districts and OCS regions, federal guidance documents, as well as national resources.

- DEED has been encouraging eligible districts to apply for Title V-B Rural Education Achievement Program (REAP), Rural and Low-Income School Program (RLIS), or Small, Rural School Achievement Program (SRSA) funds available from US ED. The REAP grants are small (typically about \$15,000), non-competitive awards offered to rural school districts. In the first quarter of FY19, 28 Alaska districts received awards whose combined total exceeded \$500,000.
- The English learner program is currently forming a stakeholder feedback group for the 19-20 school year. DEED hopes to enlist the expertise of stakeholders with strong backgrounds in either English learner education or English language development who can provide input on several topics, which may include: Alaska's current WIDA ACCESS for ELLs exit criteria, screener entrance criteria, and assigning missing domain scores on ACCESS for students with disabilities.

Health and Safety Programs

- The Health and Safety Team has secured funding to offer a second School Safety & Well-Being Summit this fall (Sept. 18-19, 2019 at the Egan center in Anchorage). Last year's Safety and Well-Being Summit, attended by more than 350 educators from more than 40 districts, was exceptionally well-received by our educational partners, and summit evaluations indicated a strong district need for continuing opportunities to advance foundational best practices for trauma-engaged schools, positive school climate, and crisis response preparedness. The team is currently reaching out to key education partners to construct the summit planning committee. The Health and Safety Team will provide the board with a draft agenda next quarter.
- The Health and Safety Team is seeking guidance in the development of a "toolkit" to go with our newly released resource entitled *Transforming Schools: A Framework for Trauma-Engaged Practice in Alaska*. Over the summer, DEED and partners will be starting to gather resources for each chapter of the framework to help district with their implementation. Excitingly, many districts are already incorporating the framework into their daily school lives (Juneau, Kenai, Fairbanks, and Bering Straits to name a few). The framework is also generating national attention, is being added/referenced on national sites like Joseph Spinazzola's Complex Trauma Resources and the National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth, and has been incorporated into a 3-part webinar delivered by the American Institutes of Research's Supportive School Discipline Community of Practice's (SSDCoP).
- The team has announced its intent to award a new 3-year cycle of district Suicide Awareness, Prevention and Postvention (SAPP) grants. These life-saving grants are made possible via DEED's ongoing partnership with the DHSS's Statewide Suicide Prevention Council. The SAPP competitive grant program provides an opportunity for schools to support programs, practices, and policies that focus on areas related to the Statewide Suicide Prevention Plan's goals and strategies. Letters of intent to award grants were issued to the following districts: Anchorage, Mat Su, Kenai, Juneau, Petersburg, North Slope, Bering Straits and Fairbanks. It is noteworthy that more than half of these districts integrated *Transforming Schools: A Framework for Trauma-Engaged Practice in Alaska* into their proposals.
- Trainings Delivered:

- The Health and Safety Team delivered statewide ESSA Title ID Neglected and Delinquent and Title IV Part A Student Support and Academic Enrichment Grants workshops and technical assistance trainings to district staff in Anchorage on April 9, 10, and 11 at the ESEA Technical Assistance Workshop.
- The team also partnered with the Council on Domestic Violence and Sexual Assault to conduct a statewide Coaching Boys into Men training (evidence-based dating violence prevention training) to 45 coaches across the state in Juneau on April 18 and 19.
- The team provided 2 statewide trainings for districts on suspension, expulsion, and truancy data collection for annual reporting in the State Reporting Management System on April 17 and 23.
- The team provided Youth Mental Health Training to community members in Juneau
- eLearning for Credit! The team created a new function within the eLearning Program that enables teachers renewing a 5 or 10-year certificate to receive a continuing education unit (CEU) upon completion of a suite of DEED’s eLearning courses. Fifteen hours of course content must be completed to receive 1 CEU—eligible courses that can be used toward accruing a CEU include topics such as: child abuse awareness and prevention, domestic violence awareness and prevention, suicide prevention, trauma-informed schools, and more. This new function saves teachers time and money while providing them with high quality training aligned to statewide education goals.
- Quality Schools Annual Report to the Legislature: In February, the team finalized and submitted its statutorily required 6-part report to the Legislature detailing how each district utilized its Quality School grant funding to align to or implement state standards.
- Alaska Safe Children’s Act: The team is continuing its development of a state authored student training to support districts with the implementation of the Alaska Safe Children’s Act. The curricula development committee convened in Sitka in April and made excellent progress on the outline for the 3rd grade bands of curricula to be developed for dating violence awareness and prevention and sexual assault/abuse awareness and prevention. Per district request, these trainings will be formatted and delivered as eLearning courses.

Special Education Program

- Compliance/ Special Education Monitoring –
 - FY18 compliance monitoring is completed.
 - FY19 compliance monitoring for all districts now complete
 - FY19 On-Site Technical Assistance requirements remain for: Lower Yukon
- The special education team is currently interviewing for the previously posted vacancy
- With the approval last year of the legislature making *Powerschool-Special Programs* the “preferred vendor” for IEP management software, the department is currently pursuing a customized linking software to the district systems to conduct desk audits, as well as to begin the process of reducing district reporting requirements that may be directly obtainable from the state connection to *Powerschool-Special Programs*
- The Annual Progress Report and the State Performance Plan for special education were submitted to the federal agency on time, as was the State Systemic Improvement Plan (AKA

Indicator 17). The Office of Special Education Programs note one area in which additional clarification was requested, which has been submitted and is pending review.

- The annual special education federal grant application is currently posted for public comment per federal requirements.
- The department will be conducting two special education director trainings per year, based on stakeholder input for the special education directors. The changes are planned to be effective next school year.
- No new regulations or policies from the department's special education unit are being considered at this time.
- All federally required data that is posted on the state special education website is current and ADA compliant.
- Complaint and Due Process Hearing information remains available to the public (not posted online as per 34 CFR 300.513 (d))

The Due Process and Administrative Complaints data for the year to date are as follows:

- Due Process Hearings: 3 (1 dismissed and two open)
- Complaint Investigations: 6 (2 complaints pending)

Standards

- Senate Bill 104- Instructional Materials.
 - Completing database of ELA and Math instructional materials for all Alaska school districts- 53 out of 54 school districts materials identified.
 - Comparisons of EdReports and other statewide review process to inform review curriculum adoption process nationwide.
 - Met with Education Northwest and Louisiana's Education Department.
 - Completing Publisher's Rubric for sending materials to DEED for evaluation collection.
 - Completing Evaluation Tools for Math/ELA curriculum materials for evaluation process.
- Libraries, Archives, and Museums (LAM) and the Alaska Standards team are working on Library/Information Literacy Standards and adding to the Standards webpage.
- Updating the Alaska Standards webpage for accessibility and usability for teachers and districts.
- The Math Curriculum Specialist attended the Content Review in Anchorage to participate in and help facilitate assessment item review meetings for the Performance Evaluation for Alaska's School (PEAKS).

State System of Support/School Improvement

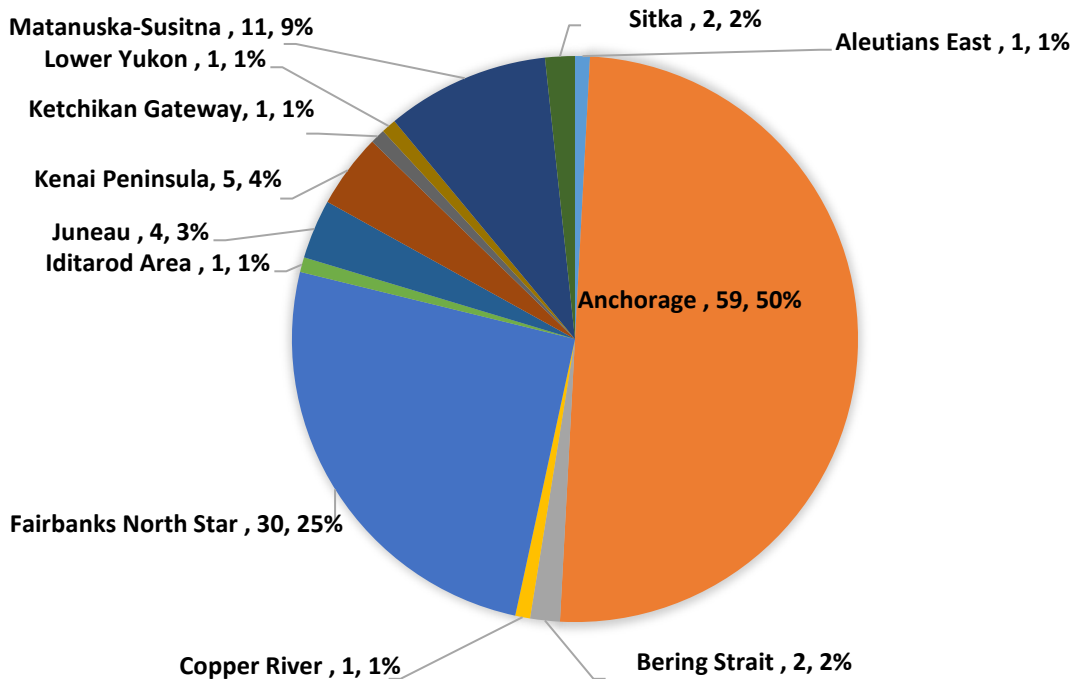
- Grant support for designated Schools
 - Over 95% percent of Alaska's 107 CSI and TSI designated schools applied for school improvement funds through an application that was submitted to the department March 15th, 2019. The State System of Support Team is reviewing school improvement plans submitted along with the applications for funds. Designated schools are required to
 - conduct a local (school level) Needs Assessment
 - involving local stakeholders, and
 - implement evidence-based-interventions through
 - a school improvement plan designed to address the reasons a school was designated CSI or TSI.

- The school improvement grants are available to schools through the 2019-2020 school year.
- Year-End Inservice Support
 - Using funds designated by the legislature for “direct crisis response” to districts in need, the department is supporting a three-day year-end training event for one district. This convening takes place after the end of school to not interrupt student learning time. It gathers all returning district and school staff involved in student instruction.
- Alaska School Leadership Institute
 - The team is invested in the success of the annual sponsored by the Alaska Staff Development Network. This late May event has support rural school districts through year-end training on English language arts and math instruction, school leadership skills, and continuous improvement planning processes.
- School Improvement Coach Data Briefings
 - School improvement coaches will provide data briefings to department staff on the status of improvement in the sixteen schools newly designated for Comprehensive Support and Improvement (five percent). Coaches have been working in these schools since January of this year and the May briefings will reflect work since then.

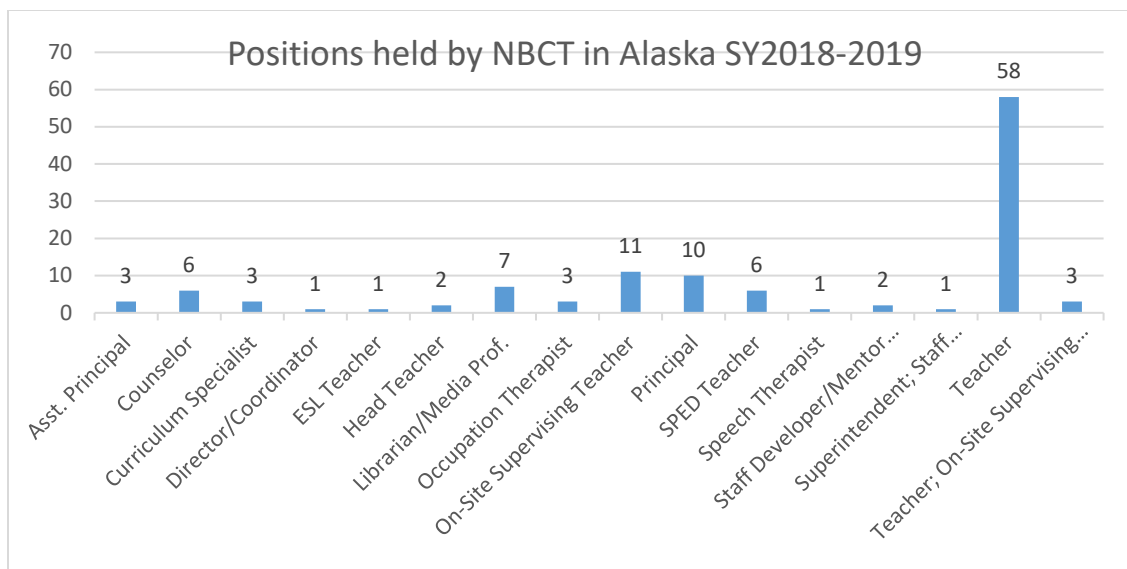
Teacher Education & Certification

- The Teacher Education and Certification Office has been had a number of inquiries concerning various types of certifications. National Board Certification has been one area of Interest. Below is information that was recently shared.
- National Board Certified Teachers (NBCT) in Alaska (SY 2018-2019)
 - National Board Certification (NBC) is a voluntary, advanced teaching credential that goes beyond state licensure. NBC has national standards for what accomplished teachers should know and be able to do. The National Board certifies teachers who successfully complete its rigorous certification process. The cost to individuals seeking National Board Certification is approximately \$2000.
 - During the 2018-2019 school years, 118 of the 199 Alaska educators who have gained NBC are employed in an Alaska public school district.

NBCT IN ALASKA SCHOOL DISTRICTS SY2018-2019



Sources: Teacher Certification Database; October 2018 Certified Staff Accounting; and National Board Certified Teachers' Website



Positions held by NBCT in Alaska SY2018-2019	# of Educators
Asst. Principal	3
Counselor	6
Curriculum Specialist	3

Director/Coordinator	1
ESL Teacher	1
Head Teacher	2
Librarian/Media Prof.	7
Occupation Therapist	3
On-Site Supervising Teacher	11
Principal	10
SPED Teacher	6
Speech Therapist	1
Staff Developer/Mentor Teacher	2
Superintendent; Staff Developer/Mentor Teacher; Director/Coordinator; Director of Curriculum	1
Teacher	58
Teacher; On-Site Supervising Teacher	3
Total	118

Sources: Teacher Certification Database; October 2018 Certified Staff Accounting; and National Board Certified Teachers' Website

Teacher Quality Update

- Elevate and Celebrate Effective Teachers and Teaching (ECET2)

Southcentral

Alaska's convenings are part of a national movement called Elevating and Celebrating Teachers and Teaching, (ECET2) supported through grants from the Bill and Melinda Gates Foundation. Based on the success of the 2016 statewide ECET2 convening, three regional convenings occurred during this school year. The first in early October 2018 was the ECET2 Interior convening, it was followed in last October by the ECET2 Southcentral convening and the final ECET2 Southeast convening was held in March 2019. Last Fall, there was a convening of 50 teachers from the six southcentral Alaskan school districts: Kenai Peninsula Borough SD, Kodiak Island Borough SD, Chugach SD, Cordova City Schools, Valdez City Schools, and Yakutat SD.

ECET2 Southcentral Convening, hosted by the Kenai Peninsula Borough School District, cultivated a supportive, collaborative community of educators who left feeling empowered as effective teachers, teacher leaders, and an integral part of a peer network. Participants were a mix of teachers from rural, small town, and semi-urban districts from the entire southcentral region of Alaska. The goals of the convening were to celebrate the teaching profession and the teachers in our region, provide teacher-driven professional development through thematic sessions featuring teachers in leadership roles, and weaving in solution-oriented discussions for colleagues to process problems of practice, gaining both strategies and resources.

By highlighting teachers in leadership roles throughout the conference, we modeled and celebrated our teachers while promoting conversation focused on building capacity for teacher leadership within schools, districts and the entire state. Our convening attempted to cultivate in teachers the view of themselves as capable and effective leaders. The knowledge that they carry forward will hopefully help to minimize the

attrition that educators face in Alaska through strategic support and consequently minimize the substantial and detrimental teacher turnover. We have continued this support through the school year with a credit course that many attendees are taking along with a follow up smaller convening on the Kenai for KPBSD ECET2 Alumni.

- **Alaska Teacher of the Year**

- Danielle Riha, an educator at the Alaska Native Cultural Charter School in Anchorage and the 2019 Alaska Teacher of the Year, was selected as one of four finalists for the 2019 National Teacher of the Year. Four educators with diverse teaching styles and who teach different subjects have been selected as finalists for the 2019 National Teacher of the Year. Finalists for the Nation's Top Teaching Honor are from Alaska, the District of Columbia, Oklahoma, and Virginia.
- The 2019 National Teacher of the Year is Rodney Robinson! He teaches social studies and history at Virgie Binford Education Center, a school inside the Richmond Juvenile Detention Center.
- The 2020 Alaska Teacher of the Year selection process has begun with nominations due by April 1, 2019.

- **Educator Talent Pool**

DEED has an ongoing process to seek recommendations for exemplary K-12 teachers and principals. We are looking for educators, relatively new to the profession, who demonstrate outstanding instructional and leadership abilities that impact students, colleagues, and the community. These distinguished educators are considered for special recognition programs. Additionally, these educators might be asked to be on for statewide and national advisory boards and task forces. Anyone can submit a recommendation using the [Talent Pool Recommendation Form \(docx\)](#).

- **Instructional Leadership Education and Support**

DEED is pleased to have three statewide projects to support Principals and Schools Leaders support by ESSA Title II, Part A federal funds. The three projects include Alaska Professional Learning Network (AkPLN), Alaska Education Network (ECHO), and the New Principals Academy.

The Alaska Professional Learning Network ([AkPLN](#)) coordinated by the Alaska Staff Development Network (ASDN) has completed the third and final year of this project. The project offers an online collaborative space to support professional growth of educators throughout Alaska. Additionally, it offers access to the Teaching Channel's library of videos of actual teachers with students.

During the first year, the project developed pathways of engaging professional learning resources to support implementation of the Alaska ELA and Math Standards. In year two, online courses using the pathways were offered to a statewide audience in the fall and the spring. During Year 3, the pathways and online courses were enhanced to support specific skills that Alaska students struggled with on the PEAK, the statewide standards assessment. The project will submit a sustainability plan at the end of August and will have the opportunity to continue activities through the end of September 2019.

The Alaska Education Network ([ECHO](#)) managed by the Anchorage School District has completed an abbreviated pilot year. This is a statewide initiative focused on uniting Alaska's educational leaders with the intent of building community and capacity. The heart of the ECHO model is its hub and spoke knowledge-sharing networks, led by expert teams who use multi-point videoconferencing (ZOOM) to conduct learning sessions. Across Alaska, educational leaders received bi-weekly or monthly professional learning and networking opportunities from January through May 2019. The project planning committee

includes DEED, University of Alaska Anchorage (UAA), and Alaska Educational Providers (e.g. ASDN). This summer adjustments for Year 2 of the project will be made. The kickoff learning sessions are anticipated to start in the Fall and be ongoing throughout the full school year.

The New Principals Academy project has completed the first full year. The Alaska Council of School Administrators and its umbrella organizations ASDN, Alaska Association of Elementary School Principals (AAESP), and the Alaska Association of Secondary School Principals (AASSP), direct the project. The project has partnerships with representatives of ASD, DEED and the University of Alaska system. The project design leveraged prior work in Alaska and utilized existing professional learning opportunities for principals. This project uses a blended learning for a cohort of early career principals and school leaders.

The project kicked off at the Principals Conference in October with two half days of cohort learning as well as attending the conference. During the fall, cohort members participated in an ongoing discussion group and two optional existing ASDN webinars. The cohort attended the RTI/MTSS Effective Instruction pre-conference and conference in January. Cohort principals participated in a follow-up ECHO session and had the option to attend additional ECHO sessions and an existing ASDN webinar in the winter. The cohort will conclude their first year by attending the Alaska School Leadership Institute (ASLI) in May. The project continues with the first cohort a second year and starting a new cohort in a beginning year.

Mt. Edgecumbe High School

State Board of Education Report

June 2019



Note from the Superintendent

It has been a busy but wonderful year. Quite a few changes were implemented last year and this year we continued to monitor them with very good results. We have some exciting plans for continued work in helping students better explore their own interests and options for post secondary and getting them involved in their own four-year planning. The last Saturday School we had students working with a reflection sheet with their own data and working through a four year plan for selecting classes after visiting a course fair. This was a big step in our goal of increasing students' own understanding and involvement in monitoring their own learning and post secondary planning.

Our staff worked through our second school improvement cycle and we look forward to some continued work in implementing dual credit/AP classes, involving students in four-year and post secondary planning, and encouraging healthy living.

Ending Enrollment Information:

Grade and Gender Distribution

October	Male	Female	Total		April	Male	Female	Total
9	39	77	116		9	39	73	112
10	51	60	111		10	46	51	97
11	42	75	117		11	40	61	101
12	38	51	89		12	31	51	81
total	165	263	433		total	157	240	392

We are consistent with last years' retention rate at about 90%, however the pattern is different. We have had amazing retention in 9th grade- which is wonderful. This does mean less room for 10th grade applicants for next year.

Admissions for 2018-19

The process of admitting students for the 2019-20 school year is underway. The first "deadline" was March 31. At that time 116 applications were complete (including transcripts, test scores,

educator assessments) and a total of 135 fully complete in review by April 15. MEHS will continue to accept applications and encourage completion of applications. As of May 5, 260 applications had been submitted, yet many lack the supporting documents to be complete.

MEHS will have about 125 openings for this year if all current students choose to return. It is expected that once students return home, some will choose to stay in their home district for the next school year. This creates more openings throughout the summer. Currently there are very small numbers for the upper grades, particularly in the 10th grade.

	Returning	Target	Openings	Complete application # 4-15-19
9		110-115	110-115	88
10	112	115-120	3-8	21
11	97	105-110	8-13	18
12	101	100-105	0-5	8
total	310	435	125	135

Strategic Plan Work:

This is the last year of the adopted Strategic Plan. The plan can be summarized into five key areas. The table below is a summary review of activities in the past year for the strategic plan. Starting next fall, the advisory board will do a complete strategic plan review and begin the process of building a new one for the next 3-5 years.

Strategic Plan Key Areas
 Increased Communication
 Alignment of Curriculum & Instructional practices to student needs
 Integrated Support services targeting student needs
 Tracking results for meaningful improvement
 Actively promoting healthy living and life-long skills

2018-19 Activities	Results/Notes	Ideas for Next Year
Increased Communication		
Continued Frequent posting on Facebook (carry over- increase our capacity) Continued use of auto email system Teacher phone calls Email itineraries test-	Continued positive feedback in maintaining facebook, emails, and phone calls Tested mailed itineraries, full implementation this spring	Get back into website and improve quality and frequency of updates

Alignment of Curriculum & Instructional Practices to Student Needs		
Placed day of curriculum work into inservice routinely Some teachers of have completed year-long maps for summer work	Still struggling with the time needed for curriculum development	Get our first year-long maps through the approval process with the board
Pursued AP/Dual Credit plan presented to Advisory board at beginning of the year	Will have 3 AP classes and our first "Launch" dual credit	Implement our new AP/ dual classes
Continued and monitored 2 intervention classes- Lit/world Hist and Modeling math	Both intervention courses are demonstrating higher than average growth- and sustained positive grades	Continue to monitor the intervention classes for the sustained results
Added a programming class to address the coding suggestion by board 2 years ago	Smaller numbers for first class, but strong demand next year with adjusted period	Implement new technology standards- increase coding
Adjusted English courses so last requirement is met by a "choice" class to help align to post-secondary plans	Will implement next year- no new classes though except AP	
Integrated Support Services Targeting Student Needs		
Continued implementation of the things added last year- Freshman study hour StAR center teacher tutorials Freshman Success Class College/Career Guide	Working on fine tuning of study hour changes StAR center now open continuously from afterschool to end of study hour- kids do access between 5 and 7	Tutor training
Planning to add an Junior Advisory time		Develop Junior Advisory time so that it is helpful
Did a big Saturday school on understanding MAP data and selecting the right courses		Continued work on consistent messaging
Tracking Results for Meaningful Improvement		
Continued use of MAP testing and guided use for teachers. In our goal of Involving students in tracking their own growth we did a big Saturday school on understanding MAP data and selecting the right courses Communicated data to boards Completed next round of schoolwide	Feedback indicates more successful use of Inquiry, yet not there yet	Need to go back and dedicate time for teacher use of MAP data in meaningful ways Decide the best way to communicate the goals and measurable targets to a wider audience

data cycle-- teachers reviewed data in fall and made plans in January for 2 year improvement		
Actively Promoting Healthy Living and Life Long Skills		
Implemented no-tech Tuesday Continued with healthy Braves Challenge Residential team is building a plan for addressing these needs Opened a POOL! Participated in the Youth Risk Behavior Survey so that we may have some additional information on that.	Healthy Braves Challenge is great- but it is still only a group of kids that consistently participate in activities	Team is continue to explore more ways to increase recreational participation-- looking at a big plan Working on ways to encourage more healthy and consistent eating

Pool Progress

The pool is officially open for community business! There are three evenings of open swim, two mornings of lap swim, and open for rentals on weekends. Schedules will change once MEHS return home for the summer. A plan for extensive use by the local health corporation is being discussed. Building up staff capacity continues to be a goal and challenge. These few months of operation should provide us with a clearer picture of future operational needs.

The swim classes and recreation swim for MEHS students has been excellent. Large numbers of students have requested swimming classes for next year as well and plan to have four swim classes, two beginning swimming and two swim for fitness. This past semester several non-swimmers have learned to swim for the first time.

Accreditation

This is the year that MEHS went through the accreditation process. An accreditation team visited MEHS and will prepare a report. Some of the highlights they shared in the exit interview included strong teacher- student relationships, significant increase in integrated technology use since last accreditation, and strong use of school-wide data.



MEMORANDUM

To: State Board of Education
Date: April 30, 2019
Thru: Commissioner Michael Johnson
Telephone: 907-465-2911
Subject: Report to the State Board of Education & Early Development Covering March – April 2019
From: Patience Frederiksen
Division of Libraries, Archives and Museums

Staffing:

Martin Baker, DOT/Division of Facility Services Maintenance Specialist, started work at the Kashevaroff Building on April 15. His arrival will free up Lisa Golisek-Nankervis' time so she can focus completely on Division Operations.

Grants:

No changes.

Division News:

Archives and Library staff reviewed 35 Alaska History Day projects for grades 6-12. The Alaska winners will go onto the national contest in College Park, Maryland this June.

One March youth activity at the APK was *Traditions with Salmon and Art* with artist Abel Ryan, teaching children how salmon influence art and technology in Alaska, the formline design process, and how to create salmon designs.

On March 6, the Legislature passed a citation honoring World War II Tlingit Code Talkers Robert Jeff David, Sr., Richard Bean, Sr., George Lewis, Jr., and brothers Harvey Jacobs and Mark Jacobs, Jr. The State Archives located the *Statements of Service* for Harvey Paul Jacobs, Mark Jacobs Jr., Richard B. Bean and Robert David and posted them to Alaska's Digital Archives.

As part of the NASA@ My Library project, the State Library is checking out three Science, Technology Engineering and Math (STEM) kits for 21 days each to libraries wishing to use these kits in programming. Librarians and the public can visit [NASA @ State Library](#) for more astronomy and space activities they can do in rain, shine or midnight sun.

Remembering the Exxon Valdez Oil Spill, an exhibit commemorating the 30th anniversary of the oil spill opened on March 26 in the 2nd floor display cases at the APK. Drawing on 1,600 boxes of materials produced during the settlement between the State of Alaska, the U.S. government and Exxon Corporation, the exhibit featured documents, images, video footage, and news clippings showing the impact of the 10.8 million gallon oil spill on Alaskan waters.

The State Archives received a donation of historic records from Sen. Bert Stedman relating to Governor Lyman Knapp, our third Governor (1889-1893) who established Alaska's historical society and library. Included was [an 1892 letter correspondence to Gov. Knapp penned by Lt. Commander of the US Navy Sam Very](#), which recounts the history, circumstances, and people of Sitka at the time of Alaska's transfer in 1867. Commander Very was an officer aboard the USS Resaca that reached Sitka in September 1867.

During March, Olivia the Octopus was the focus of community and staff attention! Children and adults came to learn about the North Pacific giant octopus with scientists Sherry Tamone and Riley Woodford and to install suckers and skin with artist Tanna Peters. Olivia was introduced to the public on April 5, when 470 people came to the APK to meet her and participate in other activities on First Friday. Many people came in marine-inspired costumes!



In the Discovery Room, visitors welcome Olivia the Octopus on her opening night.

In April, *Whale Tales and Fish Sagas* featured presentations at the APK by UAF graduate students Matt Callahan and Valentina Melica on their research focusing on sablefish (black cod) and blue whales, species that have thrived during recent warming in the Gulf of Alaska.

Wayne Price, master carver, took nineteen young people and a round cedar log to an island in the middle of the Yukon River in 2009. The only way off the island, Price made clear to the students, was by carving the cedar log into a canoe themselves. The struggle was about more than canoe building, it was also about recovery and wellness. The State Museum was proud to host a showing Wayne's film *Dugout*, which follows Price and his young apprentices as they work together to overcome challenges of modern life through application of ancient skills.

On April 20, the Division hosted our second annual table at the Travel Juneau Fair, featuring our summer exhibit of Ray Troll's *Cruisin' the Fossil Coastline*.



Addison Field, Chief Curator, awaits the public at the Division's table during the Travel Juneau Fair on April 20.

In April, School Library Coordinator Janet Madsen sent out a statewide call for volunteers for the writing and review committees to update the Library/Information literacy standards.

At APK on April 20, Pam Houston read and discussed her new book, *Deep Creek: Finding Hope in the High Country*. Her new memoir talks about it what it means to care for a piece of land and the creatures on it.

On April 27, the Division supported Alaska Robotic's annual *Mini-Con* by hosting three Alaska graphic artists and authors, who shared images of their works with students, who were also given an opportunity to illustrate a bookmark or miniature book following each presentation.

Tsin'aen (Thank You) to the Division

"I wanted to take a moment to express my gratitude for creating the Alaska Intensive Digital Stewardship program and to let you know that because of the program, we were able to submit a more competitive application for the 2019-2020 Tribal Digital Stewardship Cohort Program: Digital Heritage Management, Archiving and Mukurtu CMS Training at Washington State University's Center for Digital Scholarship and Curation. We were just notified this morning that our application was chosen to be a participant for this year's cohort as one of six Tribes participating throughout the next year. Participation in the program will allow us to continue moving forward with the development of our digital collections web-site that will also incorporate the work that our language department has been doing. Thank you again and I look forward to the remainder of the webinars in the Alaska program."

Building News:

Schmolck Engineering completed installation of the new cooling system, which included the delicate operation of flying the system off a flatbed and rotating it before lowering it onto the platform constructed on the south side of the building. The cooling system was tested during the commissioning period in April. The system appears to be working well. The Division is anxiously awaiting our first full electric bill to see what the impact of this new system will be on our utility bills.



Cooling system is lifted by a crane, rotated, and lowered onto a platform along the south side of the Kashevaroff Building.

MEMORANDUM

State of Alaska Department of Law

TO:	Members, State Board of Education and Early Development	DATE:	April 29, 2019
THRU:	Michael Johnson, Commissioner Department of Education and Early Development	FILE NO.:	JU2015200003
FROM:	Luann Weyhrauch Susan Sonneborn Assistant Attorneys General Labor & State Affairs Section Department of Law	TEL. NO.:	(907) 465-3600
		FAX NO.:	(907) 465-2520
		SUBJECT:	Attorney General's Report

This memorandum describes the status of current litigation involving the Department of Education and Early Development.

1. *DEC Enforcement Matter related to Contamination at Joe Parent Vocational Education Center in Aniak.* The Alaska Department of Environmental Conservation (DEC) identified DEED, DOT&PF, and the Kuspuk School District, as well as the federal government, AT&T Alascom, Lockheed Martin Corporation, and Exelis-Arctic Services, Inc., as potentially responsible parties (PRPs) for polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) contamination at the site of the Aniak Middle School. The contamination dates back to the use of the site by the U.S. Air Force as a White Alice Communications System site from 1958 to 1979.

At a mediation in September 2013, the PRPs agreed to the allocations (percentages of responsibility) that each party would bear in an agreement to share past and future clean-up costs for PCB and TCE contamination, although not all issues relating to TCE contamination could be resolved. In 2015, the PRPs executed an agreement (which remains in effect) to share the cost of the sub-slab-depressurization system and the TCE monitoring program at the site.

In February 2016, the Consent Decree (a settlement agreement in the form of a court order) was fully executed and DEC filed a complaint in federal district court for the purpose of establishing a forum for a court-ordered resolution. The Consent Decree was signed by the court in March 2016. In the summer of 2017, DOT&PF retained contractors who conducted PCB clean-up work. The TCE remedial investigation report, was issued May 24, 2018, and the TCE feasibility study, dated March 2019, was approved by DEC on April 11, 2019. The feasibility study includes a recommended alternative for addressing TCE at the site. DEC now seeks a project schedule to

implement the recommended alternative.

2. *North Slope Borough & North Slope Borough School District v. State of Alaska, Department of Education and Early Development*. This is a judicial appeal of the department's denial of debt reimbursement on five NSB bonds. In 2015, the department determined that the bonds were ineligible for school construction debt reimbursement under AS 14.11.100(j)(3) because they did not conform to the statutory requirement that bonds be repaid in approximately equal principal and interest payments over a period of at least 10 years. NSB filed an administrative appeal to the Commissioner. In September 2016, the Commissioner issued a final decision affirming the decision to deny reimbursement. NSB appealed the decision to the superior court. NSB then moved for a trial de novo; that motion was denied, and NSB's Petition for Review challenging the denial of trial de novo was rejected by the Alaska Supreme Court. The case has now been fully briefed in the superior court before Judge Kevin Saxby. Oral argument was held on January 23, 2019, and a decision will be issued in the next few months. AAG Janell Hafner in the Labor & State Affairs section has primary responsibility for this appeal

3(a). *Illuminations Childcare and Educational Center (Illuminations) Appeal of Department Action taken under Child and Adult Care Food Program (CACFP). Appeal within Department*. In 2015, Illuminations submitted a request for an administrative review of the department's notice suspending the participation of Illuminations in the CACFP program, proposing to terminate Illumination's agreement, proposing to disqualify Illuminations, and proposing to disqualify its owner and administrator. This notice, required under CACFP federal regulations, was sent because of action taken by the state Child Care Program Office to suspend the child care license of Illuminations based on serious health or safety violations. A review official issued a determination upholding the agency's action.

3(b). *Illuminations, LLC, d/b/a Illuminations Childcare and Educational Center, Brenda J. Fuller, and Kimberly J. Danford v. Alaska Department of Education and Early Development. Appeal to court*. In June 2015, Illuminations, *et al.*, filed an appeal in the superior court, and their opening brief was filed in December 2015. The appellants continue to agree to the postponement of the department's brief deadline (currently October 21, 2019) based initially on the discussion of settlement and claim documentation. In light of appellants' waning interest in pursuing their claims, the case is evolving into dormancy. This is likely to lead to an agreed-upon dismissal of the matter.

4. *Mary King, et al. v. Thomas Young, et al.* On January 7, 2019, Rosemarie Hotch, on behalf of Frog House members, filed a motion for a preliminary injunction in this 1976 case, to prevent the state museum from transferring certain artifacts to the Jilkaat Kwaan Cultural Center in Klukwan. The state museum has been a neutral temporary custodian of the artifacts (four carved house posts and one replica screen) based on an agreement and court order issued on May 9, 1978. In November 2018, the

museum, through the Department of Law, gave notice that the museum intended to transfer the artifacts to the Jilkaat Kwaan Cultural Center on January 14, 2019, in accord with the 1978 order. Due to competing claims to custody of the artifacts, the court issued a temporary restraining order on January 11, 2019, to prevent their transfer. Hotch and the Chilkat Indian Village have filed several motions and responses addressing whether Hotch may represent all Frog House members in this matter. The court scheduled oral argument on Hotch's Motion to Align Parties or to Intervene on April 24, 2019, but the argument did not proceed because Hotch and her attorney did not appear. As of April 29, the court has not ruled on the motion.

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 15

◆ ISSUE

This is a standing oral report to the board by the Commissioner.

◆ BACKGROUND

- The board will hear a report on the Commissioner's activities.
- Commissioner Johnson will be present to brief the board.

◆ OPTIONS

This is an information item. No action is required.

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 16

◆ ISSUE

The board is being asked to approve the minutes of its March 29, 2019 board meeting and the April 24, 2019 board work session.

◆ BACKGROUND

- Behind this cover memo are the unapproved minutes of the March 29, 2019 board meeting and the April 24, 2019 board work session.

◆ OPTIONS

Approve the meeting minutes as presented.

Amend the minutes and approve the amended meeting minutes.

Seek additional information.

◆ ADMINISTRATION'S RECOMMENDATION

Approve the meeting minutes as presented.

◆ SUGGESTED MOTION

I move the State Board of Education and Early Development approve the minutes of the March 29, 2019 board meeting and the April 24, 2019 board work session.

**Alaska State Board of Education & Early Development
Unapproved Minutes
March 29, 2019
State Board Room
Department of Education & Early Development
801 West 10th Street
Juneau, AK 99801**

Friday, March 29, 2019

Chair Fields called the meeting to order at 8:04am. All board members were present. Chair Fields then administered the Oath of Office to Lt. Col. Jeremiah Hammill, thereby making him the military advisor to the State Board of Education. After the pledge of allegiance, the board adopted the agenda for March 29, 2019, with the addition of agenda item 18B State Board of Education Public Statement. Second Vice Chair Van Diest moved to adopt the agenda with the addition of the public statement and was seconded by First Vice Chair Hamilton. Member Scott disclosed a potential conflict of interest on agenda items 7D and 9B; her uncle is on the AdvancED Northwest board. She was recused from the discussion and vote on items 7D and 9B.

Public Comment

Marshall Lynn, former commissioner of the Department of Education and Early Development, thanked board members for their service and support of Commissioner Johnson. Mr. Lynn provided comments on the state's current fiscal reality and encouraged the board to work with the commissioner during this time, and asked the board to take a position on the budget.

Kevin Mulligan provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Dave Gordon provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Robert Watson provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Richard Wean provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Kevin Knox, Sitka assembly member, provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Sam Jordan, Alaska Staff Development Network staff member, provided comments in support of the proposed computer science standards.

Tim Parker, President of the National Education Association – Alaska, provided comments on the importance of focusing on the Alaska's Education Challenge. Mr. Parker encouraged the board to lead the way, continue to invite participants, and to go on the road to talk to educators about implementation.

Jason Moore provided comments in support of the Sitka Seaplane Base and its importance to the community of Sitka.

Microsoft submitted written public comment in support of the proposed computer science standards.

Work Session

Agenda Item 1. School Construction and Major Maintenance List: Director Heidi Teshner and School Facilities Manager Tim Mearig with DEED updated the board on the school construction and major maintenance lists and answered questions about the review process, scoring criteria, and repairs needed due to the recent earthquake.

Agenda Item 2. Legislative and Budget Update. Director Teshner and Legislative Liaison Brittany Hartmann with DEED briefed the board on the work of the department during the budget process and the legislature and answered questions. Heidi Teshner updated the board on the budget process and informed the board of the amendment process that the Governor submitted to the legislature after the initial budget was submitted. Brittany Hartmann went through a list of the bills that directly relate to DEED.

Agenda Item 3. UAA School of Education Update. Director Tamara Van Wyhe with DEED updated the board on the work that the Department and UAA have been working on regarding their accreditation. At this time there has not been a plan that has been submitted to Dean Atwater, but UAA is still reviewing and refining their processes. At this time, UAA does not have approval from the Board of Regents to come back to the state board to provide further program approval. UAA is working with students to ensure that they are able to continue in their program. Member Hamilton encouraged the commissioner to bring a representative of UAA to report at each of the upcoming state board meetings to report on their progress.

Agenda Item 4. Charter School Renewals

Agenda Item 4A. Eagle Academy Charter School Renewal. Deputy Commissioner Karen Melin with DEED provided a brief overview of the school's renewal application. Representatives from the school were available on the phone and answered questions from board members regarding their charter school.

Agenda Item 4B. STreAM Academy Charter School Renewal. Deputy Commissioner Karen Melin with DEED provided a brief overview of the school's renewal application. Representatives from the school were available on the phone and answered questions from board members regarding their charter school.

Agenda Item 4C. Kaleidoscope Charter School Renewal. Deputy Commissioner Karen Melin with DEED provided a brief overview of the school's renewal application. Representatives from the school were available on the phone and answered questions from board members regarding their charter school.

Agenda Item 5. Mt. Edgecumbe High School Curriculum Update. Janelle Vanasse, Superintendent of Mt. Edgecumbe High School, provided curriculum updates to the board. Curriculum review will begin this summer. MEHS is implementing Advanced Placement courses and getting their teachers certified to

teach AP. MEHS is also looking at a dual credit bridge program, and are pleased to offer Psychology 101 as well as indigenous language classes.

Agenda Item 6. Sitka Seaplane Base Guest Presentation. Cliff Richter from the City of Sitka provided a PowerPoint presentation to the board regarding the Sitka Seaplane base. The City is asking that the board approve the sale of approximately three acres of land at the end of Seward Avenue in Sitka for the building of a new seaplane base. The current seaplane base has been operating at its current state for 65 years and is past its useful life. The new seaplane base will correct the deficiencies that now exist in the existing base. Commissioner Johnson reiterated to the board that the City of Sitka has provided great detail and have worked collaboratively with MEHS to work transparently on this project. Chair Fields recommended that the State Board issue a statement mirroring the MEHS advisory board's comment that they approve the sale with the contingency that the money stay at MEHS. Cliff Richter requested that the board make a decision soon so that the City of Sitka can apply for an Environmental Impact Study from the FAA.

Agenda Item 7. Regulations to go out for public comment

Agenda Item 7A. K-12 Science Standards regulations to go out for public comment. Deb Riddle, Division Operations Manager and Bjorn Walter with DEED updated the board on the proposed K-12 science standards. They walked through the board through the process by which they came up with those standards. Member Griffin asked how they would align with NAEP. Deb Riddle shared that NAEP does not align with any state's standards on purpose so that no state has an unfair advantage in their testing.

Agenda Item 7B. Computer Science Standards regulations to go out for public comment. Deb Riddle, Division Operations Manager updated the board on the proposed Computer Science standards. The board asked Dr. Lisa Parady from the Alaska Council of School Administrators to discuss their work in partnership with the department to craft these new computer science standards. Sam Jordan from the Alaska Council of School Administrators also presented to the board with Dr. Parady. According to Mr. Jordan, 30 states as of today have adopted computer science standards. Dr. Parady walked the board through the publication "the Great Work of Alaska's Public Schools" and called attention to the portion that states that 80% of Alaskans believe that public schools should provide a well-rounded education to all children which includes technology. Ms. Riddle, Dr. Parady, and Mr. Jordan answered questions and comments from the board.

Agenda Item 7C. Digital Literacy Standards regulations to go out for public comment. Deb Riddle, Division Operations Manager updated the board on the proposed Digital Literacy Standards and answered questions. These standards are based on the International Society for Technology and Education Standards, which provides opportunities for teachers to use instead of having to recreate criteria.

Agenda Item 7D. 11:37am AdvancED Standards regulations to go out for public comment. Luann Weyhrauch, Assistant Attorney General, Brad Billings, and Director Tamara Van Wyhe clarified that these regulations are coming back before the board for a second time. This is because there was a document that was adopted by reference that was not included in the original public comment period, and the Department of Law mandated that the regulations needed to be approved again by the board to go out for public comment. They took questions and comments from the board regarding these regulations.

Agenda Item 8A. Grade 9 Math Sublevel Scores adoption of proposed regulations. Deb Riddle, Division Operations Manager and Teacher Certification Administrator Sondra Meredith provided an overview of the regulations.

Agenda Item 8B. Basic Competency Exams adoption of proposed regulations. Sondra Meredith and Tamara Van Wyhe provided an overview of the regulations. These regulations will expand the basic competency exam list, and will also alleviate the basic competency exam requirement from one type of certification to another.

The board took an at ease for lunch at 11: 51am and Chair Fields announced that they would resume with Agenda Item 9, regulations to go out for public comment.

Business Meeting

Agenda Item 9A. K-12 Science Standards, Computer Science Standards, and Digital Literacy Standards regulations to go out for public comment. Member Van Diest motioned and Member Kowalski seconded the following motion: I move the State Board of Education & Early Development open a period of public comment on amendments to 4 AAC 04.140 Content Standards to establish computer science standards and publish them as the Alaska Computer Science Standards, update the technology standards and rename and publish them as the Alaska Digital Literacy Standards, and update the science standards and rename and publish them as the Science Standards for Alaska. The motion passed unanimously in a roll call vote. Chair Fields thanked everyone for their work on the standards.

Agenda Item 9B. AdvancED Standards regulations to go out for public comment. Member Griffin motioned and Member Kowalski seconded the following motion: I move the State Board of Education & Early Development open a period of public comment on amendments to 4 AAC 04.300. Standards for state accreditation of schools. The motion passed unanimously in a roll call vote. Member Scott was recused from this vote.

Agenda Item 10A. Grade 9 Math Sublevel Scores proposed regulations to be adopted. Member Van Diest motioned Member Hamilton seconded the following motion: I move the State Board of Education & Early Development to adopt the proposed amendment to 4 AAC 06.822(b), relating to the measurement of student growth in Alaska's new accountability system (the System for School Success). The motion passed unanimously in a roll call vote.

Agenda Item 10B. Basic Competency Exams proposed regulations to be adopted. Member Kowalski motioned and Member Scott seconded the following motion: After considering all public comment, I move the State Board of Education & Early Development adopt the proposed amendments to 4 AAC 12.310 Designation and qualifying scores of teacher competency examination and 4 AAC 12.372 Limited career or technical education certificate (Type M). The motion passed unanimously in a roll call vote.

Agenda Item 11. Standing Reports. Written reports were provided from Student Learning & Educator and School Excellence; Mt. Edgecumbe High School; Libraries, Archives and Museums, and the Assistant Attorney Generals.

Agenda Item 12. Commissioner's Report. Commissioner Johnson thanked DEED staff for their participation in the board meeting and in legislative session. He clarified the comment yesterday from

the House that the minutes were not on the website; all approved minutes are on the website. Once meeting minutes are approved, they are placed on the website. Brittany Hartmann is working with the Representatives to ensure they know where the meeting minutes are located on the website. The Commissioner noted Paul Prussing's retirement and thanked him for his work with the department. The Commissioner appreciated the comments about the Alaska's Education Challenge and encouraged the board to continue to stay focused on the items included in the Challenge. The Commissioner stated with regards to the budget, the commitment of the department, whatever is decided and whatever is sent our way, we will do our job to ensure that it works for students. The Commissioner closed by sharing his appreciation for the board's work yesterday at the retreat and their comments to the joint House and Senate Education Committees.

Agenda Item 13. Museum Collections Advisory Committee Appointments. Patience Frederiksen updated the board on the roles of the Museum Collections Advisory Committee and explained to the board the reason why the board needs to approve these two new members.

Second Vice Chair Van Deist motioned and Member Griffin seconded the following motion: I move the State Board of Education & Early Development appoint Mr. Aaron Leggett and Mr. Charles Ditters to serve three-year terms on the Museum Collections Advisory Committee beginning January 1, 2019. The motion passed unanimously in a roll call vote.

Agenda Item 14. Approve Dr. Niki Tshibaka as Assistant Commissioner. Commissioner Johnson introduced Dr. Tshibaka to the board, and Dr. Tshibaka took questions from board members.

Member Griffin motioned and Member Scott seconded the following motion: I move the State Board of Education & Early Development approve the Commissioner's appointment of Niki Tshibaka as Assistant Commissioner. The motion passed unanimously in a roll call vote.

Agenda Item 15. Approve Linda Mattson as Executive Secretary. Commissioner Johnson shared positive comments about Linda's background and her steady hand in her first few days in her position. Members Kowalski, Hamilton, and Van Diest provided positive comments and appreciation for her work to date.

Member Stockhausen motioned and Member Kowalski seconded the following motion: I move the State Board of Education & Early Development approve the Commissioner's appointment of Linda Mattson as Executive Secretary to the Commissioner and the State Board of Education. The motion passed unanimously in a roll call vote.

Agenda Item 16. Approve the School Construction and Major Maintenance List. Member Scott motioned and Member Kowalski seconded the following motion: I move the State Board of Education & Early Development approve the department's FY2020 final School Construction Grant Fund and Major Maintenance Grant Fund priority lists. The motion passed unanimously in a roll call vote.

Agenda Item 17A. Eagle Academy Charter School Renewal. Member Stockhausen motioned and Member Kowalski seconded the following motion: I move the State Board of Education & Early Development approve the Eagle Academy Charter School application for a period of ten years, terminating on July 1, 2029. The motion passed unanimously in a roll call vote. Member Griffin commented that good people in good programs create good outcomes.

Agenda Item 17B. STreaM Academy Charter School Renewal. Member Kowalski motioned and Member Griffin seconded the following motion: I move the State Board of Education & Early Development approve the STreaM Academy Charter School application for a period of ten years, terminating on July 1, 2029. The motion passed unanimously in a roll call vote.

Agenda Item 17C. Kaleidoscope Charter School Renewal. Second Vice Chair Van Diest motioned and First Vice Chair Hamilton Seconded the following motion: I move the State Board of Education & Early Development approve the Kaleidoscope Charter School application for a period of ten years, terminating on July 1, 2029. The motion passed unanimously in a roll call vote.

Member Lorrington commented that every time she goes to Kaleidoscope she loves the culture that exists within the school and the community.

Agenda Item 18A. Sitka Seaplanes Base. Member Griffin motioned and Second Vice Chair Van Diest seconded the following motion: I move the State Board of Education and Early Development direct DEED staff to work with the Governor's Office, the Department of Law, and the Department of Natural Resources to further investigate the request of the City and Borough of Sitka to purchase the approximately 3.0 acre parcel of land owned by DEED and located at 1190 Seward Avenue in Sitka. The motion passed unanimously in a roll call vote.

Member Stockhausen requested that the board suggest that the board craft language to match what the advisory board recommended regarding any proceeds of the sale of the property go to MEHS. Commissioner Johnson encouraged the board to communicate their intent to advocate the return of the funds to the MEHS. Second Vice Chair Van Diest expressed her desire for the moneys from the sale of the property go to MEHS. Member Lorrington asked who technically owns the land. Luann Weyhrauch answered that the DEED received a quitclaim deed from the Department of Natural Resources (DNR). Technically, DEED owns the land but DNR has a reversionary interest which means that if DNR deems that DEED is not using the land for unrestricted public use and access, the land would revert back to DNR. Member Griffin requested that any funds from the sale of the property go to MEHS. Chair Fields expressed his desire for any proceeds that are generated from the sale go to MEHS as well.

Agenda Item 18B. State Board of Education Public Statement. First Vice Chair Hamilton motioned and Second Vice Chair Van Diest seconded the following motion: I move the State Board of Education and Early Development adopt the following statement:

The State Board of Education and Early Development (board) takes its responsibility to Alaska's students very seriously. Each of us volunteers to serve on the board because we believe in the promise of Alaska's youth. They are the future of our state.

This year, an intense focus has developed on the board's response to Governor Michael J. Dunleavy's proposed budget. The board acknowledges that the State of Alaska's financial challenges call for Alaskans, including its appointed and elected officials, to prioritize re-evaluating its budget. We are pleased with the level of engagement the public has demonstrated in response to our sobering budget reality. With the public testimony that has been delivered, we are confident that public education will continue to be a priority for those with decision-making authority, as it is for the board. Whether our budget increases or decreases or remains the same, it will not change our resolve to use the resources allocated to us to fulfill the three commitments we have made to our youth through Alaska's Education Challenge:

- 1) Improve student success;
- 2) Cultivate safety and well-being; and
- 3) Support responsible and reflective learners.

Finally, we cannot emphasize enough our steadfast support for Alaska's schools, educators, students, and their families. These times require the creative and innovative solutions that can only come through cooperation and partnership with state leadership. It is with this same spirit that the board also extends its support to the Governor and the Legislature, as they work together to pass a sustainable budget that reflects the values of all Alaskans and positions our state for a prosperous future. The motion passed unanimously in a roll call vote.

Agenda Item 19. Consent Agenda. Second Vice Chair Van Diest motioned: I move the State Board of Education and Early Development approve the minutes of December 18, 2018 work session with the following change - to strike "Members Kowalski and Van Diest were not present." The members were present and called in a few minutes after roll call was taken. And the minutes of February 4-5, 2019 meeting and February 14, 2019 meeting. Member Griffin seconded. The motion passed unanimously in a roll call vote.

Agenda Item 20. Executive Session. The board moved to convene in executive session to discuss Commissioner Johnson's evaluation.

At 3:18pm, Chair Fields moved to come out of executive session. First Vice Chair Van Diest seconded. The board came out of executive session without objection.

Board Comments

Member Scott thanked Chair Fields for his leadership during the challenging meetings during the last two days.

Member Griffin shared that despite the challenges that are going on, he is blessed to be on the board and to work to make things better for kids. He is happy for every moment he has.

Member Kowalski concurred with member Scott's comments regarding Chair Fields' leadership. She thanked the commissioner for his work to keep the Alaska's Education Challenge at the focus of the conversation. She shared her excitement about the conversations with the charter schools, and her happiness to hear about the many students who are taking indigenous language classes at MEHS.

Member Stockhausen echoed Member Scott's comments about Chair Fields' leadership. She shared her excitement about the new science standards and is looking forward to seeing how they are implemented.

Second Vice Chair Van Diest welcomed the new staff. She shared her appreciation for yesterday's retreat and the work on the subcommittees, and is excited to see the work that comes out of the subcommittee work. She shared her pleasure to approve for public comment the regulations and is excited to see how stakeholders get involved in the process. She stated goodbye to Member Lorrington as this is her last in person meeting and wished her good luck.

Member Maynard shared her thankfulness about being on the board and looks forward to more meetings and learning.

Member Lorrington thanked the new staff, and recognized Heidi Teshner, the Commissioner, and Chair Fields for their work with the legislature and noted their leadership and that students look up to and need that leadership. She shared her excitement to see where she and the board go from here, and closed by welcoming Member Maynard.

Member Hammill shared his thanks for the warm welcome from the board and staff. He commented on how refreshing it is to see that the focus is on kids and not advancing someone's agenda. He closed by sharing his excitement to see the progress of the new science and computer science standards and is eager to see where it goes.

First Vice Chair Hamilton welcomed Member Maynard to the board, and thanked Member Lorrington for her work. He welcomed the new members of the department staff and stated that he is looking forward to working with them. Thanked the commissioner for his work and agreed that everyone wants to work to make students successful. He closed by encouraging the Commissioner to continue his work with the Alaska's Education Challenge and to not get distracted by other things.

Chair Fields thanked Member Van Meter for his work and welcomed Member Hammill. He also welcomed Member Maynard and thanked Member Lorrington for her work on the board. Chair Fields stated that the clarity that the commissioner has kept is important and this board is meant to be as non-political as possible and the board is intent to keep their integrity. He stated that the kids are worth not having a board that is politically motivated. Chair Fields closed by thanking the board for having his back yesterday at the hearing, and looks forward to the continued work that the board will do together.

Meeting adjourned at 3:32pm.

Alaska State Board of Education & Early Development
Unapproved Minutes
April 24, 2019
Audio/Work session originating in Juneau, Alaska

Wednesday, April 24, 2019

Chair Fields called the meeting to order at 10:00 a.m. After the pledge of allegiance, the board adopted the agenda for April 24, 2019. Roll Call began at 10:00 a.m. Student Advisory Member Mainard was not present. There were no potential conflicts of interest.

Work Session

Agenda Item 1. Commissioner's Report. Commissioner Johnson congratulated the members of the board (Scott, Griffin, and Stockhausen) who were recently confirmed by the Alaska State Legislature. He shared his congratulations to Danielle Rhea, Alaska's Teacher of the Year and one of four finalists for the National Teacher of the Year. Although she was not selected as the National Teacher of the Year, it does not in any way diminish the celebration of her and what she's done for the students at her school. The commissioner and the board celebrated administrative professional's day by providing flowers to Joa Sangster and Linda Mattson for their work.

The commissioner updated the board on the work of the board committees. We have appreciated the patience and the feedback as we go through those meetings. The commissioner highlighted that they are productive ways to advance your agenda as well as the Alaska Education Challenge.

Erin Hardin, DEED Public Information Officer, updated the board on the internal professional work that DEED is doing. She will check with the Department of Law to verify that the board can listen in to those meetings as it may be a public meeting act issue.

Deb Riddle updated the board on the CTE plan regarding the Federal Carl Perkins Law updates. She also updated the board on the department's statewide testing efforts.

Agenda Item 2. Legislative Update. Commissioner Johnson briefed the board on behalf of Chief of Staff Hartmann due to the fact that she was in a legislative hearing and unable to attend. He encouraged the board to read through SB 114 as it may have implications to education in the state.

Board Comments

Chair Fields expressed his appreciation to the newly confirmed board members for their professionalism in their confirmation hearings and is looking forward to their continued work with the board.

Board members expressed their appreciation to Joa Sangster and Linda Mattson for their administrative work as part of administrative professional's day.

The meeting adjourned at 10:32 a.m.

**To: Members of the State Board of
Education and Early Development**

June 7, 2019

From: Dr. Michael Johnson, Commissioner

Agenda Item: 17

◆ ISSUE

The board will hold an executive session to evaluate the performance of the Commissioner of Education and Early Development.

◆ BACKGROUND

- An executive session is necessary for this purpose in accordance with the state's open meetings act, AS 44.62.310(c)(2), specifically the provision related to "subjects that tend to prejudice the reputation and character of any person, provided the person may request a public discussion."

◆ SUGGESTED MOTION

I move the State Board of Education and Early Development convene in executive session to evaluate the performance of the Commissioner of Education and Early Development.