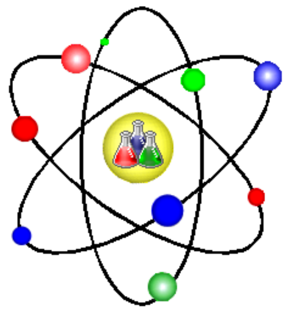
Science Curriculum

Middle School



Juneau School District Board of Education

Adopted April 17, 2018

Juneau Schools District Science Curriculum, Middle School

JSD Middle School Science Curriculum

Introduction

"Don't forget our way of life. This wonderful thing that was born on the world, that saved our ancestors. Don't ever let it go. Hold onto it. It was born for us," - K aajaakwti, Dr. Walter Soboleff, L'eeneidi, Dog Salmon Clan Leader, Scholar

The Juneau School District K-12 Science Curriculum represents the essential skills and knowledge that students will need to be scientifically literate citizens in the twenty-first century. By adopting this curriculum, the Juneau School District affirms its commitment to provide a guaranteed and viable science education for all of our students.

Many stakeholders of the community were involved in developing this curriculum. The goal was to uphold our students to rigor by integrating culturally-relevant and place-based experiences and using the Next Generation Science Standards (NGSS) as the foundation framework.

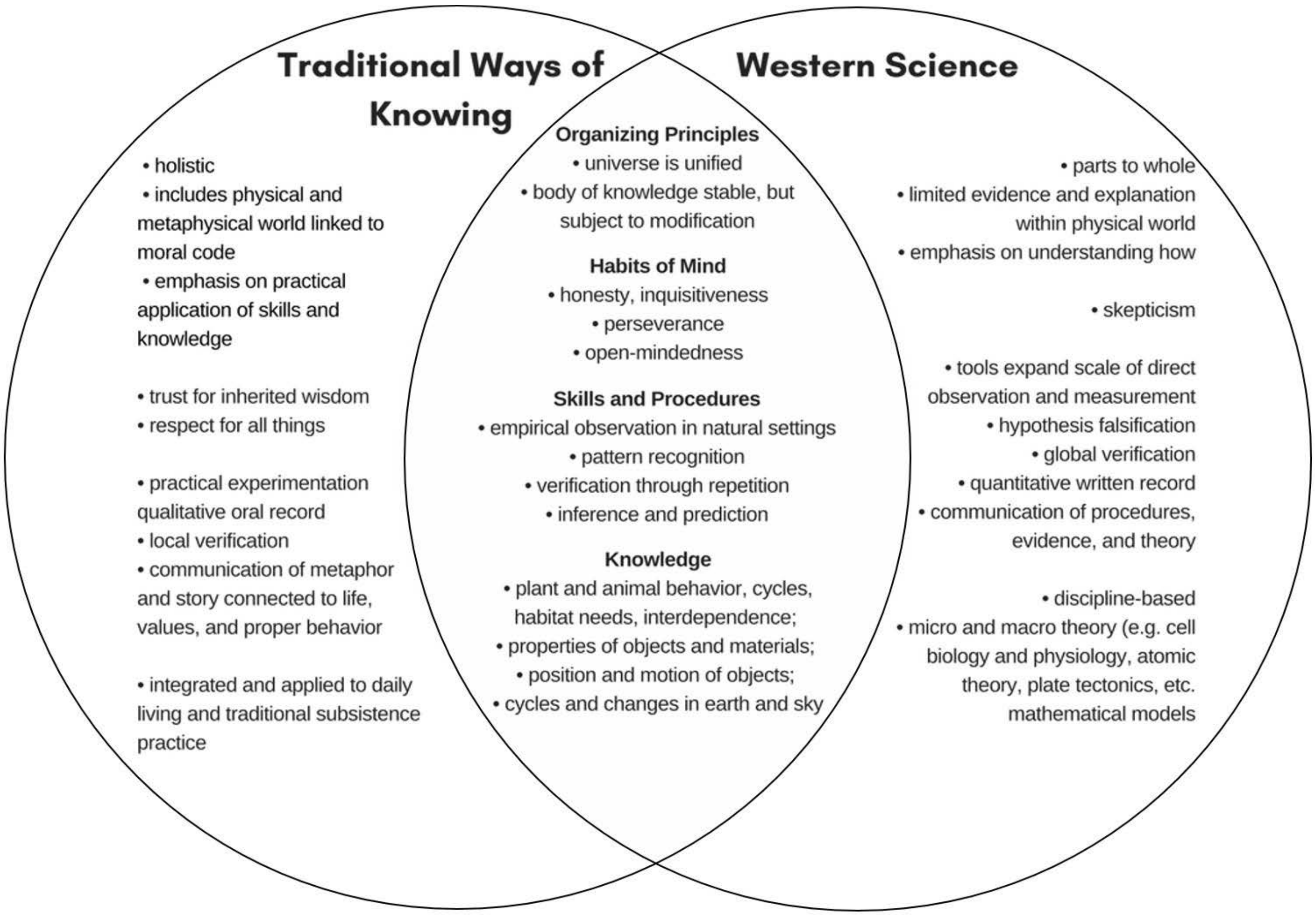
"Place-based education involves integrating local history, indigenous [Tlingit] knowledge and a deep sense of place into the curriculum. Place-based education is the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science and other subjects across the curriculum. This approach to education, which emphasizes hands-on, real-world learning experiences, increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens. Community vitality and environmental quality are improved through the active engagement of local citizens, community organizations, and environmental resources in the life of the school." (*Place-Based Education Connecting Classrooms & Communities* by David Sobel, Orion Society, 2005).

The use of phenomenon is another dominant component throughout K-12, as the goal of building knowledge in science is to develop general ideas, based on evidence, that can explain phenomena. Phenomena are observable events that occur in the universe. When students are motivated to explain these observable events, the focus of learning shifts from learning about a topic to figuring out why or how something happens.

This document is a reflection of what our community values in education: high standards for all students and a deep respect for both indigenous and Western Knowledge that connects students to this unique place we call home.

Qualities Associated with Traditional Knowledge and Western Science

"Indigenous Knowledge Systems and Alaska Native Ways of Knowing," Ray Barnhardt and Angayuqaq Oscar Kawagley, Anthropology Education Quarterly, vol.36, no.1, 2005



Traditional Native Science is a universal intellect of thought that shares common organizing principles of Western Science. The use of these two knowledge systems mutually strengthen students' connection with place and understanding of local and global issues. The goal is: Wooch een yéi jidané-working together.

Curriculum Organization

"Every student deserves the opportunity to learn in a world-class educational setting that is respectful and free from bias."
- JSD Board Policy 0450

The curriculum is organized for three levels of education in our district (K-5, 6-8, 9-12) and aligned with:

- Alaska Cultural Standards
- Alaska English Language Arts and Math Standards
- Alaska Science Standards
- International Standards in Technology Education (ISTE)
- Next Generation Science Standards (NGSS)

The Next Generation Science Standards, authored by a consortium of 26 states, is based on the national Framework for K-12 Science Education. Released in 2013, it was a collaborative effort to defining key elements of science and describing progressive steps that help students grow in their capacity to do science. The goal is to shift the focus of learning about a topic to figuring out why or how something happens. The NGSS promote science literacy including an appreciation of understanding how the natural world works and interfaces with the designed world.

The Science Committee worked diligently to make this curriculum relevant to Juneau students by including local phenomena, and cross-curricular, cultural, and place-based connections for each grade-level topic. We will continue to expand cultural and place-based connections over time. Live links to NGSS and other online resources are provided across the curriculum and are identified as underlined in suggested activities and cultural and place-based resources.

The NGSS are organized around three dimensions of how science is practiced:

1. Cross-cutting themes: 7 cross cutting concepts that are a way of linking across multiple content areas.
   a. Patterns, similarity and diversity
   b. Cause and effect
   c. Scale, proportion and quantity
   d. Systems and system models
   e. Energy and matter
   f. Structure and function
   g. Stability and change

2. Disciplinary Core Ideas: 4 key domains of science.
   a. Physical science
   b. Life science
   c. Earth and space science
   d. Engineering, technology and science applications

3. Science & Engineering Practices: Practices for students to think and act like scientists and engineers across all domains.
    a. Asking questions and defining problems
    b. Developing and using models
    c. Planning and carrying out investigations
    d. Analyzing and interpreting data
    e. Using math and computational thinking
    f. Constructing explanations and designing solutions
    g. Engaging in argument from evidence
    h. Obtaining, evaluating and communicating information

The NGSS includes learning goals related to engineering, technology, and applications of science across the K-12 span. These goals highlight a focus on engaging students in the science and engineering practices - all essential components of Science, Technology, Engineering, and Math (STEM). It is also intended to educate learners for civic engagement and personal fulfillment connecting student experiences to societal or personal concerns that require scientific or technological knowledge. STEM and NGSS are complementary and provide the vision for our curriculum to prepare our students to address the challenges and opportunities of the future.

Elementary Curriculum

The Elementary curriculum is organized by the following three domains, with specific topics at each grade level.

1. Earth Science
2. Physical Science
3. Life Science

Performance expectations develop ideas and skills that allow students to explain complex phenomena in the four disciplines as they progress to middle school and high school. Students develop an understanding of the four disciplinary core ideas, beginning with recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s).

Students will participate in hands on learning experiences and investigations. They will use critical thinking and problem solving skills to explore the world. This document is inspired by cultural and place based phenomena. (*Topic Arrangements* of the Next Generation Science Standards Achieve, Inc. 2013)

Middle School Curriculum

Students continue to develop understanding of the three core branches of science: Earth and Space, Physical and Life. The Performance Expectations blend the core ideas with Scientific and Engineering Practices and Crosscutting Concepts to support students in developing useable knowledge across the science disciplines.

Each year, students will explore the Nature of Science to provide a foundation in reasoning, thinking, and methodology so that they graduate seeing themselves as scientifically literate.

The goal for middle school students is to have more experience in engineering design by defining problems more precisely, conducting a more thorough process of choosing the best solution, and optimizing the final design. (*Topic Arrangements of the Next Generation Science Standards*, Achieve, Inc. 2013)

Middle School is organized by topic and grade:

Grade 6 Physical Science

- Nature of Science
- Matter and Energy
- Chemical Reactions
- Forces and Interactions

Grade 7/8 Life Science

- Nature of Science
- Cells
- Body Systems
- Heredity, Evolution
- Ecosystems

Grade 7/8 Earth and Space Science

- Nature of Science
- Space Systems
- History of Earth
- Earth's Systems
- Weather and Climate

High School Curriculum

High School students continue to build upon their middle school learning about the nature of science, physical, life, and earth sciences. The required courses for graduation, Physical Science and Biology, include the most fundamental concepts of chemistry, physics, and life science and are intended to leave room for further study in upper level high school courses.

Physical Science topics include: Nature of Science, Matter and Interactions, Motion and Stability (Forces and Interactions), Energy, Waves and their application in Technology for Information Transfer. Physical Science topics engage students in more in-depth phenomena central to the physical sciences. The physical science performance expectations focus on scientific practices including: developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and using these practices to demonstrate understanding of core ideas. Students are also expected to demonstrate understanding of several engineering practices including design and evaluation. *(Topic Arrangements of the Next Generation Science Standards, Achieve, Inc. 2013).*

Life Science/Biology ideas build upon students' science understanding and address life science topics: Nature of Science, Photosynthesis/Cellular Respiration, Genetics, Evolution, Ecology and Anatomy and Physiology. 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. *(Topic Arrangements of the Next Generation Science Standards, Achieve, Inc. 2013).*

High School Courses are sequenced with the two required courses (2 credits) to meet district graduation requirements, Physical Science and Biology, and require students to take a third credit of science from the elective science options.

Elective course options include Honors and AP courses which students may take as advanced learning options and courses connected to dual credit opportunities and Alaska's high demand career pathways in Health Sciences, Marine Biology, and STEM.

- Honors and AP course options include:
    - Honors Biology, Honors Physical Science, Honors Chemistry, AP Biology, AP Environmental Science, AP Physics.
- Elective science course options include:
    - Applied Science-STEM, Earth Science, EMT, ETT, Fisheries Tech I and II, Forensic Science, Geology, Human Anatomy and Physiology, Introduction to Chemistry, Introduction to Engineering Design, Introduction to Health Sciences, Marine Biology, Oceanography, Outdoor Biology, Physics, Principles of Engineering.

Course descriptions and syllabi are provided for all these course offerings, and the curriculum defines the content for the required Physical Science and Biology courses.

Community Connections

There has been active community involvement throughout 2016-17 in revising the science curriculum. Community members are excited about the adoption of NGSS and its focus on inquiry-based, cross-disciplinary, and place-based learning. The Committee has used the JSD STEM Coalition Database, suggestions from committee members, and community networking events to develop links to specific Juneau and Alaska-based science experiences. Ongoing work is needed to organize ideas for resources so that they are 1) continually kept up to date and 2) easily and usefully accessed by a wide range of teachers. JSD will coordinate that organizing work with the Juneau STEM Coalition and other community partners including local Native organizations.

Science Committee Members 2016-2017

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Joanna Hinderberger, GAST
Julie Leary HBV
Kimberly Frangos, GV
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Henry Hopkins, JDHS
James White, DHMS
Jessica Cobley, FDMS
Jonathan Smith, JDHS
Kristen Wells, TMHS
Kathleen Galau, TMHS
Rebecca Farrell, FDMS
Ryia Waldern, YDHS
Ruby Hughes, Cultural ParaEducator, DHMS/JDHS
Topaz Shyrock, TMHS

District Administrators
Barbara Cadiente-Nelson, K-12 Native Students Success Coordinator, Teaching & Learning Support
Kristy Dillingham, Principal, Mendenhall River Community School
Haifa Sadighi, Assistant Principal, Floyd Dryden Middle School

Parents/Community Members

Angie Lunda, Science Educator, faculty, UAS School of Education
Bjorn Wolter, Parent, Science Educator, Alaska Department of Education & Early Development
Bonita Nelson, Biologist, NOAA
Brenda Taylor, Parent, Math Teacher, Juneau Community Charter School
David Katzeek, Cultural Knowledge Bearer, Chair, Juneau Indian Studies Program
Elissa Borges, Consultant, Juneau Indian Studies Program
Kelly Sorenson, Educator, Discovery Southeast
Kristen Romanoff, Parent, Science Educator, Alaska Department of Fish and Game
Lori Buzzell, Parent, Administrative Assistant, Teaching & Learning Support
Marilyn Sigman, Science Educator, Alaska Sea Grant
Norma Shorty, Curriculum Specialist Contractor, Juneau Indian Studies Program
Paul Berg, Curriculum Specialist, Goldbelt Heritage Foundation
Peggy Cowan, Science Consultant, Alaska Sea Grant
Rebecca Soza, STEM, Juneau Economic Development Council
Sarah King, Parent, Administrative Assistant, Teaching & Learning Support
Stephanie Hoag, Science Educator

Facilitators

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Pam Garcia, Instructional Coach, Teaching & Learning Support
Ted Wilson, Director, Teaching & Learning Support

JSD Middle School Science Curriculum

K-12 Science Curriculum: Scope and Sequence

Grade	Life	Physical	Earth	Other
Elementary School				
K	Interdependent Relationships in Ecosystems, Plants, and their Environment	Forces and Interactions: Pushes and Pulls	Weather and Climate	
1	Structure, Function, and Information Processing	Waves: Light and Sound	Space Systems: Patterns and Cycles	
2	Interdependent Relationships in Ecosystems	Structure and Properties of Matter	Earth's Systems: Processes that Shape the Earth	
3	Interdependent Relationships in Ecosystems Inheritance and Variation of Traits	Forces and Interactions	Weather and Climate	
4	Structure, Function, and Information Processing	Energy Waves: Waves and Information	Earth's Systems: Processes that Shape the Earth	
5	Matter and Energy in Organisms and Ecosystems	Structure and Properties of Matter	Earth's Systems Space Systems: Stars/Solar System	
Middle School				
	Life	**Physical**	**Earth**	**Other**
6		QA=Nature of Science QB= Matter & Energy QC=Chemical Reactions QD=Forces and Interactions		
7 Rotating in DZ	Nature of Science Q1 = Cells Q2 = Body Systems Q3= Heredity, Evolution Q4= Ecosystems		Nature of Science Q1 = Space Systems Q2 = History of Earth Q3 = Earth Systems Q4 = Weather and Climate	
8 Rotating in DZ	Nature of Science Q1 = Cells Q2 = Body Systems Q3= Heredity, Evolution Q4= Ecosystems		Nature of Science Q1 = Space Systems Q2 = History of Earth Q3 = Earth Systems Q4 = Weather and Climate	

JSD Middle School Science Curriculum

High School				
	Life	**Physical**	**Earth**	**Engineering**
9		Physical Science/Honors ● Nature of Science ● Matter & Interaction ● Motion & Stability ● Energy ● Waves & their applications in technologies for info transfer	Physical Science/Honors ● Nature of Science ● The universe and stars ● Earth and solar system ● Weather and Climate ● Natural Resources	
10	Biology/Honors ● Nature of Science ● Photosynthesis/Cellular Respiration ● Genetics ● Evolution ● Ecology ● Anatomy and Physiology		Biology/Honors ● Nature of Science ● Weather & Climate ● Biogeology ● Human Impact - Earth’s Systems ● Global Climate Change	
High School Electives (offered depending on school, staff, resources, student demand) (* = CTE courses, # = UAS Dual Credit)				
	*Outdoor Biology	Intro Chemistry	*Geology, .5 credit	*Intro to Eng Design
	#*Marine Biology	Honors Chemistry	*Earth Science/Geology, 1 credit	*Principles of Engineering
	*Human Anatomy and Physiology	Physics		*Applied Science -STEM, .5 credit
	#*Intro Health Sciences, .5 credit	AP Physics		
	AP Biology	#*Forensic Science, .5 credit		
	#*ETT, .5 credit	#*Oceanography		
	#*EMT	AP Environmental Science		
	#*Fisheries Tech I, .5 credit			
	#*Fisheries Tech II, .5 credit			

Alaska Cultural Resources

The following are additional cultural resources and references to support the science curriculum. Some have already been cited in specific grade-level topics in which they align to.

Cultural Tool Kit

- **http://www.ankn.uaf.edu/publications/knowledge.html (Guidelines for Respecting Cultural Knowledge)**
- **http://www.ankn.uaf.edu/publications/Knowledge.pdf (Guidelines for Respecting Cultural Knowledge)**
- **http://www.goldbeltheritage.org/wp-content/uploads/2016/09/GHF-Elder-Culture-Bearer-Request.pdf**
- How to **prepare your students for an elder visit** by Roby Littlefield
- **Tlingit Elders Traditional Education Checklist**
- Email **isp@juneauschools.org** for support in developing or delivering culturally relevant, place-based curricula - Elder Support
- **Indigenous Knowledge Systems/Alaska Native Ways of Knowing** - Venn diagram comparing Traditional Knowledge and Western Science
- **https://drive.google.com/file/d/1XNx2og-mbN7m0yrFgUGq9JaOUXimp7TN/preview (Tlingit Ecological Knowledge / Traditional Oral Narratives: Lecture by Dr. Daniel Monteith**
- **https://vimeo.com/47734749 "Our Grandparents' Names on the Land" - "Our names are science," D. Katzeek**
- Oral Narratives protocols [work in progress - Indian Studies Program, Juneau School District]
- **http://tlingitlanguage.com/media/Nyman_1993.pdf** (Juneau place-based resource)
- **https://trt.geolive.ca/stories.html** (Yanyeidi Clan History of T'aaku Kwaan as told by Yanyeidi Elder (Canadian):
- **http://tlingitlanguage.com/wp-content/uploads/2015/01/Dauenhauer-1987-Haa-Shuk%C3%A1.pdf ("Our Science is our Stories - D. Katzeek")**
- **http://tlingitlanguage.com/media/Dauenhauer-Beginning-Tlingit.pdf**
- **Dictionary of Tlingit by Keri Edwards**
- **http://www.goldbeltheritage.org/wp-content/uploads/2014/02/Tlingit-Dictionary-GHF-UAS-and-Twitchell.pdf**
- **http://www.sealaskaheritage.org/sites/default/files/BeginningTlingitWorkbook.pdf**
- **http://www.sealaskaheritage.org/programs/Language%20Resources/Tlingit_dictionary_web.pdf**
- **https://www.sharingourknowledge.org/program_pdfs/2009_program.pdf**
- **https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd475457.pdf** (Our Food is our Way of Life)

Ways to Include Alaska Culture in the Classroom

- Utilize Juneau School District- Indian Studies Program, Goldbelt Heritage Foundation, Sealaska Heritage Foundation, Douglas Indian Association (a.k.a. T'aaku Kwaan Tribal Government), and Tlingit & Haida Central Council for cultural resources, elders and place based curriculum
- Email JSD Indian Studies (isp@juneauschools.org) or speak to your school's cultural expert on content, protocols, narratives, etc.
- Consider bringing students' summer camp projects from local tribal organizations into the classroom; Héen Latínee Outdoor Classroom - a curriculum guide including Glacier Migration, Stream Ecology & the Story of Soil. *(Proposing a collaborative project between Goldbelt, Fisheries, Marine Biology, UAS and Juneau School District)*.
- Give cultural examples when describing frequent science terms: Phenomena Observations- for example, up in Yukon, white fish come in when the buds come in on plants. Also, take students outside and explore the land at the start. Honing their observation skills.
- --->Scientific Investigations - based around traditional knowledge (for example, Alaska Native Science Fair)

Alaska Cultural Resources Relevant to Teaching Science

- **http://www.ankn.uaf.edu/curriculum/Tlingit/Salmon/axehand.html (Axe Handle Curricula Framework for Place-Based Education)**
- **http://nsgl.gso.uri.edu/aku/akue99001.pdf (Sun, Moon, Tide by Dolly Garza)**
- **http://www.ankn.uaf.edu/publications/handbook/handbook.pdf**
- **http://www.ankn.uaf.edu/publications/VS/toteacher.html Village Science by Alan Dick**
- **http://www.goldbeltheritage.org/elementary-resources/science-units-elementary**
- **http://www.goldbeltheritage.org/middle-school/science-units-middle-school**
- **http://www.goldbeltheritage.org/high-school/science-units-high-school**
- **https://drive.google.com/file/d/0BykCjaiQvmszRnM2ZGw4WE9hQmc/preview (High School Héen Latínee Outdoor Classroom - a curriculum guide including Glacier Migration, Stream Ecology & the Story of Soil)**
- Sealaska Heritage Foundation Middle School Science Curriculum (Developmental Language Process Resource): **http://www.sealaskaheritage.org/institute/education/resources/sciencems**
- Sealaska Heritage Foundation Grade 6 Science (Developmental Language Process Resources)
- Grade 6 Book One: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20Unit%201.pdf**
- Grade 6 Book Two: **http://www.sealaskaheritage.org/sites/default/files/science_6_book_2_web.pdf**
- UNIT 1 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20Unit%201.pdf**
- UNIT 2 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20Unit%202.pdf**
- UNIT 3 B–1: Concepts of Physical Science:**http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%204.pdf**
- UNIT 4 B–1: Concepts of Physical Science**:http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%204.pdf**
- UNIT 5 C–1: Concepts of Life Science: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%205.pdf**
- UNIT 6 C–1: Concepts of Life Science:**http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%206.pdf**
- UNIT 7 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%207.pdf**

- UNIT 8 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%208.pdf**
- UNIT 9 E–1: Science and Technology; F–1: Cultural, Social, Personal Perspectives of Science; G–1: History of Science: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%209.pdf**
- UNIT 10 Raven and the King Salmon: **http://www.sealaskaheritage.org/sites/default/files/Science%20Grade%206%20UNIT%2010.pdf**
- SHI Grade 7 Science (Developmental Language Process Resources)
- Grade 7 Book One: **http://www.sealaskaheritage.org/sites/default/files/Book1_Grade7.pdf**
- Grade 7 Book Two: **http://www.sealaskaheritage.org/sites/default/files/Book2_Grade7.pdf**
- UNIT 1 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/unit1_1.pdf**
- UNIT 2 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/unit2_1.pdf**
- UNIT 3 B–1: Concepts of Physical Science: **http://www.sealaskaheritage.org/sites/default/files/unit3_1.pdf**
- UNIT 4 B–1: Concepts of Physical Science: **http://www.sealaskaheritage.org/sites/default/files/unit4_1.pdf**
- UNIT 5 C–1: Concepts of Life Science: **http://www.sealaskaheritage.org/sites/default/files/unit5_1.pdf**
- UNIT 6 C–1: Concepts of Life Science: **http://www.sealaskaheritage.org/sites/default/files/unit6_1.pdf**
- UNIT 7 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/unit7_1.pdf**
- UNIT 8 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/unit8_1.pdf**
- UNIT 9 E–1: Science and Technology; F–1: Cultural, Social, Personal Perspectives of Science; G–1: History of Science:**http://www.sealaskaheritage.org/sites/default/files/unit9_1.pdf**
- GLOSSARY: **http://www.sealaskaheritage.org/sites/default/files/glossary_2.pdf**

- SHI Grade 8 Science (Developmental Language Process)
- Grade 8 Book One: **http://www.sealaskaheritage.org/sites/default/files/Book1_Science8.pdf**
- Grade 8 Book Two: **http://www.sealaskaheritage.org/sites/default/files/Book2_Science8.pdf**
- INTRODUCTION: **http://www.sealaskaheritage.org/institute/education/resources/sciencems**
- UNIT 1 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/UNIT1_0.pdf**
- UNIT 2 A–1: Science as Inquiry Process: **http://www.sealaskaheritage.org/sites/default/files/UNIT2_0.pdf**
- UNIT 3 B–1: Concepts of Physical Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT3_0.pdf**
- UNIT 4 B–1: Concepts of Physical Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT4_0.pdf**
- UNIT 5 C–1: Concepts of Life Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT5_0.pdf**
- UNIT 6 C–1: Concepts of Life Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT6_0.pdf**
- UNIT 7 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT7_0.pdf**
- UNIT 8 D–1: Concepts of Earth Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT8_0.pdf**
- UNIT 9 E–1: Science and Technology; F–1: Cultural, Social, Personal Perspectives of Science;
- G–1: History of Science: **http://www.sealaskaheritage.org/sites/default/files/UNIT9_0.pdf**
- UNIT 10 Story of the Frog Crest of the Kiks.ádi of Wrangell: **http://www.sealaskaheritage.org/sites/default/files/UNIT10_1.pdf**
- GLOSSARY: **http://www.sealaskaheritage.org/sites/default/files/glossary_1.pdf**
- Soapberries - Medicinal Use (Helen Watkins - SHI Soapberry Contest with many Elders)
- **https://vimeo.com/71717**

- **89'Nothing but dinner': Seaweed on the plate** - newspaper article about Dolly Garza
- **http://www.adfg.alaska.gov/index.cfm?adfg=subsistence.main** - Subsistence in Alaska - ADF&G
- Village Science- published by Alaska Native Knowledge Network, UAF

Books:

Barnhardt, R. & Kawagley, A.O. (2011). *Alaska Native Education-Views From Within.*
Barnhardt, R. & Kawagley, A.O. (2005). ***Indigenous knowledge systems/Alaska native ways of knowing.***
Barnhardt, R. & Kawagley, A.O. (2011). *Sharing Our Pathways: Native Perspectives on Education in Alaska.*
Biggs, C. (1999). Volume 1 & 2; Wild Edible and Medicinal Plants: Alaska, Canada and Pacific Rainforest. [Resource for medicinal plants]
Garza, D. (2013). Surviving on the Foods and Water from Alaska's Southern Shores. *[Resource for traditional foods]*
Garza, D. (2011). ***Alaska Native Science: A Curriculum Guide.*** Alaska Native Knowledge Network; University of Alaska Fairbanks.
Fortuine, R (1989). Chills And Fever: Health and Disease in the Early History of Alaska. University of Alaska Press.

TRADITIONAL ECOLOGICAL KNOWLEDGE (RESEARCH):

Hunn, Eugene S., Johnson, Darryll, Russell, Priscilla, Thornton, Thomas F Glacier Bay Science Symposium on Huna Seagull Egg Harvest: **https://www.nps.gov/glba/learn/nature/upload/Hunn_etal2007_GullEggHarvests.pdf**
Langdon, Steve Herring Synthesis: Documenting and Modelling Herring Spawning Areas Within Socio-ecological Systems **http://herringsynthesis.research.pdx.edu/final_docs/HerringSynthesisFINAL102710.pdf**
Langdon, Steve (2006) Traditional Knowledge and Harvesting of Salmon by Huna and Hinyaa Tlingit: **http://www.goldbeltheritage.org/wp-content/uploads/2014/03/Fisheries-Unit-Traditional-Knowledge-Final-Report1.pdf**
Nyman, E., & Leer. J. (1993). *Gágiwduł.àt: brought forth to reconfirm: the legacy of a Taku River Tlingit clan.*
Stewart, H. (1995). *Indian Fishing: Early Methods on the Northwest Coast.* University of Washington Press.
Williams, M. (2009). *The Alaska Native Reader: History, Culture, Politics.* Duke University Press Books.
Davis, Neil. (1982) *Alaska Science Nuggets.* University of Alaska Press. [Resource filled with science relevant to Alaska]

Additional Secondary Science Curriculum Resources

General State Resources - Free
Users may need sign-in credentials for these State provided databases.
Contact your school librarian or the State or Public Libraries for information.

1. SLED • SLED, the Statewide Library Electronic Doorway, is an easy-to-use website that connects to high quality Alaska information. Once you leave SLED's main menu, SLED cannot control the information you access.
   - It was developed by the Alaska State Library and Rasmuson Library, University of Alaska Fairbanks, and is currently supported by the Alaska State Library.
2. Science
3. Databases found on SLED
4. Relevant science resources for secondary
   - Brainpop
   - Brainpop Educators

Websites with free resources:
- Alaska Energy Smart: http://www.akenergyefficiency.org/about-us/
- Alaska State Museum: State Museum Hands-On Loan Program
- Bozeman Science: www.bozemanscience.com
- Explore by the seat of your pants: www.exploringbytheseat.com
- Google Earth: www.google.com/earth/
- Juneau City Museum: Tours and Educational Kits
- Mosa Mack Science: https://mosamack.com/
- National Science Foundation, Science 360 videos: https://science360.gov/files/
- NGSS Phenomena: https://www.ngssphenomena.com/
- PhET Online Simulations www.phet.colorado.edu
- Philanthropic media organization: www.explore.org
- Taku River Tlingit Place Names: Trt.geolive.ca
- The Globe Program: www.gobe.gov
- The Nature Conservancy: www.nature.org
- UAF: Geophysical Institute http://www.gi.alaska.edu/
- UC Berkeley Evolution: evolution.berkeley.edu

State of Alaska: Alaska Wildlife Notebook
The Alaska Wildlife Notebook Series is an encyclopedia of Alaska's wildlife, ranging from little brown bats to blue whales. It is available online and in print form, as a perfect-bound, 300-page black and white book. The Alaska Wildlife Notebook series has long been one of the most popular publications of the Alaska Department of Fish and Game. The book was updated in 2008 and the new edition, revised by department biologists, features more than 150 different animals. Included are: big game, small game, furbearers, nongame animals, birds, fish, shellfish, reptile and amphibians. Each chapter offers insights into the life history, reproductions, feeding habits, management and conservation of Alaska's diverse wildlife. Links are also provided throughout the curriculum where appropriate.

<table>
<tr><td>Course: Physical Science</td><td>Grade: 6</td></tr>
<tr><td colspan="2">Course Description: Sixth grade science is an introduction the core topics of Physical Science and the Nature of Science as it relates to Western Science and Cultural Ways of Knowing. The core topics include: Matter and Energy, Chemical Reactions and Forces and Interaction. The Nature of Science refers to teaching students how to “Think like a Scientist”, since it is their first experience with a dedicated science course. The middle school performance expectations in Physical Science expect learners to explain phenomena central to the physical sciences and 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. The practices will be used to demonstrate understanding of the core ideas and make connections to local and place-based phenomena. Students are also expected to demonstrate understanding of several engineering practices, including design and evaluation.</td></tr>
<tr><td>Course overview:
• QA: Nature of Science
• QB: Matter & Energy
• QC: Chemical Reactions
• QD: Forces and Interactions</td><td>Content:
• Structure and Properties of Matter: Matter and Energy
• Definitions of Energy
• Conservation of Energy and Energy Transfer
• Defining and Delimiting Engineering Problems
• Developing Possible Solutions
• Structure and Properties of Matter: Chemical
• Chemical Reactions
• Forces and Motion
• Types of Interactions</td></tr>
</table>

<table>
<tr><td>QA Instructional Focus: Nature of Science</td><td rowspan="4">Suggested Anchor Phenomena: Any Discrepant Event
Water and alcohol with ice cubes
Essential Questions:
How can we use science to understand our environment /world/universe?”
What is science?
What are the ways in which science is accomplished?
What other ways of knowing are there other than western science?
What are the ancient narratives of community and landscape that reveal the process of science?
What do we learn of Tlingit practices of old which are important to current understandings and applications of science today?
How do Tlingit place names reflect scientific knowledge?
What is a theory and what is a law?
What is the importance of modeling and peer review?
What is pseudoscience? How can it be used to mislead?
How has the process of science evolved over time?</td><th colspan="2">Standards</th></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>B1, D5, E3, E4</td></tr>
<tr><td>Pacing Explanation: In 6th grade, students are experiencing a dedicated Science Class for the first time. Because of this, <u>teachers are expected to include 2 in-depth place-based lessons</u> that allow students to fully engage in the Nature of Science content described here.</td><td>Alaska ELA Standards

Alaska Math Standards

Alaska Science Standards</td><td>RI.6.2, RI.6.7, RI.6.8, W6.1, W6.2, W6.8, W6.9

MP 1-5

SA1.1, SA1.2, SA2.1, SA3, SA3.1, SE2, SG1, SG2, SG3, SG4</td></tr>
<tr><td>Content/Topics:
Scientific Investigations
Scientific knowledge
Scientific Models, Laws, Theories, Principles and Phenomena
As a Human Endeavor</td><td>ISTE</td><td>3, 4, 5</td></tr>
</table>

Alaska Cultural Standard to Emphasize	**Community Contacts**
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **3**: Demonstrate and understand the relationship between worldview and the way knowledge is formed and used.	• **STEM Database Community Resources** • **AK Dept. Fish & Game:** SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural & Place-Based Connections</th></tr>
<tr><th>Nature of Science: Performance Expectations (PEs)</th><th>Nature of Science: Major Themes</th></tr>
<tr>
<td>NGSS Appendix H: Design and revise multiple basic scientific investigations to test a hypothesis regarding an explanation to an observed phenomenon.

Clarification Statement: Designs and implementation should include a testable hypothesis, quantifiable data, adequate controls for repeatability, and proper data analysis and conclusion. The overall significance of the findings should be presented in context.

Assessment Boundary: Assessment should not be restricted to any one specific “scientific method.” Assessments should emphasize the need for peer review in science and the difference between science and other ways of knowing.</td>
<td>NGSS Appendix H: Middle School grade level themes for understanding the nature of science
• Scientific Investigations Use a Variety of Methods
• Scientific Knowledge is Based on Empirical Evidence
• Scientific Knowledge is Open to Revisions in Light of New Evidence
• Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
o Theories and laws provide explanations in science but theories do not with time become laws or facts
o A scientific theory is substantiated by some aspect of natural world, based on a body of facts that has repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted
• Science is a Way of Knowing
• Scientific Knowledge Assumes an Order and Consistency in Natural Systems
• Science is a Human Endeavor
• Science Addresses Questions About the Natural and Material World</td>
<td>Activities:
• <u>Oobleck Lab(GEMS unit)</u>
• 2 Place based units
• <u>Place base field trip/lab</u>
• <u>Erosion Lab</u>
• <u>Biology corner scientific method</u>
• <u>Sealaska Heritage Institute: Language Development, Book 1, Unit 1 & 2</u></td>
<td>Tlingit World View:
Observe, Listen, Test, Perfect
Wooch.een: How do these work together? Affect the other? In every action is a reaction:
Wooch Yaxhdati: Balance
Yan kásanóo: Prove it!
Technological Expertise & Indigenous Knowledge: Why did Tlingit ancestors do it this way and why is it important today? Examples of learning and creating from scientific process: Fish traps, tidal salmon traps, medicinal plants, tool making, traditional clam beds, canoe building, food preservation, watertight baskets.
• Codes of ethics for scientists working with people and environment or marine life. [<u>Arctic Council</u>]
• “Our Science is our Stories” - David Katzeek
• Raven Lessons: “Raven is the Scientific Inquiry Model” (Raven observes, questions, assesses, resolves, concludes, acts)
• Forces of water, back eddies, ability to read the waters, rivers, tides (Tlingit knowledge)
• Why do soap berries, when stirred up with your hands or tool, become fluffy?</td>
</tr>
</table>

QB Instructional Focus: Matter & Energy	Suggested Anchor Phenomena:	Standards	
Pacing: one quarter	• Comparison of Dry ice vs Glacier ice (or freezer ice) **Essential Questions:** • How can particles combine to produce a substance with different properties? • How does thermal energy affect particles? • How can energy be transferred from one object or system to another? • What are the properties of some animal hair that regulate body temperature? (Goat, Bear, Beaver, Birds)	Alaska Cultural Standards	B1, B2, E2, E3, E4
Quarter Content: • Structure and Properties of Matter • Definitions of Energy • Conservation of Energy and Energy Transfer • Defining and Delimiting Engineering Problems • Developing Possible Solutions • Relationship Between Energy and Forces		Alaska ELA Standards	RST.6-8.1, RST.6-8.7 WHST.6-8.8
		Alaska Math Standards	6.NS.5, 6.RP.3, MP2, MP4
		Alaska Science Standards	SB1.1, SB3.1, SB3.2, SD3.2,SD4.1, SB2.1, SE1, SF1, SG1
		ISTE	1c, 3, 5, 7

Alaska Cultural Standard to Emphasize	Community Contacts
E: Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **4:** Determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.	• **STEM Database Community Resources** • **AELP:** Hydro Projects, 463-6303 • **Alaska Energy Smart:** http://www. Akenergyefficiency.org • **Juneau Makerspace**: juneaumakerspace@gmail.com • **Juneau Sailing Club**: http://seasailing.us/ • **NOAA/NMFS**: Chemist 789-6000; Facilities 789-6632 • **REAP:** Energy Education, education @realaska.org 929-7770x6 • **Transparent Devices LLC**: general physics and engineering resources, 957-1014 • **UAS:** Chemistry Professor, 796-6200

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural & Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td><u>MS-PS1-1</u>: 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.

Cross-cutting Concepts: Scale, Proportion, and Quantity <u>(MS-PS1-1)</u>

Science and Engineering Practices: Developing and Using Models <u>(MS-PS1-1)</u></td>
<td><u>PS1.A:</u> 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. <u>(MS-PS1-1)</u>

Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). <u>(MS-PS1-1)</u></td>
<td>Activity Links:
<u>Dry Ice Lab (GEMS unit):</u>
<u>PhET Build-a-Molecule</u>
<u>Periodic table</u>
Research and utilize a variety of models of atoms and molecules.
Examples of molecular level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms. (At this level, students are not expected to explain valence electrons or bonding energy.)
Students design a method to determine the salinity of water by measuring density and comparing to solutions of known salinity.
Make a periodic table using shoes, coffee cups, and ordinary objects, or a class periodic table where students each have a family, creating one wall-sized chart.
<u>Periodic Table Basics</u></td>
<td>Tlingit World View: “Ach áwé hél dutieemi at atxh sitee:” That which is matter, you don’t see what makes up matter: spirit within defines the content.

AELP energy transfer from hydro-plant to town (Snettisham operation)

Phase changes of water across seasons - lakes, rivers

Build periodic table through scavenger hunt and assign elements to industries in town (carbon = capital transit, gold = downtown jewelry shops)</td>
</tr>
</table>

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. **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect (MS-PS1-4) **Science and Engineering Practices:** Developing and Using Models (MS-PS1-4)	**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. (MS-PS1-4) 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. (MS-PS1-4) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) **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 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. (secondary to MS-PS1-4) The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is	**NGSS Activity Links:** • States of Matter Basics • Changes of State **Other Activities:** • Dry Ice Lab (GEMS unit) • Conduct a lab/simulation • Sticky icky-polymers • Slime • A Silly Polymer • Chemistry Units • Alaska Resource Education: Energy Detective	• Discuss indigenous uses, properties of copper, oxidation of copper, where it was traded from in Alaska, and how it is processed. • Hardening of copper and annealing, *Tináa*. • A guest Tlingit artist would be a great resource about copper and how it is processed and hammered out. • NOAA: Hydro-heating of lab • USFS Pacific Northwest Research Station • Airport and Diamond Park, ground heat source pumps • Forest Energy Transfer: C is reduced (energized) through photosynthetic bio-synthesis

	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. *(*secondary to MS-PS1-4)		
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 whiffle ball versus a tennis ball. **Assessment Boundary:** none **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-PS3-1) **Science and Engineering Practices**: Analyzing and Interpreting Data (MP-PS3-1)	**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. (MS-PS3-1)	**NGSS Activity Links:** • Energy Skate Park Basics Energy Exploration • Wind turbine blade design **Other Activities:** • Switch curricula	• Descriptive relationship between kinetic energy and mass: harnessing wind energy (kinetic) for canoe travel increases speed of canoe, depending on canoe mass. • Kwakiutl-Sailing-Boats.jpg • USCG wind turbine • Bowling at Taku Lanes • Avalanches, Mudslides, Rockslides • Skateboarding, skiing, bike riding (mass of person going down slope affects speed) • Juneau Sailing Club: S.E.A.S guest speakers, demonstrations, videos

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, and a Styrofoam cup. **Assessment Boundary:** Assessment does not include calculating the total amount of thermal energy transferred. **Cross-cutting Concepts:** Energy and Matter (MS-PS3-3) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-PS3-3)	**PS3.A: Definitions of Energy:** Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4) **PS3.B: Conservation of Energy and Energy Transfer**: Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) **ETS1.A: Defining and Delimiting Engineering Problems:** 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:** 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)	**NGSS Activity Links:** • Cooking with the Sun - Creating a Solar Oven • Save the Penguins **Other Activities:** • Dry Ice Lab (GEMS unit) • AK Energy Smart: Designing Your Energy Efficient House Part One: The Heat Loss Equation • AK Energy Smart: Designing Your Energy Efficient House Part Two: Modeling Your Energy Efficient House	• Cooking in bentwood boxes: What elements of design allow it to maximize thermal energy transfer? (Can just heat water for activity.) • NOAA Hydro Heating of Lab • Follow how food is shipped to Alaska (contact Alaska Air Cargo, Alaska Marine Lines, Alaska Glacier Seafoods) • Hypothermia • Heat escapes to cooler outdoors when leaving door or window open • Snow cave or igloo • Clothing items that prevent heat loss (insulated boots, different types of coats, gloves, hats…) • Home energy audit guidelines-conduct survey of home

<u>MS-PS3-5</u>: 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. **Cross-cutting Concepts:** Energy and Matter <u>(MS-PS3-5)</u> **Science and Engineering Practices:** Engaging in Argument from Evidence <u>(MS-PS3-5)</u> **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence <u>(MS-PS3-5)</u>	<u>PS3.B:</u> **Conservation of Energy and Energy Transfer:** When the motion energy of an object changes, there is inevitably some other change in energy at the same time. <u>(MS-PS3-5)</u>	**NGSS Activity Links:** • <u>Energy of Motion</u> **Other Activities:** • Catapults • <u>Transfer of energy</u> • <u>Motion energy</u>	• <u>Kinetic energy of Indian Arrowhead</u>: when it hits its target, speed, weight of object. Arrowhead - *T'uka* (Tlingit word for arrow.) • NOAA Hydro Heating of Lab • Airport & Diamond Park Heat pump source • AELP hydro plant - Lake Dorothy • Mass wasting, laws of thermodynamics - ordering of system through dissipation of energy - landslides

Supplemental:			
MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, type of matter, mass, and 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. **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-PS3-4) **Science and Engineering Practices:** Planning and Carrying Out Investigations (MS-PS3-4) **Connections to Nature of Science:** Science Knowledge Is Based on Empirical Evidence (MS-PS3-4)	**PS3.A: Definitions of Energy:** Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4) **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. (MS-PS3-4)	**NGSS Activity Links:** • Heat, Temperature and Conduction • Atmospheric Process: Radiation • Melting Ice **Other Activities:** • AK Energy SMART Curriculum: Designing Your Energy Efficient Home Pat One: The Heat Loss Equation	• Plan an investigation using a Bentwood box to determine relationship between number of heated rocks and water temperature. Can it boil? • Mendenhall Glacier • Learn from local oceanographers- properties of water, ice, salinities and densities as descriptors of states of matter

QC Instructional Focus: Chemical Reactions

Pacing: one quarter

Quarter Content:

- Structure and Properties of Matter
- Chemical Reactions

Suggested Anchor Phenomena:

- Provide students with materials that react (ex: lemon, baking soda, Mentos, coke, diet coke, vinegar, eggs). Let them decide what they mix together to make a new substance.
- How does Alder wood battle bacteria on fish when smoked?

Essential Questions:

- What happens when new materials are formed? What stays the same and what changes?

Standards	
Alaska Cultural Standards	B1, B2, E2, E3, E4
Alaska ELA Standards	RST.6-8.1, RST.6-8.3 RST.6-8.7, WHST.6-8.7
Alaska Math Standards	6.RP.3, 6.SP4 6.SP..5, MP.2 - MP.4
Alaska Science Standards	6. SB1.1, 6 .SB.2.1, 6.SB3.1
ISTE	3, 5, 7

Alaska Cultural Standard to Emphasize

E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.

3: Demonstrate an understanding of the relationship between worldview and the way knowledge is formed and used.

Community Contacts

- **STEM Database Community Resources**
- **NOAA/NMFS**: Chemist 789-6000
- **UAS**: Chemistry Professor 796-6200
- **US Forest Service:** Pacific NW Research Station, 586-7955, 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml

NGSS		Suggested Activities	Cultural & Place-Based Connections
Performance Expectations (PEs)	**Disciplinary Core Ideas (DCIs)**		
MS-PS1-2: Analyze and interpret data on properties of substances before and after substances interact to determine if chemical reaction has occurred. **Clarification Statement:** Reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, mixing zinc with hydrogen chloride... **Assessment Boundary:** Limited to analysis of density, melting point, boiling point, solubility, flammability, and odor. **Cross-cutting Concepts:** Patterns (MS-PS1-2) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-PS1-2) **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence (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. (MS-PS1-2) (*Note*: This Disciplinary Core Idea is also addressed by 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. (MS-PS1-2), (MS-PS1-5) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-3.)	**NGSS Activity Links:** • Can You Copperplate? • Energy Changes in Chemical Reactions • Baggie Chemistry • Design and Build a Biosuit **Other Activities:** • Collect current events from newspapers with elements in the news from Alaskan areas (e.g., mining, water quality). • Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide and mixing zinc with hydrogen chloride. • Create/show compounds, make mixtures (e.g., lemonade, fizzy lemonade made with baking soda). • Energy Changes in Chemical Reactions • PhET lab simulations to model various physical standards • Other labs: Density, Elements, Compounds, Mixtures, Salinity • Adventures in Chemistry	• Chemical reactions in food preservation techniques ensured survival/food during winter. Examples: dried fish/meat. • Tanning seal hides with urine is a chemical reaction that preserved the hide so it could be used in many ways • Indigenous uses of copper- urine and copper mixed together make blue color; properties and oxidation of; where it was traded from in Alaska; how it is processed • How gold is extracted; environmental testing • Ron's Apothecary: How they make medicine • Ocean acidification • CBJ Water Purification Plant • Create ice cream; measure temperature changes and graph; discuss Native ways of making ice cream

<table>
<tr><td>QD Instructional Focus: Forces and Interactions</td><td rowspan="3">Suggested Anchor Phenomena:
<u>Tumble Wing Demonstration:</u> have students recreate with different types of paper
Essential Questions:
How can one describe physical interactions between objects and within system of objects?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>B1, B2, E2, E3, E4</td></tr>
<tr><td rowspan="4">Quarter Content
Types of Interactions
Forces and Motion</td><td>Alaska ELA Standards</td><td>RST.6-8.1, RST.6-8.3 RST.6-8.7, WHST.6-8.7</td></tr>
<tr><td></td><td>Alaska Math Standards</td><td>6.RP.3, 6.SP.4 - 6.SP.5, MP.2 - MP.4</td></tr>
<tr><td></td><td>Alaska Science Standards</td><td>SA1, SB3, SB3.1, SB4, SB4.1, SB4.2, SE1, SF1, SG1</td></tr>
<tr><td></td><td>ISTE</td><td>3, 5, 7</td></tr>
</table>

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E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.
3: Demonstrate an understand of the relationship between worldview and the way knowledge is formed and used</td><td>Community Contacts
<u>STEM Database Community Resources</u>
AELP Director of Energy Service, Hydro Projects, 463-6303
<u>AK Dept. Fish & Game</u>, SE Region Coordinator for Hunter Safety, 586-4101
AK Marine Safety Ed Assoc., Sitka: 907-747-3287 <u>http://www.amsea.org/</u>
<u>Juneau Hydropower Inc.</u>, 789-2775
NOAA Facilities Manager, 789-6632
STEM Robotics Coaches
UAS: Physics and Math Professors, 796-6200
US Coast Guard, 463-2025</td></tr>
</table>

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<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural &
Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td><u>MS-PS2-1</u>: 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.

Cross-cutting Concepts: Systems and System Models <u>(MS-PS2-1)</u>

Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World <u>(MS-PS2-1)</u>

Science and Engineering Practices: Constructing Explanations and Designing Solutions <u>(MS-PS2-1)</u></td>
<td><u>PS2.A:</u> 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). <u>(MS-PS2-1)</u></td>
<td>NGSS Activity Links:
• <u>3 Puck Chuck</u>
• <u>Newton's Third Law: Complete Toolkit</u>

Other Activities:
• Billiards: balls colliding
• Airplane flying through sky
• Rocket launching</td>
<td>• Salmon swimming up a river
• Eagle/Raven flying through air
• Native Youth Olympics
• Gold Medal Basketball
• Basketball, hockey, baseball, golf, bowling, ...
• Vehicle collisions
• Rock fall
• Glacial advance via snowfall</td>
</tr>
</table>

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. Newton's 1st & 2nd Law **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:** 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. **Cross-cutting Concepts:** Stability and Change (MS-PS2-2) **Science and Engineering Practices:** Planning and Carrying Out Investigations (MS-PS2-2) **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence (MS-PS2-2)	**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. (MS-PS2-2) 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. (MS-PS2-2)	**NGSS Activity Links:** • Forces and Motion • Science of NHL Hockey: Newton's Three Laws of Motion • Force and Motion: Newton's Second Law • Acceleration Simulator • Lift Chair Challenge **Other Activities:** • Roller coaster • Newton's comics • Balloon/mousetrap cars • Catapults/trebuchets • Hot Air balloons • Big Mouth tumblewing • Cartesian divers • Labs with diffraction gratings, mirrors, spinners • Inquiry Labs: o Block cars, weights and elapsed times (use variables: add sandpaper to the track; graphite on wheels, graph the block car lab runs and compare) o Catapults - marshmallows o Balloon Races o Scooter Races o Skateboards and raw eggs o Rockets (model, Alka-Seltzer rockets) o Build a marble roller coaster • Project- explain the physics of favorite activity including forces, speed, acceleration, laws of motion and ways	• Totem pole raising • Moving a kayak/canoe to and from beach • Native Youth Olympics • Discuss riding in a car or flying in a Super Cub, include using a GPS and topographic maps for planning a hunting/fishing trip • Playground equipment (swings, teeter-totter, merry-go-rounds…) • Bear moving rocks over to look for crabs, barnacles… • Eagles carrying away salmon • Beavers moving logs and branches • Eaglecrest

		energy is converted between potential and kinetic energy • Compare potential energy of roller coaster car at different points on a roller coaster; or energy of a sled at different positions on hill	
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:** Limited to electric and magnetic fields, and to qualitative evidence for the existence of fields. **Cross-cutting Concepts:** Cause and Effect (MS-PS2-5) **Science and Engineering Practices:** Planning and Carrying Out Investigations (MS-PS2-5)	**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). (MS-PS2-5)	**NGSS Activity Links:** • Inspector Detector Challenge • Floating Static Bands • Build a Charge Detector **Other Activities:** • Compare the potential energy of a magnet held at different positions within a magnetic field or the potential energy of a statically charged balloon at different distances from a classmate's hair • Design and conduct experiments with electromagnets, testing how the strength of the magnet varies with wire length, number of wraps, voltage source, size of core, current, composition of core, neatness of wraps, etc. • Use a compass to detect an electric field around an electrical current.	• Magnetic ore deposits

Supplemental:			
MS-PS2-1: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. **Clarification Statement:** Practical problems could include impact of collisions between two cars, a car and stationary objects, and between a meteor and a space vehicle. **Assessment Boundary:** Limited to vertical or horizontal interactions in one dimension. **Cross-cutting Concepts:** Systems and System Models (MS-PS2-1) **Connections to Engineering, Technology, and Applications of Science:** (MS-PS2-1) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-PS2-1)	**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). (MS-PS2-1)	**NGSS Activity Links:** • 3 Puck Chuck • Newton's Third Law: Complete Toolkit **Other Activities**: • Billiards • PhET simulation	
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. Newton's 1st & 2nd Law	**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	**NGSS Activity Links:** • Forces and Motion • Science of NHL Hockey: Newton's Three Laws of Motion • Force and Motion: Newton's Second Law • Acceleration Simulator • Lift Chair Challenge	• Different types of waves and canoeing • Goldbelt Heritage Foundation: Southeast Math, Lesson 3, Measuring Wavelength; *Ooxjaa Toox yaa Kakux* • Forces and motion on canoe travel/migration. Wind/TIde/Paddlers (Forces) and impact on motion. Stability of canoe based on force

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. **Cross-cutting Concepts:** Stability and Change (MS-PS2-2) **Science and Engineering Practices:** Planning and Carrying Out Investigations (MS-PS2-2) **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence (MS-PS2-2)	object, a larger force causes a larger change in motion. (MS-PS2-2) 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. (MS-PS2-2)	**Other Activities:** • Fire Signal Play	exerted and importance of working together when paddling for survival • Hunter Ed • Orienteering • Tidal Observations-tide charts
MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	**PS2.B: Types of Interactions:** Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes	**NGSS Activity Links:** • Electromagnetic Power!	• Geothermal use of energy at the airport and at NOAA/TSMRI • Magnetic ore deposits

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, or the effect of increasing the number or strength of magnets on the speed of an electric motor. **Assessment Boundary:** Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking. **Cross-cutting Concepts:** Cause and Effect (MS-PS2-3) **Science and Engineering Practices:** Asking Questions and Defining Problems (MS-PS2-3)	of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)	**Other Activities:** • Design and conduct experiments with electromagnets, testing how the strength of the magnet varies with wire length, number of wraps, voltage source, size of core, current, composition of core, neatness of wraps, etc. • Use a compass to detect an electric field around an electrical current.	
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.	**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. (MS-PS3-1)	**NGSS Activity Links:** • Energy Skate Park Basics Energy Exploration **Other Activities:** • Drop balls of different weights, mass and measure speed	• Avalanches, Mudslides, Rockslides • 1958 Lituya Bay landslide caused by earthquake • Design and build a live trap; Invite trappers in to explain their strategies: Alaska Trappers Assoc. • Bowling at Taku Lanes

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 whiffle ball versus a tennis ball. **Assessment Boundary:** none **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-PS3-1) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-PS3-1)		• Design and conduct an experiment to test how an object's mass and/or speed affect its momentum. • Use the design process to build and test a capsule that safely lands an egg dropped from a designated height. • Demonstrate your knowledge of factors that affect the speed of a falling object. • Create a device that uses an electromagnet to accomplish a real-world task (i.e., door lock, vehicle, trap). • Newton's Rollercoaster.	
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, and a Styrofoam cup. **Assessment Boundary:** Assessment does not include calculating the total amount of thermal energy transferred.	**PS3.A: Definitions of Energy:** Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4) **PS3.B: Conservation of Energy and Energy Transfer**: Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)	**NGSS Activity Links:** • Cooking with the Sun - Creating a Solar Oven • Save the Penguins • Mini food Packaging module **Other Activities:** • Building mini-homes with same heat source (light bulb) • Compare the temperature change of different materials as they cool or heat the environment. Apply this to practical applications such as packaging.	• Design, build, test and redesign a salmon smoker. • Snow caves • Compare articles of clothing, sleeping bags, or shelters. Which ones prevent heat loss best? • Geothermal use of energy at the airport • NOAA facilities heating process

Cross-cutting Concepts: Energy and Matter (MS-PS3-3) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-PS3-3)	ETS1.A: **Defining and Delimiting Engineering Problems:** 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:** 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)*		

<table>
<tr><td>Course: Earth & Space Science</td><td>Grade: 7 - 8</td></tr>
<tr><td colspan="2">Course Description: Seventh/Eighth grade science is an introduction to the core topics of Earth and Space Science and a continuation of the Nature of Science, as they relate to Western Science and Cultural Ways of Knowing. The core topics include: Space Systems, History of the Earth, Earth Systems and Weather and Climate. The middle school performance expectations have learners explain phenomena central to the Earth and Space sciences. In the Earth and Space 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. The practices will be used to demonstrate understanding of the core ideas and make connections to local and place-based phenomena. Students are also expected to demonstrate understanding of several engineering practices including design and evaluation.</td></tr>
<tr><td>Course overview:
Nature of Science
Q1 Space Systems
Q2 History of Earth
Q3 Earth Systems
Q4 Weather and Climate</td><td>Content:
The Universe and Its Stars
Earth and the Solar System
Human Impacts on Earth Systems
The History of Planet Earth
Earth Materials and Systems
The Roles of Water in Earth’s Surface Processes
Weather and Climate
Plate Tectonics and Large-Scale System Interactions
Natural Resources
Natural Hazards
Global Climate Change</td></tr>
</table>

<table>
<tr><td>Unit: Nature of Science</td><td rowspan="3">Suggested Anchor Phenomena:
<u>“Satellite Blocks our Star”</u>- (video): Discuss size and scale of Earth in relation to Moon, Sun and our solar system.
Essential Questions:
How can we use science to understand our environment /world/universe?
What is science?
What are the ways in which science is accomplished?
What other ways of knowing are there other than western science?
What are the ancient narratives of community and landscape that reveal the process of science?
What do we learn of Tlingit practices of old which are important to current understandings and applications of science today?
How do Tlingit place names reflect scientific knowledge?
What is a theory and what is a law?
What is the importance of modeling and peer review?
What is pseudoscience? How can it be used to mislead?
How has the process of science evolved over time?</td><th colspan="2">Standards</th></tr>
<tr><td>Pacing: First unit of year, up to one week, and throughout the entire year</td><td>Alaska Cultural Standards</td><td>B1, D5, E3, E4</td></tr>
<tr><td rowspan="4">Content/Topics:
Scientific Investigations
Scientific knowledge
Scientific Models, Laws, Theories
Phenomena
As a Human Endeavor</td><td>Alaska ELA Standards</td><td>RI.6.2, RI.6.7, RI.6.8, W6.1, W6.2, W6.8, W6.9</td></tr>
<tr><td>Alaska Math Standards</td><td>MP 1-5</td></tr>
<tr><td>Alaska Science Standards</td><td>SA1, SA1.1, SA1.2, SA2 SA2.1, SA3, SA3.1, SE2, SG1, SG2, SG3, SG4</td></tr>
<tr><td>ISTE</td><td>3, 4, 5</td></tr>
</table>

<table>
<tr><td>Alaska Cultural Standard to Emphasize:
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.
3: Demonstrate an understand of the relationship between worldview and the way knowledge is formed and used.</td><td>Community Contacts
<u>STEM Database Community Resources</u></td></tr>
</table>

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural & Place-Based Connections</th></tr>
<tr><th>Nature of Science: Performance Expectations (PEs)</th><th>Nature of Science: Major Themes</th></tr>
<tr>
<td>NGSS Appendix H: Design and revise a basic scientific investigation to test a hypothesis regarding an explanation to an observed phenomenon.

Clarification Statement: Designs and implementation should include a testable hypothesis, quantifiable data, adequate controls for repeatability, and proper data analysis and conclusion. The overall significance of the findings should be presented in context.

Assessment Boundary: Assessment should not be restricted to any one specific “scientific method.” Assessments should emphasize the need for peer review in science and the difference between science and other ways of knowing.</td>
<td>• Scientific Investigations Use a Variety of Methods
• Scientific Knowledge is Based on Empirical Evidence
• Scientific Knowledge is Open to Revisions in Light of New Evidence
• Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
  ◦ Theories and laws provide explanations in science but theories do not with time become laws or facts
  ◦ A scientific theory is substantiated by some aspect of natural world, based on a body of facts that has repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted
• Science is a Way of Knowing
• Scientific Knowledge Assumes an Order and Consistency in Natural Systems
• Science is a Human Endeavor
• Science Addresses Questions About the Natural and Material World</td>
<td>• <u>Oobleck Lab(GEMS unit)</u>
• <u>Erosion Lab</u>
• <u>Nature of Science Lessons</u>
• <u>The Biology Corner (Science Methods)</u>
• <u>Sealaska Heritage Institute Language Development: Book 2, Unit 7, 8, 9 to be used throughout course</u></td>
<td>Tlingit World View:
Observe, Listen, Test, Perfect.
Wooch.een: How do these work together? Affect the other? In every action is a reaction:
Wooch Yaxhdati: Balance;
Yan kásanóo: Prove it!

Technological Expertise & Indigenous Knowledge: Why did Tlingit ancestors do it this way, and why is it important today? Examples of learning and creating from scientific process: Fish traps, tidal salmon traps, medicinal plants, tool making, traditional clam beds, canoe building, food preservation, watertight baskets.
• <u>Montana Creek Fish Trap</u> (at City Museum)
• Codes of ethics for scientists working with people and environment or marine life. [<u>Arctic Council</u>]

<u>Thomas Thornton’s Cultural Atlas</u> illustrates scientific observation: Tlingit place names are biological and/or topographic. Place names describe the land/ecology and provide a map for navigation and historical record of geography, ecology, biology, hydrology and land ownership.</td>
</tr>
</table>

			• **Activity:** Find example of local place name which communicates scientific knowledge/science process skills (observation, biology, topography, hydrology)

<table>
<tr><td>Q1 Instructional Focus: Space Systems</td><td rowspan="3">Suggested Anchor Phenomena:
The story of <u>K</u>aa<u>x</u>’ achgo’ok by A.P. Johnson from Haa Shuka’, Our Ancestors
Essential Questions:
What is Earth’s place in the Universe?
What makes up our solar system and how can the motion of Earth explain seasons and eclipses?</td><th colspan="2">Standards</th></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>B2, D4, E3, E4, E8</td></tr>
<tr><td rowspan="4">Quarter 1 Content:
The Universe and Its Stars
Earth and the Solar System
Human Impacts on Earth Systems</td><td></td><td>Alaska ELA Standards</td><td>RST.6-8.1, RST.6-8.7, SL.8.5, WHST.6-8.7 - WHST.6-8.8, WHST.6-8.9</td></tr>
<tr><td></td><td>Alaska Math Standards</td><td>6.EE.6, 6.RP.1, 7.EE.4, 7.RP.2, MP.2 - MP.4</td></tr>
<tr><td></td><td>Alaska Science Standards</td><td>SD3.1, SD4.1, SD4.2, SE, SE1, SE2, SE3</td></tr>
<tr><td></td><td>ISTE</td><td>1c, 2a, 3, 4ab, 5, 6, 7</td></tr>
</table>

<table>
<tr><th>Alaska Cultural Standard to Emphasize</th><th>Community Contacts</th></tr>
<tr><td>E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.
4: Determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.</td><td><u>STEM Database Community Resources</u>
Discovery Southeast Naturalists: 463-1500, <u>info@discoverysoutheast.org</u>
<u>Marie Drake Planetarium</u>
NOAA Supervisory Research Geneticist: 789-6000; Auke Creek Marine Station Hatchery, Fisheries Biologist: 789-6096
UAF Fish and Fisheries Genetics, Conservation, Ecology; 796-5441; <u>Geophysical Institute:</u> (907) 474-7558
UAS Auke Creek Studies Biologist: 796-6200</td></tr>
</table>

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural &
Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td><u>MS-ESS1-1</u>: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

Clarification Statement: Examples of models -physical, graphical, or conceptual.

Assessment Boundary: none

Cross-cutting Concepts:
Patterns <u>(MS-ESS1-1)</u>

Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems <u>(MS-ESS1-1)</u>

Science and Engineering Practices: Developing and Using Models <u>(MS-ESS1-1)</u></td>
<td><u>ESS1.A:</u> 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. <u>(MS-ESS1-1)</u>

<u>ESS1.B:</u> 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. <u>(MS-ESS1-1)</u></td>
<td>NGSS Activity Links:
• <u>Seasons Interactive</u>
• <u>Eclipse Interactive</u>
• <u>Lunar Phases</u>
• <u>Seasons Interactive - SEPUP</u>
• <u>NASA Eclipse Web Site</u>

Other Activities:
• Identify stars by luminosity and mass to determine color and star stage (put in chart)</td>
<td>Oral Narrative
Kaax'achgo'ok by A.P. Johnson from Haa Shuka', Our Ancestors. Kaax'achgo'ok observed and documented sun, moon and star patterns over time to predict how to navigate home after becoming marooned in a strange land (possibly Kuril Islands).

• <u>Tlingit Calendar</u>
• <u>Marie Drake Planetarium</u>
• <u>Alaska State Museum: Science on a Sphere</u>
• Observe patterns of sun, moon, and stars in sky</td>
</tr>
<tr>
<td><u>MS-ESS1-2</u>: 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</td>
<td><u>ESS1.A:</u> 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. <u>(MS-ESS1-2)</u>

<u>ESS1.B</u>: Earth and the Solar System: The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids</td>
<td>NGSS Activity Links:
• <u>The Pull of the Planets</u>
• <u>Gravity and Orbits</u></td>
<td>• <u>Marie Drake Planetarium</u>
• <u>Alaska State Museum: Science on a Sphere</u></td>
</tr>
</table>

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. **Cross-cutting Concepts:** Systems and System Models (MS-ESS1-2) **Connections to Nature of Science**: Scientific Knowledge Assumes an Order and Consistency in Natural Systems (MS-ESS1-2) **Science and Engineering Practices:** Developing and Using Models (MS-ESS1-2)	that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2) The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)		

MS-ESS1-3: Analyze and interpret 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. **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-ESS1-3) **Connections to Engineering, Technology, & Applications of Science**: Interdependence of Science, Engineering, and Technology (MS-ESS1-3) **Science and Engineering Practices**: Analyzing and Interpreting Data (MS-ESS1-3)	**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. (MS-ESS1-3)	**NGSS Activity Links:** • Solar System Scale and Size • Toilet Paper Solar System **Other Activities:** • Earth/Sun/Moon tides • Homemade comet with dry ice/dirt etc. • Create scaled sizes of planets • Models of the world • Research seasons in the Northern and Southern Hemispheres • Create a scale model of the solar system on the playground or in school that demonstrates an understanding of the scale of the system and the objects within it.	• Marie Drake Planetarium • Alaska State Museum: Science on a Sphere • Observe and draw the moon for 30 days.

<u>MS-ESS3-3:</u> 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). **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect <u>(MS-ESS3-3)</u> **Connections to Engineering, Technology, and Applications of Science**: Influence of Science, Engineering, and Technology on Society and the Natural World <u>(MS-ESS3-3)</u> **Science and Engineering Practices:** Constructing Explanations and Designing Solutions <u>(MS-ESS3-3)</u>	<u>**ESS3.C:**</u> **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. <u>(MS-ESS3-3)</u> 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. <u>(MS-ESS3-3)</u>	**NGSS Activity Links:** • <u>Pollution Patrol</u> • <u>Plastic, Plastic Everywhere!</u>	*Khaawú*- People who watched and protected water • What happened to the herring on Douglas- Sandy Beach area? o <u>Historical Image</u> - Tlingit children gathering herring on a Douglas Island beach, near Juneau, Alaska, by Winter & Pond, 1895. o <u>Sandy Beach Mercury Levels Article</u> • <u>Article on Revival of Pacific indigenous Clam Gardens & Human Impact</u> • CBJ Wastewater treatment plant • Juneau Landfill • <u>Juneau Watershed Partnership</u> • Students observe number of plants, animals (insects) within a specific area, measure soil and air temperature, and develop a story of related factors that may have influenced or changed the habitat and animals living in the environment. • Auke Bay herring beds (near Auke Nu condos)

Q2 Instructional Focus: History of Earth	Suggested Anchor Phenomena:	Standards	
Pacing: one quarter	• Comparing unique land formations. Show basalt rocks, pancake rocks, painted hills etc. **Essential Questions:** • How do people figure out that the Earth and life on Earth have changed over time? • What do Tlingit place names, petroglyphs, oral narratives, and clan histories reveal about the history of our local place on Earth? • How does the movement of tectonic plates impact the surface of Earth?	Alaska Cultural Standards	B2, E2, E3, E4, E6, E8
Quarter 2 Content: • The History of Planet Earth • Earth Materials and Systems • The Roles of Water in Earth's Surface Processes • Weather and Climate • Plate Tectonics and Large-Scale System Interactions • Nuclear Processes		Alaska ELA Standards	RST.6-8.1, RST.6-8.7 RST.6-8.9, WHST.6-8.2, SL.8.5
		Alaska Math Standards	6.EE.6, 7.EE.4, MP.2
		Alaska Science Standards	SD1, SD1.1, SD1.2, SD2, SD2.2, SD3, SD3.2, SF1, 2, SE1-3, SG1-4
		ISTE	1c, 3, 5, 6, 7

Alaska Cultural Standard to Emphasize	Community Contacts
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **3**: Demonstrate an understand of the relationship between worldview and the way knowledge is formed and used.	• **STEM Database Community Resources** • **Hecla/Greens Creek**, 789-8100, **Coeur/Kensington**, 523-3300, Geologists • **Juneau City Museum:** Tours and Educational Kits, 586-3572 • **NOAA/NMFS** 789-6000; National Weather Service, 790-6800 • **STEM Robotics coach**es • **UAS:** Physics/Math/Geologists, 796-6200; Juneau Ice fields Research Program 586-0299 • **US Forest Service:** Mendenhall Glacier Visitor Center, 789-6614 Juneau Ranger District**,** 789-6252, Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml • **US Geological Service:** Water: 586-7216, 888-ASK-USGS, askusgs@usgs.gov

NGSS		Suggested Activities	Cultural & Place-Based Connections
Performance Expectations (PEs)	Disciplinary Core Ideas (DCIs)		
MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for 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. **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-ESS1-4) **Science and Engineering Practices:** Constructing	**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. (MS-ESS1-4)	**NGSS Activity Link:** • Who's on First? A Relative Dating Activity **Other Activities:** • Pie slice of earth from core to upper atmosphere • Use the Alaska rock kits for identification & classification. • Sort fossils into a timeline. • Create puzzles of the plates and label fossils that are found on different plates as evidence for plate movement. • PhET Radioactive Dating lab.	Tlingit Petroglyphs tell history of place. Oral Narratives Revealing History of Earth/Place • Elizabeth Nyham: The Battle of the Giants • Raven and the Whale 1 • Raven and the Whale 2 • Raven's Foot Prints • *T'àkhu Yanyèdf Dàt Shkalnik/* The History of the Taku Yanyèdi in The Legacy of a Taku River Tlingit Clan by Nyman and Leer • Oral Narrative by Susie James owned by Gaanaxteidi (Glacier Story) • Map rock ages in Juneau area above JDHS (zoom 90m-different strata)

Explanations and Designing Solutions (MS-ESS1-4)			
MS-ESS2-2: Construct an explanation based on evidence for 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. **Assessment Boundary:** none **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-ESS2-2) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-ESS2-2)	**ESS2.A: Earth 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. (MS-ESS2-2) **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. (MS-ESS2-2)	**NGSS Activity Links:** • Dig This! Erosion Investigation • Musical Plates-A Study of earthquakes and Plate Tectonics • Investigating Erosion • Asteroid Impacts: The Debatable K-T Extinction **Other Activities:** • HHMI Bio-interactive: The Day the Mesozioc Died. • Story of Earth lessons	• **Haa Shuka, Our Ancestors**, by Nora and Richard Dauenhauer: *Glacier Bay History* • Sorted and unsorted deposits • Alluvial/colluvial fans • Stream erosion and deposition • Jokulhaups • Surficial Geology in Juneau Nature • Karst topography in Prince of Wales is produced by groundwater activity

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create 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 temperatures that melts glacial 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 how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent. **Assessment Boundary:** none **Cross-cutting Concepts:** Stability and Change (HS-ESS2-2) **Connections to Engineering, Technology, and Applications of Science**: Influence of Science, Engineering, and	**ESS2.A: Earth Materials and Systems:** Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2) **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. (HS-ESS2-2)	**NGSS Activity Links:** • Taking the Pulse of Yellowstone's "Breathing" Volcano: Problem-Based Learning in America's First National Park • Biomes and Climatology Comparison **Other Activities:** • Water cycle and ocean currents • Polar ice caps melting • Ocean freshening by glacial melt. • Story of Earth lessons	• Isostatic Rebound • Jokulhaups • Research steps that could be taken to reduce the causes of climate change as well as adaptations Alaskans can take to cope with climate changes. • Glacial history and landforms in Juneau Nature • As Alaska's Glaciers Melt, It's Land is Rising (article) • Analyze the past 90 years' worth of monthly average temperatures in Juneau, Alaska to show empirical evidence of climate change. • Compare and contrast current and past satellite images of various land forms. • Tidal changes to shoreline • Temperature probe datasets = UAS, Pacific Northwest Research Station, NOAA, NPS

Technology on Society and the Natural World (HS-ESS2-2) **Science and Engineering Practices:** Analyzing and Interpreting Data (HS-ESS2-2)			
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:** Paleo magnetic anomalies in oceanic and continental crust are not assessed. **Cross-cutting Concepts:** Patterns (MS-ESS2-3) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-ESS2-3) **Connections to Nature of Science:** Scientific Knowledge Is Open to Revision in Light of New Evidence (MS-ESS2-3)	**ESS1.C: The History of Planet Earth:** Tectonic processes continually generate new ocean seafloor at ridges and destroy old sea floor at trenches. *(secondary to MS-ESS2-3)* **ESS2.B: Plate Tectonics and Large-Scale System Interactions:** Maps of ancient land and water patterns, base on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)	**NGSS Activity Links:** • Interactives-Dynamic Earth • Continental Drift Activity • Activity: A Plate Tectonic Puzzle • Virtual Lab-Fossil Dating • Modeling Sea Level: Lateral and Vertical Facies Changes **Other Activities:** • Magnetic Pole reversal maps	• 1958 Lituya Bay Earthquake • 1964 Alaska Earthquake • Alaska Roadside Geology by Cathy Connor • Rock quarry visit; mine • Mendenhall Glacier • Alaska Rock kit • Alaska Plate Tectonics • Tectonic Plate Movement in Alaska • Natural History of Cowee-Davis (map with types of bedrock and fault also available for all of Juneau) • Reading Southeast Alaska's Landscape by Richard Carstensen and Cathy Connor • Faults in Juneau area are: Gastineau, Fish Creek, Sumdum, and Silverbow

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. **Assessment Boundary:** none **Cross-cutting Concepts:** Energy and Matter (HS-ESS2-3) **Science and Engineering Practices:** Developing and Using Models (HS-ESS2-3) **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence (HS-ESS2-3), (HS-ESS2-3), (HS-ESS2-3)	**ESS2.A: Earth Materials and Systems:** Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surfaces 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, and 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. (HS-ESS2-3) **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 tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3)	**NGSS Activity Links:** • Determining and Measuring Earth's Layered Interior • Exploring Plate Boundaries With Seismic Data • IRIS Seismic Monitor • Incorporated Research Institutions for Seismology (IRIS) Seismic Wave Simulator **Other Activities:** • Use a tub with ice, hot water, and Styrofoam for convection currents and plate movement	• The Legacy of the Taku River Clan by Elizabeth Nyman and Jeff Leer:: *Khudzitiyi Át Khulagàwu*/The Battle of the Giants. • US Coast Guard • Tsunami warning center • Alaska Plate Tectonics • Tectonic Plate Movement in Alaska • Map of faults in Juneau area

<u>**HS-ESS1-5:**</u> 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 on 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 ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions). **Assessment Boundary:** none **Cross-cutting Concepts:** Patterns <u>(HS-ESS1-5)</u> **Science and Engineering Practices:** Engaging in Argument from Evidence <u>(HS-ESS1-5)</u>	<u>**PS1.C**</u>**: 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. <u>*(*secondary to HS-ESS1-5)</u> <u>**ESS1.C**</u>**: 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. <u>(HS-ESS1-5)</u> <u>**ESS2.B**</u>**: 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. <u>*(*secondary to HS-ESS1-5)</u>	**NGSS Activity Links:** • <u>Plate Tectonics Simulation</u> **Other Activities**: • Earthquakes and volcanoes • Very basics covered with what core is made of/convection currents.	• *Alaska Roadside Geology* by Cathy Connor • <u>Reading Southeast Alaska's Landscape</u> by Richard Carstensen and Cathy Connor • Local earthquake maps • <u>USGS</u> • Compare Aleutian Chain volcanism to Sitka's Mt Edgecumbe

<table>
<tr><td>Q3 Instructional Focus: Earth Systems</td><td rowspan="3">Suggested Anchor Phenomena:
Richard Carstensen's Images of the Mendenhall Glacier over 150 yrs. of change
Essential Questions:
How do the materials in and on Earth's crust change over time?
How does water influence weather, circulate in the oceans, and shape Earth's surface?
How can natural hazards be predicted?
How do human activities affect Earth's systems?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>B2, E2, E3, E4, E6, E8</td></tr>
<tr><td rowspan="4">Quarter 3 Content:
Earth Materials and Systems
Plate Tectonics and Large-Scale System Interactions
The Roles of Water in Earth's Surface Processes
Natural Resources
Natural Hazards
Human Impacts on Earth Systems</td><td>Alaska ELA Standards</td><td>SL.8.5, RST.6-8.1, WHST.6-8.1, WHST.6-8.2, WHST.6-8.9</td></tr>
<tr><td></td><td>Alaska Math Standards</td><td>6.EE.6, 7.EE.4,6.RP.1, 7.RP.2</td></tr>
<tr><td></td><td>Alaska Science Standards</td><td>SD2, SD2.1, SD2.2, SD3, SE1, SF1, SG1, SG2</td></tr>
<tr><td></td><td>ISTE</td><td>1c, 3, 5, 6, 7</td></tr>
</table>

<table>
<tr><th>Alaska Cultural Standard to Emphasize</th><th>Community Contacts</th></tr>
<tr><td>E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.
4: Determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.</td><td>STEM Database Community Resources
Hecla/Greens Creek, 789-8100 and Coeur/Kensington, 523-3300, Geologists
Juneau City Museum: Tours and Educational Kits, 586-3572
NOAA/NMFS 789-6000; National Weather Service, 790-6800
US Forest Service: Mendenhall Glacier Visitor Center, 789-6614 Juneau Ranger District, 789-6252, Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml
US Geological Service: Water: 586-7216, 888-ASK-USGS, askusgs@usgs.gov</td></tr>
</table>

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural &
Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr><td>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.

Cross-cutting Concepts:
Stability and Change (MS-ESS2-1)

Science and Engineering Practices: Developing and Using Models (MS-ESS2-1)</td><td>ESS2.A: Earth 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)</td><td>NGSS Activity Links:
• Rock Cycle Journey
• The Rain Man</td><td>• Tlingit Oral Narratives: White Raven and Water
• Mendenhall Glacier Field Trip
• Mines
• Alaska's Rock Kit
• Juneau City Museum Field Trip: Rocks and Mineral display
• Rock outcrops, road cuts, quarries</td></tr>
<tr><td>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,</td><td>ESS2.A: Earth Materials and Systems: Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-1) (Note: This Disciplinary Core Idea is also addressed by HS-ESS2-2.)</td><td>NGSS Activity Links:
• Plate Tectonics Simulation

Other Activities:
• Earthquakes and volcanoes
• Earth's Ever-changing Surface</td><td>• Tlingit Oral Narratives:
  o Raven's Footprints viewed in Yakutat area (ancient oral narrative)
  o Raven and the Whale 1
  o Raven and the Whale 2
• Glaciers and Migration History from Heen Latinee Outdoor Classroom unit
• Mendenhall Glacier Programs</td></tr>
</table>

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, etc.) 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. **Cross-cutting Concepts:** Stability and Change (HS-ESS2-1) **Science and Engineering Practices:** Developing and Using Models (HS-ESS2-1)	**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. (HS-ESS2-1), (HS-ESS2-1)		
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.	**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), (MS-ESS2-4)	**NGSS Activity Links:** • Exploring the Water Cycle • Leaf it to me • Sweatin' to the Coldies	• Predicting Weather-Interdisciplinary Unit from Alaska Native Knowledge Network • NOAA weather service forecasting • Eaglecrest weather station • Pacific NW Research Station https://www.fs.fed.us/pnw/about/programs/index.shtml o Online resource: gauge data for Mendenhall River, Montana Creek, track with rainfall

Cross-cutting Concepts: Energy and Matter (MS-ESS2-4) **Science and Engineering Practices:** Developing and Using Models (MS-ESS2-4)			
MS-ESS3-1: Construct a scientific explanation based on evidence 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). **Assessment Boundary:** none	**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)	**NGSS Activity Links:** • Minerals on the Edge	Thomas Thornton's Cultural Atlas to locate place names/ sites rich in minerals, groundwater etc. • Abundant fisheries • Large tree forests in SE due to groundwater, soils, and alluvial fans (Geomorphology). • Gold, Silver, Copper, Nickel... • Juneau City Museum Field Trip: Fishing, Mining and Rock/Minerals displays • Alaska Resource Education: Finding Oil is a Piece of Cake • Alaska Resource Education: Renew A Bean • Geography of Copper Tanaa resources: Oral narrative Where copper was in the water • Pacific NW Research Station

Cross-cutting Concepts: Cause and Effect (MS-ESS3-1) **Connections to Engineering, Technology, and Applications of Science**: Influence of Science, Engineering, and Technology on Society and the Natural World (MS-ESS3-1) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-ESS3-1)			
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 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, and droughts). Examples of the results of changes in climate that can affect populations or drive mass	**ESS3.A: Natural Resources:** Resource availability has guided the development of human society. (HS-ESS3-1) **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. (HS-ESS3-1)	**NGSS Activity Links:** • Community Resilience • Will there be enough freshwater? **Other Activities:** • AK Energy Smart Lesson: Energy Efficiency and Alaska Native Dwellings	• Explore where village sites were located for Taku Kwaan and Auk Kwaan and identify natural resources. Use of Cultural Atlas. Why were they in those locations and not situated in downtown Juneau or Douglas sites? • The cities of Juneau and Douglas were founded because of location of gold (Goldbelt location) • USFS Pacific NW Research Station

migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised. **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect (HS-ESS3-1) **Connections to Engineering, Technology, and Applications of Science:** Influence of Science, Engineering, and Technology on Society and the Natural World (HS-ESS3-1) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (HS-ESS3-1)			
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	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. (MS-ESS3-4)	**NGSS Activity Links:** • Next Generation Climate - Grades 6-8 - Lesson 2 • Climate Change and Michigan Forests **Other Activities:** • Alaska Climate Change • Alaska Resource Education: Energy on the Move • Alaska Resource Education: Solving the Challenges of Mining • Alaska Resource Education: Recycling Metals	• Fisheries management in Alaska • NOAA • Juneau RecycleWorks • USFS Pacific NW Research Station • US Coast Guard • Sustainable Forestry - history of forest, Tongass Forest planning (USFS)

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. **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect (MS-ESS3-4) **Connections to Engineering, Technology, and Applications of Science**: Influence of Science, Engineering, and Technology on Society and the Natural World (MS-ESS3-4) **Connections to Nature of Science:** Science Addresses Questions About the Natural and Material World (MS-ESS3-4) **Science and Engineering Practices:** Engaging in Argument from Evidence (MS-ESS3-4)			

Q4 Instructional Focus: Weather and Climate	Suggested Anchor Phenomena:	Standards	
Pacing: one quarter	• Jokuhlaup (show video of Mendenhall glacier flooding) **Essential Questions:** • What factors interact and influence weather and climate?	Alaska Cultural Standards	B2, D5, E2, E3, E4, E6, E8
Quarter 4 Content: • Natural Hazards • The Roles of Water in Earth's Surface Processes • Weather and Climate • Global Climate Change		Alaska ELA Standards	RST.6-8.1, RST.6-8.7, RST.6-8.9, WHST.6-8.8, SL.8.5
		Alaska Math Standards	6.EE.6, 7.EE.4, 6.NS.5, MP.2
		Alaska Science Standards	SD1.1, SD2.1, SD2.3, SD3.1, SD3.2, SE 1-3, SF1, SF3, SG 1, 3, 4
		ISTE	1c, 3, 5, 6, 7

Alaska Cultural Standard to Emphasize	Community Contacts
E. **Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.** **2:** Understand the ecology and geography of the bioregion they inhabit.	• **STEM Database Community Resources** • **AELP** Director of Energy Service, Hydro Projects, 463-6303 • **Hecla/Greens Creek**, 789-8100 and **Coeur/Kensington**, 523-3300, Geologists • **NOAA/NMFS** 789-6000; National Weather Service, Meteorologist, 790-6800 • **US Forest Service:** Mendenhall Glacier Visitor Center, 789-6614 Juneau Ranger District, 789-6252, Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml • **US Geological Service:** Water: 586-7216, 888-ASK-USGS, askusgs@usgs.gov

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<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td><u>MS-ESS2-5</u>: Collect data to provide evidence for how the motions and complex interactions of air masses results 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.

Cross-cutting Concepts: Cause and Effect <u>(MS-ESS2-5)</u>
Science and Engineering Practices: Planning and</td>
<td><u>ESS2.C:</u> 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. <u>(MS-ESS2-5)</u>

<u>ESS2.D:</u> Weather and Climate: Because these patterns are so complex, weather can only be predicted probabilistically. <u>(MS-ESS2-5)</u></td>
<td>NGSS Activity Links:
• <u>Air Masses</u>

Other Activities:
• Examine weather maps, diagrams, and visualizations to collect data on motion and interactions of air masses.
• Explore the air currents with student-created hot air balloons.
• Record weather observations for a length of time using UAF's Arctic Climate Modeling Project lessons.
• Compare and contrast weather in Alaska to that of Hawaii with UAF's Arctic Climate Modeling project lessons and extend lesson to hypothesize how our Alaska communities would be affected if the two different climates suddenly flipped.
• <u>Regional Patterns of Climate in PNW lesson</u></td>
<td>• Invite an elder to talk about changes in weather patterns.
• Haa Shuka, Our Ancestors: Tlingit Oral Narratives by Nora Marks and Richard Dauenhauer: Naatislanei
• <u>Predicting Weather-Interdisciplinary Unit from Alaska Native Knowledge Network</u>
• USGS stream gauging technique
  o How does a tide gauge work? How do you predict tides?</td>
</tr>
</table>

Carrying Out Investigations (MS-ESS2-5)			
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 the evidence for 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, erosion using variations in soil moisture content, or 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). **Assessment Boundary:** none **Cross-cutting Concepts:** Structure and Function (HS-ESS2-5)	**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. (HS-ESS2-5)	**NGSS Activity Links:** • Soil Color and Redox Chemistry **Other Activities:** • Rust lab • Stream tables • Comparing soil composition • Solubility lab • Wedging by frost lab • Ice crystals lab • Crystal formation • Karst topography	• Cowee Creek Landslide • Eaglecrest weather station • Jokulaup • USFS Pacific NW Research Station research: dissolved constituents in water - carbon, nitrogen, ions

Science and Engineering Practices: Planning and Carrying Out Investigations (HS-ESS2-5)			
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. **Cross-cutting Concepts:** Systems and System Models (MS-ESS2-6)	**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. (MS-ESS2-6) **ESS2.D: Weather and Climate:** 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), (MS-ESS2-6)	**NGSS Activity Links:** • Ocean Currents and Sea Surface Temperature • Adopt a Drifter: Do Ocean Surface Currents Influence Climate? • Engaging in Argumentation with a Science Seminar: Regional Climate in the Atacama Desert **Other Activities:** • Observe convection currents with *Convection Currents Paper Dots* lab. • Tides: measure, compare different latitudes; Predict the tide.	• Alaska Seas and Watersheds: Ocean in Motion unit • Ocean buoy/data from NOAA

Science and Engineering Practices: Developing and Using Models (MS-ESS2-6)			
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). **Assessment Boundary:** none	**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. (MS-ESS3-2)	**NGSS Activity Links:** • Asteroid Impact	• How did Tlingits predict weather? Predicting Weather by Alysa Loring • Cultural elder storytelling of natural history of area • Lituya Bay • Taku Winds • Eaglecrest weather station • Jokulaup • Local avalanche expert • Juneau Mt. Rescue • SeaDogs • Landslides • Cowee creek tsunami

Cross-cutting Concepts: Patterns (MS-ESS3-2) **Connections to Engineering, Technology, and Applications of Science:** Influence of Science, Engineering, and Technology on Society and the Natural World (MS-ESS3-2) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-ESS3-2)			
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). Evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures. **Assessment Boundary:** none	**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. (MS-ESS3-5)	**NGSS Activity Links:** • What is the Future of Earth's Climate? • Using the Very, Very Simple Climate Model in the Classroom • Next Generation Climate - Grades 6-8 - Lesson 2	• Indigenous stories of glaciers and a great flood • Alaska State Museum: Science on a Sphere • Alaska's Seas and Watersheds: Our Changing World unit • USFS: Pacific Northwest Research Station: coastal soils measurements of CO_2 and CH_4

	Cross-cutting Concepts: Stability and Change (MS-ESS3-5) **Science and Engineering Practices:** Asking Questions and Defining Problems (MS-ESS3-5)			

<table>
<tr><td>Course: Life Science</td><td>Grade: 7 - 8</td></tr>
<tr><td colspan="2">Course Description: Seventh/Eighth grade science is an introduction to the core topics of Life Science, and a continuation of the Nature of Science, as they related to Western Science and Cultural Ways of Knowing. The core topics include: Cells, Body Systems, Heredity/Evolution and Ecosystems. The middle school performance expectations allow learners to explain phenomena central to the Life Sciences. In the Life 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. The practices will be used to demonstrate understanding of the core ideas and make connections to local and place based phenomena. Students are also expected to demonstrate understanding of several engineering practices including design and evaluation.</td></tr>
<tr><td>Course overview:
Nature of Science
Q1 Cells
Q2 Body Systems
Q3 Heredity, Evolution
Q4 Ecosystems</td><td>Content:
Structure and Function
Energy in Chemical Processes and Everyday Life
Organization for Matter and Energy Flow in Organisms
Information Processing
Growth and Development of Organisms
Inheritance of Traits
Variation of Traits
Natural Selection
Evidence of Common Ancestry and Diversity
Adaptation
Interdependent Relationships in Ecosystems
Ecosystem Dynamics, Functioning and Resilience
Biodiversity in Humans
Developing Possible Solutions
Cycles of Matter and Energy Transfer in Ecosystems</td></tr>
</table>

<table>
<tr><td>Unit: Nature of Science</td><td rowspan="3">Suggested Anchor Phenomena:
Thinking like a Scientist: Pick an appropriate phenomena from TJ McKenna
Essential Questions:
How can we use science to understand our environment /world/universe?
What is science?
What are the ways in which science is accomplished?
What other ways of knowing are there other than western science?
What are the ancient narratives of community and landscape that reveal the process of science?
What do we learn of Tlingit practices of old which are important to current understandings and applications of science today?
How do Tlingit place names reflect scientific knowledge?
What is a theory and what is a law?
What is the importance of modeling and peer review?
What is pseudoscience? How can it be used to mislead?
How has the process of science evolved over time?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: First unit of year, up to one week</td><td>Alaska Cultural Standards</td><td>B1, D5, E3, E4</td></tr>
<tr><td>Content/Topics:
Scientific Investigations
Scientific knowledge
Scientific Models, Laws, Theories
Phenomena
As a Human Endeavor</td><td>Alaska ELA Standards

Alaska Math Standards

Alaska Science Standards

ISTE</td><td>RI.6.2, RI.6.7, RI.6.8, W6.1, W6.2, W6.8, W6.9

MP 1-5

SA1, SA1.1, SA1.2, SA2 SA2.1, SA3, SA3.1, SE2, SG1, SG2, SG3, SG4

3, 4, 5</td></tr>
</table>

Alaska Cultural Standard to Emphasize	Community Contacts
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **3**: Demonstrate an understand of the relationship between worldview and the way knowledge is formed and used.	• **STEM Database Community Resources** • **AK Dept. Fish & Game:** SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural &
Place-Based Connections</th></tr>
<tr><th>Nature of Science:
Performance Expectations (PEs)</th><th>Nature of Science:
Major Themes</th></tr>
<tr>
<td>NGSS Appendix H: Design and revise a basic scientific investigation to test a hypothesis regarding an explanation to an observed phenomenon.

Clarification Statement: Designs and implementation should include a testable hypothesis, quantifiable data, adequate controls for repeatability, and proper data analysis and conclusion. The overall significance of the findings should be presented in context.

Assessment Boundary: Assessment should not be restricted to any one specific “scientific method.” Assessments should emphasize the need for peer review in science and the difference between science and other ways of knowing.</td>
<td>• Scientific Investigations Use a Variety of Methods
• Scientific Knowledge is Based on Empirical Evidence
• Scientific Knowledge is Open to Revisions in Light of New Evidence
• Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
  • Theories and laws provide explanations in science but theories do not with time become laws or facts
  • A scientific theory is substantiated by some aspect of natural world, based on a body of facts that has repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted
• Science is a Way of Knowing
• Scientific Knowledge Assumes an Order and Consistency in Natural Systems
• Science is a Human Endeavor
• Science Addresses Questions About the Natural and Material World</td>
<td>NGSS Activities:
• <u>Oobleck Lab(GEMS unit)</u>
• <u>Erosion Lab</u>
• <u>Nature of Science lessons</u>
• <u>The Biology Corner</u>
• <u>Sealaska Heritage Language Development: Book 1 & 2, Unit 5, 6, 9 to be used throughout course</u></td>
<td>Observe. Listen. Test. Perfect.
• Wooch.een: How do these work together? Affect the other? In every action is a reaction:
• Wooch Yaxhdati: Balance
• Yan kásanóo: Prove it!

Technological Expertise & Indigenous Knowledge: Respect of technical expertise and indigenous knowledge. Why did Tlingit ancestors do it this way and why is it important today? Learning and creating from trial and error. Examples: Fish traps, tidal salmon traps, medicinal plants, tool making, traditional clam beds, canoe

<u>Thomas Thornton’s Cultural Atlas</u> illustrates scientific observation: Tlingit place names are biological and/or topographic. Place names describe the land and ecology and provide a map for navigation as well as historical record of geography, ecology, biology, hydrology and land ownership.
• Activity: Find an example of a local place name which communicates scientific knowledge and/or science process skills (observation, biology, topography, hydrology etc.)</td>
</tr>
</table>

			• **Goldbelt Heritage Unit:** HAA ATXAAYÍ- Investigating Harvest Ecology • **Ethics** - codes of ethics when scientists are working with people and the environment or marine life. [Arctic Council] • Acknowledgement to studied creatures: Tlingit people may explain to the organisms what they are doing to it and they may say. "I een áwé yei jigaxh tunei, i daat át haa tuwasigoo át wutuskoowú. Gunalchéesh!" • We are going to work with you. We want to learn about you! Thank you!" **Experiments, Activities or Units Involving Traditional Ways of Knowing:** • Investigating Tlingit Ecological Knowledge (Goldbelt Heritage Institute) • *Village Science* - by Alan Dick • Modern versus traditional diaper experiment - traditional sphagnum moss, cloth, and store-bought diapers. • Curing, fermenting, brining, drying, smoking, in regards to preventing bacterial and fungus growth. **AK Dept Fish & Game** research: • Division of Wildlife Conservation Publications Database, Search by topic, species, author, year.

			• Divisions of Sport Fish, Commercial Fisheries and Subsistence Publications Database • Review and examine mission, program objectives and mandates of local research organizations: USFS Pacific Northwest Research Station, NOAA, USGS, UAS, ADFG

<table>
<tr><td>Q1 Instructional Focus: Cells</td><td rowspan="3">Suggested Anchor Phenomena:
Salmon DNA in tree cells
Essential Questions:
How can one explain the ways cells contribute to the function of living organisms?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter; 3 weeks per unit</td><td>Alaska Cultural Standards</td><td>C3, D5, E3, E4</td></tr>
<tr><td rowspan="4">Quarter 1 Content:
Structure and Function
Energy in Chemical Processes and Everyday Life
Organization for Matter and Energy Flow in Organisms</td><td>Alaska ELA Standards</td><td>RST.6-8.1, RST.6-8.2, WHST.6-8.2, WHST.6-8.7, WHST.6-8.9</td></tr>
<tr><td>Alaska Math Standards</td><td>6.EE.9</td></tr>
<tr><td>Alaska Science Standards</td><td>SA1, SC2.1, SC2.3, SC3.1, SG1</td></tr>
<tr><td>ISTE</td><td>1c 3, 5b, 6, 7</td></tr>
</table>

Alaska Cultural Standard to Emphasize	Community Contacts
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **3:** Determine how ideas and concepts from one knowledge system related to those derived from other knowledge systems.	• **STEM Database Community Resources** • **AK Dept Fish & Game:** SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547 • **UAS** Biology & Marine Science, Chemist, Biologist 796-6200 • **US Forest Service:** Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml

NGSS		Suggested Activities	Cultural & Place-Based Connections
Performance Expectations (PEs)	**Disciplinary Core Ideas (DCIs)**		
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 varied cells. **Assessment Boundary:** none **Cross-cutting Concepts:** Scale, Proportion, and Quantity (MS-LS1-1) **Connections to Engineering, Technology, and Applications of Science**: Interdependence of Science, Engineering, and Technology (MS-LS1-1) **Science and Engineering Practices:** Planning and Carrying Out Investigations (MS-LS1-1)	**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). (MS-LS1-1)	**NGSS Activity Links:** • Cell exploration **Other Activities:** • Living vs. nonliving: arrange pictures into categories living and nonliving, group characteristics of living things by analyzing the pictures in each category. • Experiment with yeast cells to determine their energy needs by adding yeast culture to a test tube and placing a balloon over the tube and measuring change in size of balloon. • Technology: create a mind map/concept of cells and cell organelles. • Develop analogies that refer to the characteristics of cell organelles. • Compare and contrast plant and animal cells using Venn Diagram or Double Bubble Thinking Map. • Osmosis Egg Experiment: Soak raw eggs in vinegar solutions. Weigh egg between solutions to observe/demonstrate the process of osmosis in cells. • Mitosis: Complete online Onion Root Tip Lab- cell biology project.	Anooch': gills taking up oxygen/processing oxygen Forests photosynthesizing carbon accretion, wood

		• Technology Computer Simulation: observe the reproduction rate of bacteria and compare to reproduction of multicellular organisms. www.cellsalive.com • Levels of organization: Sort images of cells, tissues, organs, and systems by level of organization and by system.	
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 on tracing movement of matter and flow of energy. *Students understand that plants do both photosynthesis and respiration.* **Assessment Boundary:** Does not include the biochemical mechanisms of photosynthesis. **Cross-cutting Concepts:** Energy and Matter (MS-LS1-6) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-LS1-6) **Connections to Nature of Science**: Science Knowledge Is Based on Empirical Evidence (MS-LS1-6)	**PS3.D: Energy in Chemical Processes and Everyday Life:** The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. *(secondary to MS-LS1-6)* 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)* **LS1.C: Organization for Matter and Energy Flow in Organisms:** Plants, algae (including phytoplankton), microorganisms use energy from light to make sugars from carbon dioxide from atmosphere and water through the photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)	**NGSS Activity Links:** • Investigating Photosynthesis	**Southeast Alaska Traditional Foods Guide:** A weekly reminder to encourage gathering and using local plants and berries (SEARHC) **AK Fish & Game:** • Alaska Ecology Cards • Alaska Wildlife Curriculum (5 Volumes) o Alaska's Forests & Wildlife, Section I-Make a tasty leaf

<table>
<tr><td>Q2 Instructional Focus: Body Systems</td><td rowspan="3">Suggested Anchor Phenomena:
Hyponatremia: death from too much water
Essential Questions:
How do organisms change over time in response to changes in the environment?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>C3, D6, E4</td></tr>
<tr><td rowspan="4">Quarter 2 Content:
Structure and Function
Growth and Development of Organisms
Information Processing
Organization for Matter and Energy Flow in Organisms
Energy in Chemical Processes and Everyday Life
Circulatory/Respiratory/Excretory/Reproductive Systems</td><td>Alaska ELA Standards</td><td>RI.6.8, RST.6-8.1, SL.8.5 WHST.6-8.1, WHST.6-8.8</td></tr>
<tr><td>Alaska Math Standards</td><td>6.EE.9</td></tr>
<tr><td>Alaska Science Standards</td><td>SA1, SC2.3, SC3.1, SE1, SG1, SG3</td></tr>
<tr><td>ISTE</td><td>1c, 3, 5b, 6</td></tr>
</table>

Alaska Cultural Standard to Emphasize	Community Contacts
E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. **4:** Determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems..	• **STEM Database Community Resources** • **AK Dept Fish & Game:** SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547 • **UAS** Biology & Marine Sciences, Chemist/Biologist 796-6200 • **US Forest Service:** Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml

NGSS		Suggested Activities	Cultural and Place-Based Connections
Performance Expectations (PEs)	Disciplinary Core Ideas (DCIs)		
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. **Cross-cutting Concepts:** Systems and System Models (MS-LS1-3) **Connections to Nature of Science:** Science Is a Human Endeavor (MS-LS1-3) **Science and Engineering Practices:** Engaging in Argument from Evidence (MS-LS1-3)	**LS1.A: Structure and Function:** 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. (MS-LS1-3)	**Activities**: • Life-size walk through of each system (tape them out on the floor)	**Tlingit words:** for edible body parts during dissections. Could make a hands-on puzzle with new vocabulary. **Salmon Boy story** with dissections as a way to share respect for all creatures. **Goldbelt Heritage Foundation:** • **Guawakaan** Cultural significance and anatomy of the black-tailed deer **Dissections:** Contact Fish and Wildlife for local road kill. Comparative biology/anatomy • Examine the features of animal body parts and learn how these are used in tools, clothing or other uses. Example: sea otter fur, bird feather/ hide.

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. **Clarification Statement:** none **Assessment Boundary:** Assessment does not include mechanisms for this information. **Cross-cutting Concepts:** Cause and Effect (MS-LS1-8) **Science and Engineering Practices:** Obtaining, Evaluating, and Communicating Information (MS-LS1-8)	**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. (MS-LS1-8)	**NGSS Activity Link:** • Bat Echolocation (Phenomenon)	• The Parable of Salmon Boy • Salmon migration and homing instinct: main cues used are geomagnetic and olfactory cues.
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.	**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)	**NGSS Activity Links:** • The Simple Story of Photosynthesis and Food • Food for Corn	**Traditional Nutrition** • Macromolecules: Understanding the impact of food on the body; (example: winter foods - are there foods better to eat before heading out in the cold for a hunt?) • Energy Food: o Tlingit salmon egg cheese: Khaghóo l'i o Dried salmon eggs: kaháakw'kaxóok • *Haa atxaayi haa kusteeyix sitee* Our Food is Our Tlingit Way of Life: Newton, R. G. (2005). • Final Report on the Alaska Traditional Diet Survey: Study on

Cross-cutting Concepts: Energy and Matter (MS-LS1-7) **Science and Engineering Practices:** Developing and Using Models (MS-LS1-7)			top 50 household foods; shows the top foods are not currently not traditional foods pp. 16 -25 • SEARHC Native Foods Study: Nutritional Values of Traditional Native Foods • Dr. Walter Soboleff Key-Note Address at Alaska Native Educators' Conference (Seasons for Traditional Foods - activity connections to seasons for berries, fermentation, fish runs, herring spawns, seaweeds, seal hunting, mushrooms; pp. 141 - 142) • Alaska Traditional Food Resources (Eat Smart Alaska)

JSD Middle School Science Curriculum

<table>
<tr><td>Q3 Instructional Focus: Heredity, Evolution</td><td rowspan="3">Suggested Anchor Phenomena:
Long ago man found under the ice
Essential Questions:
How do living organisms pass traits from one generation to the next?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>A2, A5, E1, E4, E8</td></tr>
<tr><td rowspan="4">Quarter 3 Content:
Inheritance of Traits
Variation of Traits
Growth and Development of Organisms
Evidence of Common Ancestry and Diversity
Natural Selection
Adaptation</td><td>Alaska ELA Standards</td><td>RI.6.8,RST.6-8.1, RST.6-8.4, RST.6-8.7, RST.6-8.9, SL.8.1, SL.8.4, SL.8.5, WHST.6-8.1,WHST.6-8.2, WHST.6-8.8, WHST.6-8.9</td></tr>
<tr><td></td><td>Alaska Math Standards</td><td>6.EE.6, 6.RP.1, 7.RP.2, 6.SP.2, 6.SP.4, 6.SP.5, MP.4</td></tr>
<tr><td></td><td>Alaska Science Standards</td><td>SC1.1, SC1.2, SC2.1, SC2.2, SE1, SF1, SG1. SG3</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Alaska Cultural Standard to Emphasize:	Community Contacts
A. Culturally-knowledgeable students are well grounded in the cultural heritage and traditions of their community. **2**. Recount their own genealogy and family history.	• **STEM Database Community Resources** • **AK Dept Fish & Game:** SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547 • **Discovery Southeast:** Naturalists: 463-1500, info@discoverysoutheast.org • **NOAA/NMFS:** Biologists, 789-6000; Posters; Auke Creek Marine Station, 789-6096 • **UAF:** Fisheries Genetics, 796-5441 • **UAS:** Auke Creek Studies Biologist, 796-6200 • **US Forest Service:** Mendenhall Glacier Visitor Center: 789-6614 Juneau Ranger District, 789-6252, Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural & Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td>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.

Assessment Boundary: none

Cross-cutting Concepts: Cause and Effect (MS-LS3-2)

Science and Engineering Practices: Developing and Using Models (MS-LS3-2)</td>
<td>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. (MS-LS3-2)

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. (MS-LS3-2)</td>
<td>NGSS Activity Links:
• Investigating Reproductive Strategies
• Junior's Family Tree
• Dragon Genetics – Understanding Inheritance</td>
<td>Tlingit Genetics
• Making Indigenous People Equal Partners in Gene Research
• DNA Tracks Ancient Alaskan's Descendants
• Tlingit Family Linked to Long Ago Person Found - video
• Teachings From Long Ago Person Found - online booklet
• Migration and Genetic Diversity
• Clan, language, and migration history has shaped genetic diversity in Haida and Tlingit populations from Southeast Alaska
• Kwäday Dän Ts'ìnchi - "Tlingit Ice Man" shows connection between coastal Tlingit to inland Tlingit

How long have the Tlingit been in this area? [The Tlingit oral history has stories of living among prehistoric animals. There are also stories about escaping to mountain tops at the time of a great flood. Geologists believe floods could have occurred at the end of the last major ice age, more than 10,000 years ago. Ancient cairns or rock nests found in the alpine have been described by Tlingit as flood markers].</td>
</tr>
</table>

			How long have the Tlingit been in this area? Did they travel by land bridge or along the coastline to Southeast Alaska? • **Haa Shuká, Our Ancestors: Tlingit Oral Narratives:** *Basket Bay History* by Robert Zuboff pp. 63-71 **Customs that could lead to more genetic variation**: Clan-based marriages had to be with somebody from an opposite clan. This knowledge is usually essential teachings that mothers give to their children in the Tlingit culture (to combat inbreeding depression). • Lineage is known and celebrated to great great grandparent's level. **AK Dept of Fish & Game:** • Division of Wildlife Conservation Publications Database, Search by topic (e.g. physiology, genetics…), species, author, year. • Exploring the ecological and genetic separation of two sibling species (harbor seals and spotted seals) • Mark-recapture using tetracycline and genetics reveal record-high bear density

MS-LS4-5: Gather and synthesize information about the 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. **Assessment Boundary:** none **Cross-cutting Concepts** Cause and Effect (MS-LS4-5) **Connections to Engineering, Technology, and Applications of Science:** Interdependence of Science, Engineering, and Technology (MS-LS4-5) **Connections to Nature of Science**: Science Addresses Questions About the Natural and Material World (MS-LS4-5) **Science and Engineering Practices:** Obtaining, Evaluating, and Communicating Information (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 onto offspring. (MS-LS4-5) **AK Science Standards** (7) SC2.2 Identifying the seven levels of classification of organisms (6) SC2.2 Identifying basic behaviors (e.g., migration, communication, hibernation) used by organisms to meet the requirements of life	**NGSS Activity Links:** • Catch Up on Tomato Technology	**Tlingit Value**: You will not have inbreeding: hél woocheen gaxh yi da xéet Tlingits had extensive trade networks and far reaching wars that enabled genflows including the Haida, and Nez Perce. Today gene flow is evident in the diversity of Tlingit people. • DNA tracks ancient Alaskan's Descendants • Students create cultural stories about plants and animals. • Family Tree

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. **Cross-cutting Concepts:** Patterns (MS-LS4-1) **Connections to Nature of Science:** Scientific Knowledge Assumes an Order and Consistency in Natural Systems (MS-LS4-1) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-LS4-1) **Connections to Nature of Science:** Science Knowledge Is Based on Empirical Evidence (MS-LS4-1)	**LS4.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. (MS-LS4-1)	**NGSS Activity Links:** • The Day the Mesozoic Died • A Guide to Developing Literacy Practices in Science: Supporting Claims with Evidence by Using an Argumentation Card Sort: Fossils	**Southeast AK Fossils** • On Your Knees Cave • Mammal Fossils

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 explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.
 	
Assessment Boundary: none
 	
Cross-cutting Concepts: Patterns (MS-LS4-2)
 	
Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems (MS-LS4-2)
 	
Science and Engineering Practices: Constructing Explanations and Designing Solutions (MS-LS4-2)
	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. (MS-LS4-2)
	
	AK Science Standards
	(8) SC2.1 Placing vertebrates into correct classes of taxonomy based on external, observable features
	
	(6) SC2.1 Using a dichotomous key to classify animals and plants into groups using external or internal features
		NGSS Activity Links:
		• Teaching With Tarantulas
		• Stickleback Evolution Virtual Lab
			Articles:
			• DNA Tracks Ancient Alaskan's Descendants - Article about On Your Knees Cave Man from Prince of Wales)
			• Tlingit Family Linked to Long Ago Person Found - video clip
			
			Dept Fish & Game: research
			• Division of Wildlife Conservation Publications Database, Search by topic (e.g. physiology, genetics), species, author, year.
			  o Example, Exploring the ecological and genetic separation of two sibling species (harbor seals and spotted seals) 04/
			• Divisions of Sport Fish, Commercial Fisheries and Subsistence Publications Database
			• Alaska Fish & Wildlife News- monthly articles about research, management and hot topics. Search topics
			  o Example, article about genetics of mountain goats in Southeast.

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. **Clarification Statement:** Behaviors that affect the probability of animal reproduction include nest building to protect young from cold, herding of animals to protect young, and vocalization of animals and colorful plumage to attract mates for breeding. Animal behaviors that affect the probability of plant reproduction include transferring pollen or seeds, and creating conditions for seed germination and growth. Plant structures include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury. **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect (MS-LS1-4) **Science and Engineering Practices:** Engaging in Argument from Evidence (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)	**NGSS Activity Links:** • Reproduction • Flowers Seeking Pollinators	Tlingit Origin Narrative: • Mosquito story - mosquitoes originated when a giant was killed. The narrative can be found in *Haa Shuká, Our Ancestors: Tlingit Oral Narratives* edited by Nora and Richard Dauenhauer, or told by Robert Zuboff: SHI Lit Book 4 pp 186-188 Articles/Online Resources: • Virus infects arboretum's Tlingit potato crop • A potato revival • Sitka Local Foods Network - Tlingit Potato • Maria's Tlingit Potato: journey to the Dauenhauer garden - a video from Tlingit clan conference

MS-LS4-4: Construct an explanation based on evidence that describes 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. **Assessment Boundary:** none **Cross-cutting Concepts:** Cause and Effect (MS-LS4-4) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-LS4-4)	**LS4.B: Natural Selection:** Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)	**NGSS Activity Links:** • An Origin of Species: Pollenpeepers • Clipbirds • Bug Hunt • The Gene Scene • Color Variation over Time in Rock Pocket Mouse Populations • HHMI Data Point: Effects of Natural Selection on Finch Beak Size • Natural Selection • Natural Selection and the Development of Antibiotic Resistance-Middle School Sample Classroom Assessment • Lab 17: Mechanisms of Evolution: Why Does a Specific Version of a Trait Become More Common in a Population Over Time? • Environmental Change and Evolution: Which Mechanism of Microevolution Caused the Beak of the Medium Ground Finch Population on Daphne Major to Increase in Size from 1976 to 1978? • Stickleback Evolution Virtual Lab	• Tlingits had extensive trade networks and far reaching wars that enabled genflow, via contact with other tribes including the Haida, Nez Perce to the south. Today gene flow is evident in the diversity of Tlingit people. • Mountain goats grow more wool during the winter months to survive in cold temperatures. For this reason, Native peoples would hunt mountain goats during the winter as the thicker hides would provide more wool per goat. Over time, the mountain goats adapted to their environment through natural selection. • (Sealaska Heritage Institute Life Science Concepts p. 15) • ADFG Stream Study • Hatcheries change salmon genetics after a single generation-article

Supplemental			
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. **Assessment Boundary:** Does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations. **Cross-cutting Concepts:** Structure and Function (MS-LS3-1) **Science and Engineering Practices:** Developing and Using Models (MS-LS3-1)	**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. (MS-LS3-1) **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. (MS-LS3-1)	**NGSS Activity Links:** • Monstrous Mutations Adaptation: Mutations & Variations Activity • A Recipe for Traits **Other Activities:** • Fish habitat assessment, habitat selection of juvenile fish research projects	**Customs that could lead to more genetic variation**: Clan-based marriages had to be with somebody from an opposite clan. This knowledge is usually essential teachings that mothers give to their children in the Tlingit culture (to combat inbreeding depression). **AK Dept Fish and Game** • Division of Wildlife Conservation- *Publications Database*, Search by topic (e.g. ecology), species, author, year. • Divisions of Sport Fish, Commercial Fisheries and Subsistence *Publications Database*

SUPPLEMENTAL: TAUGHT IN HS			
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. **Cross-cutting Concepts:** Patterns (MS-LS4-3) **Science and Engineering Practices:** Analyzing and Interpreting Data (MS-LS4-3)	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. (MS-LS4-3)	**Activity Links:** • Track the gestation cycles of development	• DIPAC field visit **AK Dept Fish and Game** • Division of Wildlife Conservation- *Publications Database*, Search by topic (e.g. ecology), species, author, year. • Divisions of Sport Fish, Commercial Fisheries and Subsistence *Publications Database*
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	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	**NGSS Activity Links:** • Natural Selection and the Development of Antibiotic Resistance-Middle School Sample Classroom Assessment	**Tlingit World View:** Everything is woven together: Ldákat át woosht kasi x̲át • Auke Creek Fish studies: sculpin and sockeye study: color change - in water depth • Glacial and ice sheet changes - New species taking over habitat

proportional reasoning to support explanations of trends in changes to populations over time. **Assessment Boundary:** Does not include Hardy Weinberg calculations. **Cross-cutting Concepts** Cause and Effect (MS-LS4-6) **Science and Engineering Practices:** Using Mathematics and Computational Thinking (MS-LS4-6)	common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)		• Murres in Southeast Affected by Die-Off - article • Harbor seals…ice flows • Clams and mussels…. distribution in comparison with past, psp also • Spruce Aphid: Small bugs, big problems

<table>
<tr><td>Q4 Instructional Focus: Ecosystems</td><td rowspan="3">Suggested Anchor Phenomena:
Colony Collapse Disorder (Bees)
Essential Questions:
How does a system of living and nonliving things operate to meet the needs of the organisms in an ecosystem?</td><td colspan="2">Standards</td></tr>
<tr><td>Pacing: one quarter</td><td>Alaska Cultural Standards</td><td>A4, C1, D4, E1, E2</td></tr>
<tr><td rowspan="5">Quarter 4 Content:
Interdependent Relationships in Ecosystems
Ecosystem Dynamics, Functioning, and Resilience
Cycles of Matter and Energy Transfer in Ecosystems
Human Impacts</td><td>Alaska ELA Standards</td><td>RI.8.8, RST.6-8.1, RST.6-8.7, RST.6-8.8, SL.8.1, SL.8.4, SL.8.5, WHST.6-8.1,WHST.6-8.2, WHST.6-8.9</td></tr>
<tr><td></td><td>Alaska Math Standards</td><td>6.SP.5, 6.RP.3, MP.4, 6.EE.9</td></tr>
<tr><td></td><td>Alaska Science Standards</td><td>SA3, SC3.1, SC3.2, SE1, SF3, SF3</td></tr>
<tr><td></td><td>ISTE</td><td>1c, 3, 5b, 6c, 7</td></tr>
</table>

<table>
<tr><th>Alaska Cultural Standard to Emphasize:</th><th>Community Contacts</th></tr>
<tr><td>E. Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.
2. Understand the ecology and geography of the bioregion they inhabit.</td><td>STEM Database Community Resources
AK Dept Fish & Game: SE Regional Wildlife Education Specialist, abby.lowell@alaska.gov, 465-4292; Statewide Wildlife Education & Outreach Coordinator, kristen.romanoff@alaska.gov, 465-8547
Bob Armstrong at Nature Bob
CBJ: Mendenhall Water Treatment Plant 957-0572
Discovery Southeast:Naturalists: 463-1500, info@discoverysoutheast.org
Hecla/Greens Creek Mine: Engineer: 523-3803
NOAA/NMFS: Genetics, Marine Ecology, 789-6000, Posters; Auke Creek Marine Station,789-6096
UAF: Fisheries Genetics, Conservation, Ecology: 796-5441
UAS: Environmental Sciences, 796-6523; UAS Auke Creek Studies biologists, 796-6200
US Forest Service: Pacific NW Research Station 586-8811, https://www.fs.fed.us/pnw/about/programs/index.shtml</td></tr>
</table>

<table>
<tr><th colspan="2">NGSS</th><th rowspan="2">Suggested Activities</th><th rowspan="2">Cultural & Place-Based Connections</th></tr>
<tr><th>Performance Expectations (PEs)</th><th>Disciplinary Core Ideas (DCIs)</th></tr>
<tr>
<td><u>MS-LS2-1:</u> 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.

Assessment Boundary: none

Cross-cutting Concepts:
Cause and Effect <u>(MS-LS2-1)</u>

Science and Engineering Practices: Analyzing and Interpreting Data <u>(MS-LS2-1)</u></td>
<td><u>LS2.A:</u> Interdependent Relationships in Ecosystems: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. <u>(MS-LS2-1)</u>

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. <u>(MS-LS2-1)</u>

Growth of organisms and population increases are limited by access to resources. <u>(MS-LS2-1)</u></td>
<td>NGSS Activity Links:
• <u>Habitable Planet Population Simulator</u>
• <u>Climate Change and Michigan Forests</u>

Other Activities:
• <u>Chesapeake Bay Food Web</u>
• <u>Mobile Greenhouse</u></td>
<td>• Signs of Red Tide: <u>K</u>ookénaa- small beach invertebrates are observed to help establish if paralytic shellfish poisoning is present. Sun and warmth may be connected with the occurrence.
• <u>Héen Latinee Outdoor Classroom</u>
• Ecosystems comparisons of Inland and Coastal Tlingit: This led to different items to trade. Also did groups have different seasonal movements? Why did they have to travel to regions with different, seasonal natural gardens?
• <u>Goldbelt Heritage Seaweed Unit</u>
• <u>Goldbelt Heritage Spruce Science</u>
AK Fish & Game:
• <u>Alaska Wildlife Curriculum</u>
  o <u>Alaska’s Wetlands and Wildlife,</u> Section II Energy Flow in an Alaska Wetland
  o <u>Alaska’s Ecology</u>, Section II Ecosystems- Connections
  o <u>Alaska’s Wildlife for the Future,</u> Section II- Population Dynamics
  o <u>Alaska Ecology Cards</u>
• <u>Alaska’s Wild Wonders</u>- a magazine geared for upper elementary/middle school about AK wildlife & habitats.</td>
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</table>

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. **Assessment Boundary:** none **Cross-cutting Concepts:** Stability and Change (MS-LS2-5) **Connections to Engineering, Technology, and Applications of Science**: Influence of Science, Engineering, and Technology on Society and the Natural World (MS-LS2-5) **Connections to Nature of Science:** Science Addresses Questions About the Natural and Material World (MS-LS2-5) **Science and Engineering Practices:** Engaging in Argument from Evidence (MS-LS2-5)	**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. (secondary to 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. (secondary to MS-LS2-5)	**NGSS Activity Links:** • Exploring the "Systems" in Ecosystems • Flow of Matter and Energy in Ecosystems • Ocean Bully • HHMI Coral Bleaching	• What were/are the ways in which tribes participate in nutrient recycling? (how/why are animal parts/plant parts returned to the Earth?) • Invite Elders and community members to share stories about historic and current movements of people and villages as a result of glaciers, tsunamis (Lituya Bay), landslides, coastal erosion, loss of sea ice, ocean acidification, changing climate. • Students talk to grandparents about where they caught/observed toads when they were kids and whether there are frogs and toads there now. • Héen Latinee Outdoor Classroom • Goldbelt Heritage Foundation: Southeast Alaska Ecology unit • Forests: clear cut forestry, windthrow, gap- phase forest disturbance, gap = solar energy

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 and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems. **Assessment Boundary:** none **Cross-cutting Concepts:** Stability and Change (MS-LS2-4) **Science and Engineering Practices:** Engaging in Argument from Evidence (MS-LS2-4) **Connections to Nature of Science:** Science Knowledge Is Based on Empirical Evidence (MS-LS2-4)	**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. (MS-LS2-4)	**NGSS Activity Links:** • Exploring the "Systems" in Ecosystems • Flow of Matter and Energy in Ecosystems • Ocean Bully • HHMI Coral Bleaching	• Invite Elders and community members to share stories about historic and current movements of people and villages as a result of glaciers, tsunamis (Lituya Bay), landslides, coastal erosion, loss of sea ice, ocean acidification, changing climate. • Students talk to grandparents about where they caught/observed toads when they were kids and whether there are frogs and toads there now. • Héen Latinee Outdoor Classroom
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.	**LS2.B: Cycles 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	**Activity Links:** • Flow of Matter and Energy in Ecosystems • Modeling Marine Food Webs and Human Impact • The Roots of the Carbon Cycle • Seaweek Lesson: Pollutants Sink, Swim, Float	**Traditional Oral Narrative:** • Raven Goes Down the Bull Kelp (Bi-valve knowledge: clams, mussels, food categorized under shellfish) • Origin of the Killer Whale (oral narrative, pp 86-88)- how Orca fits into our ecosystem. • **Food chain**: ayaa naayi

Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes. **Cross-cutting Concepts:** Energy and Matter (MS-LS2-3) **Science and Engineering Practices:** Developing and Using Models (MS-LS2-3)	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)		• That which devours each other: *wooch hás ada éen át* • The energy that flows from the lowest to highest: *wooch toonaxh ya kanadein át* **AK Dept Fish & Game:** • Wildlife for the Future, Section II: Population Dynamics and Section III: Sustaining Wildlife & Communities • Alaska's Forests & Wildlife, Section II: Forest Puzzlers • Alaska's Ecology, Section II: Ecosystem Partners • Alaska Species Profiles
Supplemental (also in HS):			
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. **Assessment Boundary:** none	**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. (MS-LS2-2)	**NGSS Activity Links:** • Florida's Everglades: The River of Grass • Flow of Matter and Energy in Ecosystems • Teaching With Tarantulas	**Traditional Tlingit value**: respect for the most minute creature. Wooch yaxh hadaali: weighted evenly, balance of any two different species Tlingit Stories: Human dependence on water and the environment: • How Raven Stole the Water • Box of Daylight **Tlingit Halibut Hook:** designed to only catch halibut of a certain size; prevents getting reproducing female halibut. **Traditional Ecological Knowledge and Natural Resource Management** edited by Charles R. Menzies

Cross-cutting Concepts: Patterns (MS-LS2-2) **Science and Engineering Practices:** Constructing Explanations and Designing Solutions (MS-LS2-2)	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. (secondary to MS-LS2-5)		**Phenomena research:** • Where have all the swallows gone? • Glacial and ice sheet changes - New species taking over habitat • Murre studies, dying off • Harbor seals and ice flows • Clams and mussels…. distribution in comparison with past, psp • Bering Sea pollock • Wolf pack studies **AK Dept Fish & Game curriculum:** • Alaska's Ecology Human Impacts on Ecosystems, Section IV • Alaska's Forests & Wildlife- Human uses and impacts in forest ecosystems, Section V • Alaska's Tundra- Human uses and impacts in tundra ecosystems, Section V • Alaska's Wetlands- Wetlands in a changing world, Section IV

Appendices

- Alaska Cultural Standards
- Alaska Science Standards
- ISTE Standards

Cultural Standards for Students

A. Culturally-knowledgeable students are well grounded in the cultural heritage and traditions of their community.

Students who meet this cultural standard are able to:

1. assume responsibility for their role in relation to the well-being of the cultural community and their life-long obligations as a community member;
2. recount their own genealogy and family history;
3. acquire and pass on the traditions of their community through oral and written history;
4. practice their traditional responsibilities to the surrounding environment;
5. reflect through their own actions the critical role that the local heritage language plays in fostering a sense of who they are and how they understand the world around them;
6. live a life in accordance with the cultural values and traditions of the local community and integrate them into their everyday behavior.
7. determine the place of their cultural community in the regional, state, national and international political and economic systems;

B. Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life.

Students who meet this cultural standard are able to:

1. acquire insights from other cultures without diminishing the integrity of their own;
2. make effective use of the knowledge, skills and ways of knowing from their own cultural traditions to learn about the larger world in which they live;
3. make appropriate choices regarding the long-term consequences of their actions;
4. identify appropriate forms of technology and anticipate the consequences of their use for improving the quality of life in the community.

C. Culturally-knowledgeable students are able to actively participate in various cultural environments.

Students who meet this cultural standard are able to:

1. perform subsistence activities in ways that are appropriate to local cultural traditions;
2. make constructive contributions to the governance of their community and the well-being of their family;
3. attain a healthy lifestyle through which they are able to maintain their own social, emotional, physical, intellectual and spiritual well-being;
4. enter into and function effectively in a variety of cultural settings.

D. Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning.

Students who meet this cultural standard are able to:

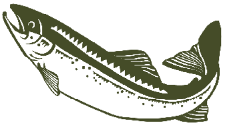
1. acquire in-depth cultural knowledge through active participation and meaningful interaction with Elders;
2. participate in and make constructive contributions to the learning activities associated with a traditional camp environment;
3. interact with Elders in a loving and respectful way that demonstrates an appreciation of their role as culture-bearers and educators in the community;
4. gather oral and written history information from the local community and provide an appropriate interpretation of its cultural meaning and significance;
5. identify and utilize appropriate sources of cultural knowledge to find solutions to everyday problems;
6. engage in a realistic self-assessment to identify strengths and needs and make appropriate decisions to enhance life skills.

E.

Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them.

Students who meet this cultural standard are able to:

1. recognize and build upon the inter-relationships that exist among the spiritual, natural and human realms in the world around them, as reflected in their own cultural traditions and beliefs as well as those of others;
2. understand the ecology and geography of the bioregion they inhabit;
3. demonstrate an understanding of the relationship between world view and the way knowledge is formed and used;
4. determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems;
5. recognize how and why cultures change over time;
6. anticipate the changes that occur when different cultural systems come in contact with one another;
7. determine how cultural values and beliefs influence the interaction of people from different cultural backgrounds;
8. identify and appreciate who they are and their place in the world.



Alaska Science Performance Standards

Specific expectations by grade band may be found on pages 105-132 of the Content and Performance Standards for Alaska Students (4th edition).

SCIENCE AS INQUIRY & PROCESS

SA1. Investigate problems, design and conduct experiments, and scientific argumentation

SA2. Reasoning, skepticism, openness, dialog, & review

SA3. Local history, knowledge, and interaction

PHYSICAL SCIENCE

SB1. Properties of matter, structure, behavior

SB2. Energy forms, transformation, transference, and conservation

SB3. Matter & energy: physical, chemical, nuclear changes, effects on systems

SB4. Motion & force: characteristics, relationships, natural forces

LIFE SCIENCE

SC1. Change over time/evolution

SC2. Structure & function, development, life cycles, biodiversity

SC3. Transfer and transformation of energy and matter.

EARTH SCIENCE

SD1. Geochemical cycles

SD2. Earth origins, processes, and forces

SD3. Earth & the solar system, energy flow & cycle from sun

SD4. Cosmic evolution

SCIENCE & TECHNOLOGY

SE1. Science, technology, & everyday life

SE2. Problem-solving

SE3. Technology innovation and advances

CULT., SOCIAL, PERSONAL PERSPECTIVES, & SCIENCE

SF1. Relationships between individuals, culture, society, people, & science.

SF2. Alternate world-views

SF3. Recording & validating cultural knowledge

HISTORY & NATURE OF SCIENCE

SG1. Scientific knowledge evolves

SG2. Parameters for scientific advancement

SG3. The role of evidence in science

SG4. Science based on curiosity, creativity, & imagination

2016

ISTE STANDARDS
FOR STUDENTS

1. Empowered Learner

Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences. Students:

a. articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.
b. build networks and customize their learning environments in ways that support the learning process.
c. use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
d. understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

2. Digital Citizen

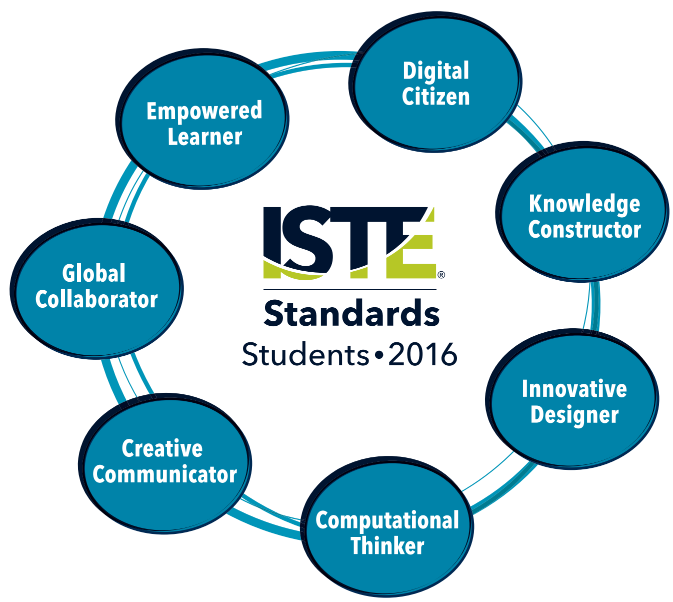
Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical. Students:

a. cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.
b. engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.
c. demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.
d. manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.

3. Knowledge Constructor

Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Students:

a. plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.
b. evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.
c. curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
d. build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.



4. Innovative Designer

Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. Students:

a. know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
b. select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
c. develop, test and refine prototypes as part of a cyclical design process.
d. exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

5. Computational Thinker

Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. Students:

a. formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
b. collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
c. break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.
d. understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

6. Creative Communicator

Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. Students:

a. choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
b. create original works or responsibly repurpose or remix digital resources into new creations.
c. communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
d. publish or present content that customizes the message and medium for their intended audiences.

7. Global Collaborator

Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally. Students:

a. use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.
b. use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.
c. contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.
d. explore local and global issues and use collaborative technologies to work with others to investigate solutions.