Kenai Peninsula Borough School District
Science
Kindergarten Unit 1: ANIMALS, PLANTS AND THEIR ENVIRONMENT

Pacing: 6 weeks
NGSS Standards:
K-LS1. Use observations to describe patterns of what plants and animals (including humans) need to survive**.**

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*

MATH STANDARDS:
K.MP.2 Reason abstractly and quantitatively. (K-ESS3-1)

K.MP.2 .1 Represent a situation symbolically and/or with manipulatives

K.MP.2 .2create a coherent representation of the problem

K.MP.2 .3use units of measurement consistently

K.MP.4 Model with mathematics. (K-ESS3-1)

K.MP.4.1 Apply mathematics to solve problems in everyday life

K.MP.4.2 Identify important quantities in a practical situation and model the situation with manipulatives or pictures

K.MP.4.3 Interpret mathematical results in the context of the situation and reflect on whether the results make sense

K.CC Counting and Cardinality (K-ESS3-1)
K.CC.1 Know number names and the count sequence.

K.CC.2 Count to tell the number of objects.

K.CC.3 Compare numbers.

K.MD Measurement and Data
K.MD.2. Make comparisons between two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. *For example, directly compare the heights of two children and describe one child as taller/shorter.*

ELA Standards:
RI.K.1 With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text. (K-ESS2-2)

W.K.1 Use a combination of drawing, dictating, and writing to state an opinion or a preference about a topic or part of a book (e.g., I like dogs better than cats because…; My favorite part of the story is when...; I think it was funny when…). (K-ESS2-2)

W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.(K-ESS2-2), (K-ESS3-3)

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and combine or summarize information/facts learned or express opinions about them). (K-LS1-1)

SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional details. (K-ESS3-1)

Big Idea:
Interaction of plants, animals and the environment

Essential Questions:
How do plants and animals change the environment in order to meet their needs?
How can humans influence their environment?

Vocabulary: environment, living, nonliving, basic needs

Kenai Peninsula Borough School District
Science
Kindergarten UNIT 2: FORCES AND INTERACTIONS: PUSHES AND PULLS

Pacing: 6 weeks
NGSS Standards:

K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

MATH STANDARDS:
K.MP.2 Reason abstractly and quantitatively (K-PS2-1)

K.MP.2 .1 Represent a situation symbolically and/or with manipulatives

K.MP.2 .2create a coherent representation of the problem

K.MP.2 .3use units of measurement consistently

K.MD.1 Describe measurable attributes of objects (e.g., length or weight). Match measuring tools to attribute (e.g., ruler to length). Describe several measurable attributes of a single object.

K.MD.A.2 Make comparisons between two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter. (K-PS2 1)

ELA/LITERACY:
RI.K.1 With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text. (K-PS2-2)

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and combine or summarize information/facts learned or express opinions about them). (K-PS2-1)

SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-PS2-2)

Big Idea:
Pushes and Pulls

Essential Questions:
What happens when you push or pull an object?
What happens when you push or pull harder?

Vocabulary: motion, force, push, pull

Kenai Peninsula Borough School District
Science
Kindergarten UNIT 3: WEATHER AND CLIMATE

Pacing: 6 weeks

NGSS Standards: Students who demonstrate understanding can:

K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.

K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area

K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.

K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather**.**

MATH STANDARDS:
K.MP.2 Reason abstractly and quantitatively (K-ESS2-1)

K.MP.2 .1 Represent a situation symbolically and/or with manipulatives

K.MP.2 .2create a coherent representation of the problem

K.MP.2 .3use units of measurement consistently

K.MP.4 Model with mathematics. (K-ESS3-1), (K-ESS3-2)

K.MP.4.1 Apply mathematics to solve problems in everyday life

K.MP.4.2 Identify important quantities in a practical situation and model the situation with manipulatives or pictures

K.MP.4.3 Interpret mathematical results in the context of the situation and reflect on whether the results make sense

K.CC.A Know number names and the count sequence. (K-ESS2-1), (K-ESS3-2)

K**.CC.4.a** Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in standard order, pairing each object with one and only one number name and each number name with one and only one object.

K.MD.1. Describe measurable attributes of objects (e.g., length or weight). Match measuring tools to attribute (e.g., ruler to length). Describe several measurable attributes of a single object.

K.MD.2. Make comparisons between two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. *For example, directly compare the heights of two children and describe one child as taller/shorter.* (K-PS3-1),(K-PS3-2)

K.MD.3. Classify objects into given categories (attributes). Count the number of objects in each category (limit category counts to be less than or equal to 10).

ELA STANDARDS:
RI.K.1 With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text. (K-ESS3-2)

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and combine or summarize information/facts learned or express opinions about them). (K-PS3-1), (K-PS3-2),(K-ESS2-1)

SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-ESS3-2)

Big Idea:
Weather and Climate Observations

Essential Questions:
What is the effect of sunlight on our earth?
What are the patterns of weather throughout the year where you live?
How does the weather forecast help us?

Vocabulary: weather, patterns, forecast, earth, temperature

Kenai Peninsula Borough School District
Science
First Grade Unit 1: WAVES: LIGHT AND SOUND

Pacing: 6 weeks

NGSS Standards: Students who demonstrate understanding can:
1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate

1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated

1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.

1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance

Math Standards:

1.MP.5 Use appropriate tools strategically. (1-PS4-4)
a. select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem
b. be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful
c. identify relevant external mathematical resources and use them to pose or solve problems
d. use technological tools to explore and deepen their understanding of concepts

1.MD.1. Measure and compare three objects using standard or non-standard units.

1.MD.2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. (1-PS4-4)

ELA Standards:
W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure (e.g., restate at the end the most interesting fact or the most important idea shared). (1-PS4-2)

W.1.7 . Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions or combine or summarize information/facts learned). (1-PS4-1),(1-PS4-2),(1-PS4-3),(1-PS4-4)

W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question (1-PS4-1),(1-PS4-2),(1-PS4-3)

SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups. a. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion). b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges. c. Ask questions to clear up any confusion about the topics and texts under discussion. (1-PS4-1),(1-PS4-2),(1-PS4-3)

Big Ideas:
Light and sound waves travel

Essential Questions
What happens when materials vibrate?
What happens when there is no light?
What happens to a beam of light when different objects are put in front of it?
How does light effect your life?

Vocabulary: light, waves, sound, vibrate

Kenai Peninsula Borough School District
Science
First Grade Unit 2: STRUCTURE, FUNCTION, AND INFORMATION PROCESSING

Pacing: 6 weeks

NGSS Standards:
1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

Math Standards:

MP.2 Reason abstractly and quantitatively (1-LS3-1)

MP.5 Use appropriate tools strategically. (1-LS3-1)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts

1.NBT.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, <. (1-LS1-2)

1.NBT.4. Add using numbers up to 100 including adding a two-digit number and a one-digit number and adding a two-digit number and a multiple of 10.Use:
a. Concrete models or drawings and strategies based on place value

b. Properties of operations
c. And/or relationship between addition and subtraction.
Relate the strategy to a written method and explain the reasoning used.
Demonstrate in adding two-digit numbers, tens and tens are added, ones and ones are added and sometimes it is necessary to compose a ten from ten ones. (1-LS1-2)

1.NBT.5 Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. (1-LS1-2)

1.NBT.C.6 Subtract multiples of 10 up to 100. Use:
a. Concrete models or drawings
b. Strategies based on place value
c. Properties of operations
d. And/or the relationship between addition and subtraction.
e. Relate the strategy to a written method and explain the reasoning used. (1-LS1-2)

1.MD.1 Measure lengths indirectly and by iterating length units**.** Measure and compare three objects using standard or non-standard units. (1-LS3-1)

ELA Standards:
RI.1.1 With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text. (1-LS1-2),(1-LS3-1)

RI.1.2 Identify the main topic or author's purpose (e.g., to teach or tell us about …) and retell key details of a text. (1-LS1-2)

RI.1.10 With prompting and support, read informational texts on a range of topics appropriately complex for grade 1, with scaffolding as needed. (1-LS1-2)

W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions or combine or summarize information/facts learned). (1-LS1-1),(1-LS3-1)

W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-LS3-1)

Big Ideas:
Structure and function of plants and animals
Heredity

Essential Questions:
What are some ways that plants and animals meet their needs so that they can survive and grow?
How are parents and their children similar and different?

Vocabulary: survive, root, stems, leaves, flowers, fruit, similar

Kenai Peninsula Borough School District
Science
First Grade Unit 3: SPACE SYSTEMS: PATTERNS AND CYCLES

Pacing: 6 weeks
NGSS Standards:

1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.

Math Standards:
MP.2 Reason abstractly and quantitatively. (1-ESS1-2)
a. Represent a situation symbolically and/or with manipulatives
b. Create a coherent representation of the problem
c. Use units of measurement consistently

MP.4 Model with mathematics. (1-ESS1-2)
a. Apply mathematics to solve problems in everyday life
b. Identify important quantities in a practical situation and model the situation with manipulatives or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense

MP.5 Use appropriate tools strategically. (1-ESS1-2)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts

1.OA.1 Use addition and subtraction strategies to solve word problems (using numbers up to 20), involving situations of adding to, taking from, putting together, taking apart and comparing, with unknowns in all positions, using a number line (e.g., by using objects, drawings and equations). Record and explain using equation symbols and a symbol for the unknown number to represent the problem. (1-ESS1-2)

1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. (1-ESS1-2)

ELA Standards:
W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions or combine or summarize information/facts learned). (1-ESS1-1),(1-ESS1-2)

W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-ESS1-1),(1-ESS1-2)

Big Ideas:
Patterns in the Sky

Essential Questions:
What objects are in the sky and how do they seem to move?
What are the patterns of sunrise and sunset over the course of a year?

Vocabulary: cycle, space, patterns, sun, moon, stars

Kenai Peninsula Borough School District
Science
2nd Grade Unit 1: EARTH'S SURFACE SYSTEMS: PROCESS THAT SHAPE THE EARTH

Pacing: 6 weeks

NGSS Standards:

2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly

2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land

2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.

2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Math Standards:

MP.2 Reason abstractly and quantitatively. (2-ESS2-1),(2-ESS2-1),(2-ESS2-2)

In grades K-2 mathematically proficient students will:

- represent a situation symbolically and/or with manipulatives
- create a coherent representation of the problem
- use units of measurement consistently

MP.4 Model with mathematics. (2-ESS1-1), (2-ESS2-1), (2-ESS2-2)
a. Apply mathematics to solve problems in everyday life
b. Identify important quantities in a practical situation and model the situation with manipulatives or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense

MP.5 Use appropriate tools strategically. (2-ESS2-1)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts

2.NBT.1 Understand place value. (2-ESS1-1) Model and identify place value positions of three digit numbers. Include: a. 100 can be thought of as a bundle of ten tens --called a "hundred". b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).

2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (2-ESS2-2)

2.MD.B.5 Fluently add and subtract using numbers up to 100. Use: strategies based on place value; properties of operations; and/or the relationship between addition and subtraction. (2-ESS2-1)

ELA Standards:
RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of informational texts using key details from the text. (2-ESS1-1)

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-ESS1-1),(2-ESS2-1)

RI.2.9 . Compare and contrast the most important points presented by two texts or related topics (e.g., a book about polar bears and a book about black bears). (2-ESS2-1)

W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. (2-ESS1-1),(2-ESS2-3)

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report or visual or oral presentation; record data from science observations). (2-ESS1-1)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-ESS1-1),(2-ESS2-3)

SL.2.2 Retell or describe key ideas or details from a text read aloud or information presented orally or through other media. (2-ESS1-1)

SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-ESS2-2)

Big Ideas:
Changes in Our Earth
Land and Water Formations
Roles of Water in Earth's Surface Processes

Essential Questions:
How does land change and what are some things that cause it to change?
What are the different types of land and water?

Vocabulary: land formations, bodies of water, volcano, earthquake, erosion, map

Kenai Peninsula Borough School District
Science
Second Grade Unit 2: STRUCTURE, PROPERTIES OF MATTER

Pacing: 6 weeks
NGSS Standards:
2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Math Standards:

MP.2 Reason abstractly and quantitatively.) In grades K-2 mathematically proficient students will represent a situation symbolically and/or with manipulatives; create a coherent representation of the problem; use units of measurement consistently. (2-PS1-2)

MP.4 Model with mathematics. (2-PS1-1),(2-PS1-2)
In grades K-2 mathematically proficient students will apply mathematics to solve problems in everyday life; identify important quantities in a practical situation and model the situation with manipulatives or picture; interpret mathematical results in the context of the situation and reflect on whether the results make sense

MP.5 Use appropriate tools strategically. (2-PS1-2)
In grades K-2 mathematically proficient students will select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem; be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful; identify relevant external mathematical resources and use them to pose or solve problems; use technological tools to explore and deepen their understanding of concepts.

2.MD.10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart and compare problems using information presented in a bar graph. (2-PS1-1),(2-PS1-2)

ELA Standards:

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of informational texts using key details from the text. (2-PS1-4)

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. (2-PS1-4)

RI.2.8 Describe how reasons support specific points the author states in a text. (2-PS1-2),(2-PS1-4)

W.2.1 Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding sentences that restate or paraphrase their opinion. (2-PS1-4)

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record data from science observations). (2-PS1-1),(2-PS1-2),(2-PS1-3)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-PS1-1),(2-PS1-2),(2-PS1-3)

Big Ideas:
Observable Structures and Properties of Matter
Matter Changes When Heated or Cooled

Essential Questions:
How are materials similar and different from one another?
How do the properties of materials relate to their use?
How can heating and cooling change matter?

Vocabulary: properties of matter, states of matter, solid, liquid, gas, reversible, irreversible

Kenai Peninsula Borough School District
Science
Second Grade Unit 3: INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS

Pacing: 6 weeks

NGSS Standards:

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats

Math Standards:
MP.2 Reason abstractly and quantitatively. . (2-LS2-1), (2-LS4-1).
a. Represent a situation symbolically and/or with manipulatives;
b. Create a coherent representation of the problem;
c. Use units of measurement consistently .

MP.4 Model with mathematics.
a. Apply mathematics to solve problems in everyday life;
b. Identify important quantities in a practical situation;
c. Model the situation with manipulatives or picture;
d. Interpret mathematical results in the context of the situation and reflect on whether the results make sense. (2-LS2-1),(2-LS2-2),(2-LS4-1)

MP.5 Use appropriate tools strategically. (2-LS2-1).
a. Select the available tools (such as pencil and paper, manipulatives, rulers, and available technology) when solving a mathematical problem;
b. Be familiar with tools appropriate for the grade level to make sound decisions about when each of these tools might be helpful;
c. Identify relevant external mathematical resources and use them to pose or solve problems;
d. Use technological tools to explore and deepen their understanding of concepts.

2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems. (2-LS2-2), (2-LS4-1)

ELA Standards:
W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report or visual or oral presentation; record data from science observations). (2-LS2-1), (2-LS4-1)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1), (2-LS4-1)

SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (2-LS2-2)

Big Ideas:
Interdependence of Plants, Animals and the Environment
Diversity of Living Things

Essential Questions:
What do plants need to live and grow?
How do plants depend on animals to pollinate or disperse seeds?
How are plants and animals different within specific habitats?

Vocabulary: habitats, pollinate, disperse, interdependent, plants

Kenai Peninsula Borough School District
Science
3rd Grade Unit 1: Overview of Engineering Design (Scientific Process)

Pacing 2 weeks
NGSS Standards:
3-5-EST1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time , or cost.

3-5-EST1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-EST1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

ELA Standards:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, (e.g., explaining what the texts says explicitly, making basic inferences and predictions), referring explicitly to the text as the basis for the answers. (3-5-ETS-2)

RI.3.7 Use information gained from illustrations (e.g., maps, photographs), and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-5-ETS-2)

RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic or related topics. (3-5-ETS1-1), (3-5-ETS1-3)

W.3.7 Conduct short research projects that build knowledge about a topic. . (3-5-ETS1-1), (3-5-ETS1-3)

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. . (3-5-ETS1-1), (3-5-ETS1-3)

Mathematics Standards
MP.2 Reason abstractly and quantitatively (3-5-ETS1-1), (3-5-ETS1-2) (3-5-ETS1-3)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics (3-5-ETS1-1), (3-5-ETS1-2) (3-5-ETS1-3)
a. Apply mathematics to solve problems arising in everyday life

b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically (3-5-ETS1-1), (3-5-ETS1-2) (3-5-ETS1-3)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

3.OA. Operations and Algebraic Thinking: Represent and solve problems involving multiplication and division. (3-5-ETS1-1), (3-5-ETS1-2)

Essential Questions
Who uses the scientific method?
What is a good question?
What is the link between what we already know and the question(s) we ask?
How do we decide which instrument to use for a valid measurement?
What do we mean by "valid"?
How do we make meaningful sense from the data?

Big Ideas:
Close observation can lead to good questions
Models help simplify and clarify how to solve a problem
Good questions suggest useful models
There are many different types of models
Before we measure anything, we need to understand "what?, Why?, and How?
How do the elements of an experiment follow the logic of the scientific method?

Vocabulary: Scientific Process , Physical Properties, Infer, Generalization, Variable, Control, Data, Experiment, Observe, Evidence, Hypothesis, Inference, Inquiry, Investigation, Microscope, Predict, Procedure, Reference, Material, Scientific Methods, Three-Dimensional, Two-Dimensional

Kenai Peninsula Borough School District
Science
3rd Grade Unit 2: Organisms-life cycles and how they are affected by the environment (Life Cycles and Traits)

Pacing 4 weeks

NGSS Standards:

3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. [Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment. [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

Math Standards:

MP.2 Reason abstractly and quantitatively (3-LS3-1),(3-LS3-2)

a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics. (3-LS1-1),(3-LS3-1),(3-LS3-2)

a. Apply mathematics to solve problems arising in everyday life

b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

3.NBT.1. Use place value understanding to round whole numbers to the nearest 10 or 100. (3-LS1-1)

3.NF.1. Understand a fraction 1/*b* (e.g., 1/4) as the quantity formed by 1 part when a whole is partitioned into *b* (e.g., 4) equal parts; understand a fraction *a*/*b* (e.g., 2/4) as the quantity formed by *a* (e.g., 2) parts of size 1/*b*. (e.g., 1/4). (3-LS1-1)

3.NBT Number and Operations in Base Ten (3-LS1-1)

3.NF Number and Operations—Fractions (3-LS1-1)

3.MD.4 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.* (3-LS4-2)

3.MD.5 . Measure and record lengths using rulers marked with halves and fourths of an inch. Make a line plot with the data, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2)

ELA Standards:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, (e.g., explaining what the texts says explicitly, making basic inferences and predictions), referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2)

RI.3.2. Determine the main idea of a text and locate details that support the main idea; paraphrase or summarize main ideas or events in a multi-paragraph text, including correct sequence and details that support the main idea. (3-LS3-1),(3-LS3-2)

RI.3.3 Describe the relationship or connection among a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2)

RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1)

W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2)

SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2)
SL.3.5 Create audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; use techniques that engage the listener (e.g. inflection, different voices); add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1)

Essential Question
How do organisms vary in their traits?

Big Ideas:
Understanding similarities and differences of organisms' life cycle.
The student will have an understanding that organisms have different inherited traits.
That the environment can also affect the traits that an organism develops

Vocabulary: Survival , Extinct, Traits, Inherit, Habitat, DNA, Genetics, Plant and Animal Cells, Biomes

Kenai Peninsula Borough School District
Science
3rd Grade Unit 3: Organisms-Life Cycles and how they are Affected by the Environment: (Interdependent Relationships in Ecosystems)

Pacing 6 weeks

NGSS Standards:
3-LS2-1 Construct an argument that some animals form groups that help members survive.

3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution,

temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
Math Standards:

ELA Standards:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, (e.g., explaining what the texts says explicitly, making basic inferences and predictions), referring explicitly to the text as the basis for the answers. (3-LS2-1)(3-LS4-1) (3-LS4-3) (3-LS4-4)

RI.3.2 Determine the main idea of a text and locate details that support the main idea; paraphrase or summarize main ideas or events in a multi-paragraph text, including correct sequence and details that support the main idea. (3-LS4-1)((3-LS4-3)(3-LS4-4)

RI.3.3 Describe the relationship or connection among a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1)(3-LS4-1) (3-LS4-3) (3-LS4-4)

W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4)

W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. a. Introduce a topic and group related information together; include labeled or captioned visuals when useful to aiding comprehension. b. Develop the topic with facts, definitions, details, and explanations that support the focus. c. Use linking words and phrases (e.g., *also*, *another*, *and*, *more*, *but*) to connect ideas within categories of information. (3-LS3-1), (3-LS3-20, (3-LS4-2)

SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1), (3-LS3-20, (3-LS4-2)

Mathematics Standards:
MP.2 Reason abstractly and quantitatively. (3-LS4-1),(3-LS4-4)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. use units consistently

MP.4 Model with mathematics. (3-LS4-1),(3-LS4-4)
a. Apply mathematics to solve problems arising in everyday life

b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically. (3-LS4-1)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

3.NBT Number and Operations in Base Ten (3-LS2-1)

3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. (3-LS4-3)

3.MD.4. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.* (3-LS4-3)

Essential Questions
How are plants animals and environment of the past similar or different current plants, animals and environments?
What happens to organisms when their environment changes?

Big Ideas:
1. Characteristics of species survival.
2. Construct an explanation using evidence for how the variations in the characteristics among individuals of the same species may provide advantages in surviving, find mates, and reproducing.
3. Organisms that lived long ago and about the nature of their environments.
Develop an understanding of types of organisms that lived long ago and about the nature of their environments.
4. Environmental changes affecting organisms

5. Develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations same move into the transformed environment and some die.

Vocabulary: Food chain, omnivore, Carnivore, Herbivore, Consumer, Decomposer, Environment, climate, Organisms, Fossils, Ecosystem, Community, Competition, Consumer, Erosion, Food Chain, habitat, Niche, Population, Producer, Resource

Kenai Peninsula Borough School District
Science
3rd Grade Unit 3: Forces and Interactions

Pacing 6 weeks

NGSS Standards:
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object

3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion

3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.

3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Math Standards:
MP.2 Reason abstractly and quantitatively. (3-PS2-1)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.5 Use appropriate tools strategically. (3-PS2-1)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems

d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

3.MD.A.2 Estimate and measure liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l) (Excludes compound units such as cm^3 and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve and create one-step word problems involving masses or volumes that are given in the same units (e.g., by using drawings, such as a beaker with a measurement scale, to represent the problem). (Excludes multiplicative comparison problems [problems involving notions of "times as much."])(3-PS2-1)

ELA Standards:
RI.3.1 Ask and answer questions to demonstrate understanding of a text, (e.g., explaining what the texts says explicitly, making basic inferences and predictions), referring explicitly to the text as the basis for the answers. (3-PS2-1), (3-PS2-3)

RI.3.3 Describe the relationship or connection among a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)

RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-1), (3-PS2-2)
W.5.7 Conduct short research projects that build knowledge about a topic. (3-PS2-1), (3-PS2-2)

W.5.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-3)

Essential Questions (Student Friendly language)
1. How do equal and unequal forces on an object affect the object?
2. How can patterns be used to predict future motion?
3. How can magnets be used?
4. How can magnets be used to solve problems?

Big Ideas:
1. Students are able to determine the effects of balance and unbalanced forces on the motion of an object.
2. Students observe an object's motion to determine an object's future motion.
3. Determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
4. Apply understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

Vocabulary: Repel, Attract, Force, Motion, Poles, Magnetic, Magnetic Field, Magnetism, Attraction, Speed

Kenai Peninsula Borough School District
Science
3rd Grade Unit 4: Weather and Climate

Pacing 6 weeks

NGSS Standards:
3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard

3-5-ETS1-1

MATH STANDARDS:
MP.2 Reason abstractly and quantitatively. (3-ESS2-1), (3-ESS2-2),(3-ESS3-1)

MP.4 Model with mathematics. (3-ESS2-1), (3-ESS2-2), (3-ESS3-1)

MP.5 Use appropriate tools strategically. (3-ESS2-1)

3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1)

3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in bar graphs. (3-ESS2-1)

ELA STANDARDS:
RI.3.1 Describe the relationship or connection among a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect (3-ESS2-2).

RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic or related topics (3-ESS2-2).

W.3.1 Write opinion pieces on topics or texts, supporting a point of view with fact- or text-based reasons (e.g., I like large dogs better than small dogs because they can pull a sled and run for a longer time than small dogs can). a. Introduce the topic or text they are writing about, state an opinion, and create an organizational structure that lists fact- or text-based reasons. b. Provide reasons that support the opinion. c. Link opinion and reasons using words and phrases (e.g., *because*, *therefore*, *since*, *for example*). d. Provide a concluding statement or section that reinforces or restates the opinion. (3-ESS3-1).
W.3.7 Conduct short research projects that build knowledge about a topic. (3-ESS3-1).

W.3.9 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-ESS2-2)

Essential Questions
1. What is typical weather in different parts of the world (during different times of the year)?
2. How can the impact of weather-related hazards be reduced?

Big Ideas:
1. Students are able to organize and use data to describe typical weather conditions expected during a particular season.
2. Apply their understanding of weather related hazards and make a claim about the merit of the design solution that reduces the impact of such hazards.

Vocabulary: Precipitation, Climate, Forecast, Meteorologist, Storm (ie Tornadoes, Monsoons,)

Kenai Peninsula Borough School District
Science
4th Grade: Earth's Systems: Processes that Shape the Earth

NGSS Standards:
4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans

MATH STANDARDS:

ELA STANDARDS:

Essential Questions:
1. How do the layers of the earth show changes over time?
2. What are the different kinds of erosion and how do they affect the earth
3. What can humans do to control erosion?

Big Ideas:
1. Identify

Vocabulary:

Kenai Peninsula Borough School District

Science

4th Grade Unit: FROM MOLECULES TO ORGANISMS; STRUCTURES AND PROCESSES

Pacing: 8 weeks

NGSS Standards:

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

ELA/LITERACY:

W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-2),(4-LS1-2)

MATHEMATICS STANDARDS:

MP.4 Model with mathematics. (4-PS4-2)

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-2)

4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. (4-LS1-1)

Essential Questions:

1. What are examples of physical adaptations that plants or animals have that help them to survive and reproduce?

2. What are examples of behavioral adaptations that plants or animals have that help them to survive and reproduce? How do plants reproduce and grow?

Big Ideas:

1. Organisms have structures and functions that help them survive, grow, reproduce and behave in a certain way.
2. Animals rely on instinct and learned behavior to meet their needs.

Vocabulary:

Kenai Peninsula Borough School District
Science
4th Grade Unit: Energy

Pacing: 12 weeks

NGS Standards: (Waves and Information)
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information

ELA/LITERACY
RI.4.1 Locate explicit information in the text to explain what the text says explicitly and to support inferences drawn from the text. (4-PS4-3)

RI.4.9 Integrate information from two texts on the same topic or related topics in order to write or speak about the subject knowledgeably. (4-PS4-3)

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes and to engage listeners more fully. (4-PS4-1) (4-PS4-2)

Mathematics
MP.4 Model with mathematics. (4-PS4-1)(4_PS4-2)

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines, and intersecting line segments. Identify these in two-dimensional (plane) figures. (4-PS4-1) (4-PS4-2)

Essential Questions
1. How is energy transferred from place to place?
2. How is energy related to waves?
3. How is energy used to send information?
4. How can energy be converted from one form to another?

Big Ideas:
1. Energy is present whenever there are moving objects, sound, light, or heat.
2. Waves are energy with regular patterns of motion.
3. Information can be transmitted using energy waves.

Vocabulary:

Kenai Peninsula Borough School District
Science
5th Grade Unit: Engineering Design

Pacing:

NGSS Standards:
5- ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of problems.

5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MATH STANDARDS:
MP.2 Reason abstractly and quantitatively.
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)
5.OA.1. Use parentheses to construct numerical expressions, and evaluate numerical expressions with these symbols.

5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as 2 x (8 + 7). Recognizing that 3 x (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.

ELA/LITERACY :
RI.5.1 Locate explicit information in the text to explain what the text says explicitly and to support inferences drawn from the text. (3-5-ETS-2)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS2)

RI.5.9 Integrate information from several texts on the same topic or related topics in order to write or speak about the subject knowledgeably. (3-5-ETS-2)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. a. Apply grade 5 Reading standards to literature (e.g., "Compare and contrast two or more characters, settings, or events in a story or drama, drawing on specific details in the text [e.g., how characters interact, how conflicts are resolved]."). b. Apply grade 5 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence supports which point[s].") (3-5-ETS1-1),(3-5-ETS1-3)

Essential Questions:
1. What is the scientific method/process and why is it important?
2. Why should evidence be used and cited to support scientific explanations?
3. How does a scientific question determine the method of study?
4. How does repeating the original research, investigation or experiment support the conclusions of the original investigation?

Big Ideas:
1. The Practice of Science: Engineering Design

2. The characteristics of Scientific Knowledge

Vocabulary: Problem, reference materials, scientific understanding, scientific investigations, systematic observations, experiments, variables, data, charts, tables, graphs, analyze, predictions, conclusions, defend, questions, control group, procedure, setup, record keeping, inferences, empirical observations, testable, evidence, support, measurement, replicable, tools, repeated trials, accurate, valid, hypothesis

Information retrieved on July 31, 2013 from
http://nstahosted.org/pdfs/ngss/20130509/CombinedTopicArrangementBookmarked5.1.13.pdf
http://www.stlucie.k12.fl.us/curriculum/P_SC/SC05Units.html

Kenai Peninsula Borough School District
Science
5th Grade Unit: Earth's Surface Systems

NGSS Standards:
5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth

5-ESS3. Earth and Human Activity

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ELA STANDARDS:
RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1), (5-ESS2-2),(5-ESS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2),(5-ESS3-1)
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1),(5-ESS2-2)

MATH STANDARDS:
MP.2 Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)

MP.4 Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures

c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context
of the situation. (5-ESS2-1)
Essential Questions:
1. How does water change as it travels through the water cycle?
2. How does the ocean affect climate?
3. How do winds and clouds interact with landforms to affect weather patterns?
4. How can communities use scientific information to protect the Earth's resources and environment?

Big Ideas:
1. The Earth's major systems, the geosphere, biosphere, hydrosphere, and/or atmosphere interact to affect Earth's surface and processes.
2. The Earth's water is found in various constructed and natural reservoirs.
3. Communities can use scientific information to protect the Earth's resources and environments.

Vocabulary: Earth, model, water cycle, water, gas, liquid, solid, states of matter, evaporation, precipitation, condensation, run off, ocean, phase changes, air temperature, air (barometric) pressure, humidity, wind speed, wind direction, weather, rain, snow, hail, sleet, environments, grasslands, rainforests, tundra, wetland, swamps, deserts, mountains, climate zones, Northern Hemisphere, Southern Hemisphere, equator, coast line, sea level, polar, tropical, temperate, latitude, elevation, proximity, forecasting weather, weather map, key, clouds, cumulus, cirrus, stratus, cumulonimbus, weather related tools, barometer, thermometer, wind vane, rain gauge, hygrometer, anemometer

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Kenai Peninsula Borough School District
Science
5th Grade Unit: Matter and Energy and Organism and Ecosystems

Pacing:

NGSS Standards:
5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body
warmth) was once energy from the sun.

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

ELA/LITERACY:
RI.5.1 Locate explicit information in the text to explain what the text says explicitly and to support inferences drawn from the text. (5-LS1-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1),(5-LS2-1)

RI.5.9 Integrate information from several texts on the same topic or related topics in order to write or speak about the subject knowledgeably. (5-LS1-1)

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with fact- or text-based reasons and information. a. Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose. b. Provide logically ordered reasons that are supported by facts and details. c. Link opinion and reasons using words, phrases, and clauses (e.g., consequently, specifically, most of all). d. Provide a concluding statement or section that reinforces or restates the opinion presented. (5-LS1-1)

SL.5.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. (5-PS3-1),(5-LS2-1)

MATHEMATIC STANDARDS:
MP.2 Reason abstractly and quantitatively. (5-LS2-1)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics. (5-LS2-1)
a. Apply mathematics to solve problems arising in everyday life.
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures.
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense.
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation.

5.MD.1 Identify, estimate measure, and convert equivalent measures within systems English length (inches, feet, yards, miles) weight (ounces, pounds, tons) volume (fluid ounces, cups, pints, quarts, gallons) temperature (Fahrenheit) Metric length (millimeters, centimeters, meters, kilometers) volume (milliliters, liters), temperature (Celsius), (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems using appropriate tools. (5-LS1-1)

Essential Questions:
1. How does matter cycle through ecosystems?
2. Where does the energy in food come from and what is it used for?

Big Ideas:
Energy transfers in organisms and ecosystems.

Vocabulary: photosynthesis, predator, prey, producer, consumer, nutrients, light, food web, food chain, decompose, decay, sun, solar energy, carnivore, herbivore, omnivore, , organisms, system, ecosystem, matter cycle, interaction, fungi, bacteria,

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http://www.discoveryeducation.com

Kenai Peninsula Borough School District
Physical Science/Earth & Space Science

5th grade Unit: EARTH'S SURFACE SYSTEMS

NGSS Standards:

5-ESS2 Earth's Systems

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3 Earth and Human Activity

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ELA Standards:

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1), (5-ESS2-2), (5-ESS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2), (5-ESS3-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1), (5-ESS2-2)

Math Standards:

MP.2 Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)

MP.4 Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
a. Apply mathematics to solve problems arising in everyday life

b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)

Essential Questions
How does water change as it travels through the water cycle?
How does the ocean affect climate?
How do winds and clouds interact with landforms to affect weather patterns?
How can communities use scientific information to protect the Earth's resources and environment?

Big Ideas:
The Earth's major systems, the geosphere, biosphere, hydrosphere, and/or atmosphere interact to affect Earth's surface and processes.
The Earth's water is found in various constructed and natural reservoirs.
Communities can use scientific information to protect the Earth's resources and environments.

Vocabulary: Earth, model, water cycle, water, gas, liquid, solid, states of matter, evaporation, precipitation, condensation, run off, ocean, phase changes, air temperature, air (barometric) pressure, humidity, wind speed, wind direction, weather, rain, snow, hail, sleet, environments, grasslands, rainforests, tundra, wetland, swamps, deserts, mountains, climate zones, Northern Hemisphere, Southern Hemisphere, equator, coast line, sea level, polar, tropical, temperate, latitude, elevation, proximity, forecasting weather, weather map, key, clouds, cumulus, cirrus, stratus, cumulonimbus, weather related tools, barometer, thermometer, wind vane, rain gauge, hygrometer, anemometer Information

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Kenai Peninsula Borough School District
Physical Science/Earth & Space Science

5th grade Unit: ENGINEERING DESIGN

NGSS Standards:

5- ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of problems**.**

5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Math Standards:
MP.2 Reason abstractly and quantitatively.
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)
5.OA.1. Use parentheses to construct numerical expressions, and evaluate numerical expressions with these
symbols.

5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as 2 x (8 + 7). Recognizing that 3 x (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.

ELA/Literacy :
RI.5.1 Locate explicit information in the text to explain what the text says explicitly and to support inferences drawn from the text. (3-5-ETS-2)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS2)

RI.5.9 Integrate information from several texts on the same topic or related topics in order to write or speak about the subject knowledgeably. (3-5-ETS-2)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1), (3-5-ETS1-3)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-
ETS1-1), (3-5-ETS1-3)
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. a. Apply grade 5 Reading standards to literature (e.g., "Compare and contrast two or more characters, settings, or events in a story or drama, drawing on specific details in the text [e.g., how characters interact, how conflicts are resolved]."). b. Apply grade 5 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence supports which point[s].") (3-5-ETS1-1), (3-5-ETS1-3)

Essential Questions:
What is the scientific method/process and why is it important?
Why should evidence be used and cited to support scientific explanations?
How does a scientific question determine the method of study?
How does repeating the original research, investigation or experiment support the conclusions of the original investigation?

Big Ideas:
The Practice of Science: Engineering Design
The characteristics of Scientific Knowledge

Vocabulary: Problem, reference materials, scientific understanding, scientific investigations, systematic observations, experiments, variables, data, charts, tables, graphs, analyze, predictions, conclusions, defend, questions, control group, procedure, setup, record keeping, inferences, empirical

observations, testable, evidence, support, measurement, replicable, tools, repeated trials, accurate, valid, hypothesis

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Kenai Peninsula Borough School District
Physical Science/Earth & Space Science

5th grade Unit: Structures and properties of matter

5-PS1 Matter and Its Interactions
NGSS Standards:
5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen

5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs whenheating, cooling, or mixing substances, the total weight of matter is conserved.

5-PS1-3. Make observations and measurements to identify materials based on their properties

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Math Standards:
MP.2 Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically. (PS1-2),(PS1-3)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

5.NBT.2. Explain and extend the patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain and extend the patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.(5-PS1-1)

5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)

5.MD.1 Identify, estimate measure, and convert equivalent measures within systems English length (inches, feet, yards, miles) weight (ounces, pounds, tons) volume (fluid ounces, cups, pints, quarts, gallons) temperature (Fahrenheit) Metric length (millimeters, centimeters, meters, kilometers) volume (milliliters, liters), temperature (Celsius), (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems using appropriate tools.(5-PS1-2)

5.MD.5. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. b. A solid figure that can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. (5-PS1-1)

5.MD.6. Estimate and measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and non-standard units. (5-PS1-1)

ELA Standards:
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2),(5-PS1-3),(5-PS1-4)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. a. Apply grade 5 Reading standards to literature (e.g., "Compare and contrast two or more characters, settings, or events in a story or drama, drawing on specific details in the text [e.g., how characters interact, how conflicts are resolved].").) b. Apply grade 5 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence supports which point[s]."). (5-PS1-2),(5-PS1-3),(5-PS1-4)

Essential Questions:
How does changing matter affect its weight?
How do the physical properties of an object affect how it goes through a physical or chemical change?
How can conditions affect the rate a substance dissolves in water?

Big Ideas:
Matter is made of particles too small to be seen.
Conservation of matter means that changing matter does not change its weight.

Vocabulary: Physical properties, mass, volume, solids, liquids, gases, size, shape, color, texture, hardness, odor, taste, temperature, attraction to magnets, Celsius, Fahrenheit, physical changes, chemical changes, water, heating, cooling, melting, freezing, boiling, evaporation, condensation, decaying animal or plant material, burning, rusting, cooking, mixtures, properties, particle, dissolve, surface area, magnetic attraction, mass, weight, temperature, stirring, thermometer, atoms, theory, atomic theory, magnification, microscope

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Kenai Peninsula Borough School District
Science
5th Grade Unit: Space Systems: Stars and the Solar System

NGSS Standards:
5-ESS1 Earth's Place in the Universe

5-ESS1-1. Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The performance expectations above.

5-PS2 Motion & Stability: Forces & Interaction.

5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

ELA/LITERACY:
RI.5.1 Locate explicit information in the text to explain what the text says explicitly and to support inferences drawn from the text. (5-PS2-1),(5-ESS1-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1)

RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)

RI.5.9 Integrate information from several texts on the same topic or related topics in order to write or speak about the subject knowledgeably. (5-PS2-1),(5-ESS1-1)

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1),(5-ESS1-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes and to engage listeners more fully. (5-ESS1-2)

MATHEMATIC STANDARDS:
MP.2 Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning

d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics. (5-ESS1-1),(5-ESS1-2)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. (5-ESS1-1)

5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2)

Essential Questions:
1. How do lengths and directions of shadows change from day to day?
2. Why do lengths of day and night change from day to day?
3. How does the appearance of some stars change in different seasons?

Big Ideas:
1. The apparent brightness of sun is due to relative distance of Earth from the sun.
2. The Earth's orbit and rotation causes observable patterns in length of day/night, position of objects in Earth's sky, and shadow lengths.

Vocabulary: galaxy, gas, dust, stars, orbit, Milky Way, Sun, Solar System, planets, moons, asteroids, comets, Earth, inner and outer planets, characteristics, surface, composition, atmosphere, size, relative position to the Sun, rings, relative temperature, relative length of year

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Kenai Peninsula Borough School District
Science
5th Grade Unit: Structures and Properties of Matter

Pacing:

NGSS Standards:
5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

5-PS1-3. Make observations and measurements to identify materials based on their properties.

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

MATH STANDARDS:
MP.2 Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)
a. Represent a situation symbolically
b. Create a coherent representation of the problem
c. Have the ability to show how problem has a realistic meaning
d. Reflect during the manipulation process in order to probe into the meanings for the symbols involved
e. Use units consistently

MP.4 Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)
a. Apply mathematics to solve problems arising in everyday life
b. Identify important quantities in a practical situation and model the situation using such tools as manipulatives, diagrams, two-way tables, graphs or pictures
c. Interpret mathematical results in the context of the situation and reflect on whether the results make sense
d. Apply mathematical knowledge, make assumptions and approximations to simplify a complicated situation

MP.5 Use appropriate tools strategically. (PS1-2),(PS1-3)
a. Select the available tools (such as pencil and paper, manipulatives, rulers, calculators, a spreadsheet, and available technology) when solving a mathematical problem
b. Be familiar with tools appropriate for their grade level to make sound decisions about when each of these tools might be helpful
c. Identify relevant external mathematical resources and use them to pose or solve problems
d. Use technological tools to explore and deepen their understanding of concepts
e. Detect possible errors by strategically using estimation and other mathematical knowledge
f. Know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data

5.NBT.2 Explain and extend the patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain and extend the patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.(5-PS1-1)

5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)

5.MD.1 Identify, estimate measure, and convert equivalent measures within systems English length (inches, feet, yards, miles) weight (ounces, pounds, tons) volume (fluid ounces, cups, pints, quarts, gallons) temperature (Fahrenheit) Metric length (millimeters, centimeters, meters, kilometers) volume (milliliters, liters), temperature (Celsius), (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems using appropriate tools.(5-PS1-2)

5.MD.5 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.
b. A solid figure that can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. (5-PS1-1)

5.MD.6 Estimate and measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and non-standard units. (5-PS1-1)

ELA STANDARDS:
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2),(5-PS1-3),(5-PS1-4)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
a. Apply grade 5 Reading standards to literature (e.g., "Compare and contrast two or more characters, settings, or events in a story or drama, drawing on specific details in the text [e.g., how characters interact, how conflicts are resolved].").
b. Apply grade 5 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence supports which point[s]."). (5-PS1-2),(5-PS1-3),(5-PS1-4)

Essential Questions:
1. How does changing matter affect its weight?
2. How do the physical properties of an object affect how it goes through a physical or chemical change?
3. How can conditions affect the rate a substance dissolves in water?

Big Ideas:
1. Matter is made of particles too small to be seen.
2. Conservation of matter means that changing matter does not change its weight.

Vocabulary: Physical properties, mass, volume, solids, liquids, gases, size, shape, color, texture, hardness, odor, taste, temperature, attraction to magnets, Celsius, Fahrenheit, physical changes, chemical changes, water, heating, cooling, melting, freezing, boiling, evaporation, condensation, decaying animal or plant material, burning, rusting, cooking, mixtures, properties, particle, dissolve, surface area, magnetic attraction, mass, weight, temperature, stirring, thermometer, atoms, theory, atomic theory, magnification, microscope.

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Kenai Peninsula Borough School District
Science
6th Grade Unit 1: Practice of Science

Pacing: Qtr 1-3 Weeks (embedded throughout all other units)

NGSS Standards:
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative (repeated) testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

ELA/LITERACY :
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.MS-ETS1-1), (MS-ETS1-2),(MS-ETS1-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2)

WHST.6-8.8 Gather relevant information from multiple print and digital sources using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standards format for citation. (MS-ETS1-1)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)

SL.8.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.(MS-ETS1-4)

MATHEMATICS STANDARDS:
MP.2 Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4)
a. Represent a situation symbolically and carry out its operations
b. Create a coherent representation of the problem
c. Translate an algebraic problem to a real-world context
d. Explain the relationship between the symbolic abstraction and the context of the problem
e. Compute using different properties
f. Consider the quantitative values, including units, for the numbers in a problem

7.EE.3, 6.EE.3. Apply the properties of operations to generate equivalent expressions. Model (e.g., manipulatives, graph paper) and apply the distributive, commutative, identity, and inverse properties with integers and variables by writing equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

Disciplinary Core Ideas:

Essential Questions:
1. What does the phrase "safety first" mean?
2. How can the scientific method be used to make informed decisions?
3. What is the difference between experimental repetition and experimental replication?
4. Why are some statements in science called laws and some called theories?
5. How would a model help you understand a concept?
6. How could you identify pseudoscience?
7. How often do measurements, whether accurate or inaccurate, impact your life?
8. What skills are necessary to be a scientist?

Big Ideas:
1. Laboratory safety is essential.
2. Scientific inquiry requires systematic processes.
3. Scientific laws and theories differ.
4. Science and pseudoscience differ.
5. The practice of science requires collecting appropriate and accurate metric measurements.

Vocabulary: scientific method, investigations, inquiry, experiments, independent variable, dependent variable, control, constant, scientific theory, scientific law, infer, observe, hypothesis

Information retrieved from http://lake.k12.fl.us on 8-5-2013

Kenai Peninsula Borough School District
Science
6th Grade Unit 2: Space Systems

Pacing: 4 weeks

NGSS Standards:
MS-ESS1-1. 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.

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.

Disciplinary Core Ideas

ELA/LITERACY :
RST.6.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)

RST.6.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram,
model, graph, or table). (MS-ESS1-3)

SL.8.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information. (MS-ESS1-1),(MS-ESS1-2)

MATHEMATIC STANDARDS:
MP.2 Reason abstractly and quantitatively. (MS-ESS1-3)
a. Represent a situation symbolically and carry out its operations
b. Create a coherent representation of the problem
c. Translate an algebraic problem to a real-world context
d. Explain the relationship between the symbolic abstraction and the context of the problem
c. Compute using different properties
d. Consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (MS-ESS1-1),(MS-ESS1-2)
a. Apply mathematics to solve problems arising in everyday life and society
b. Identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
c. Interpret their mathematical results in the context of the situation and reflect on whether the results make sense
d. Make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised

e. Analyze quantitative relationships to draw conclusions
f. Reflect on whether their results make sense
g. Improve the model if it has not served its purpose

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. Write and describe the relationship in real life context between two quantities using ratio language. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."(MS-ESS1-1),(MS-ESS1-2).(MS-ESS1-3)

6.RP.2. Understand the concept of a unit rate (a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship) and apply it to solve real-world problems (e.g., unit pricing, constant speed). For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (MS-ESS1-1),(MS-ESS1-2).(MS-ESS1-3)

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2)

6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. CHECK this one with the committee for alignment… CC and AK don't math well… (MS-ESS1-2)

Essential Questions
1. How does Earth's place in the universe affect life on Earth?
2. What is the role of gravity in the motions of objects in our Solar System?
3. How does Earth's moon affect tides on Earth?
4. How would our lives be different if the Earth was not tilted on its axis?

Big Ideas:
1. A relationship exists between the phases of the moon and the positions of the Moon, Earth and Sun as the moon revolves around the Earth.
2. The tilt of the Earth on its axis as it rotates causes seasonal changes.
3. Tides, solar eclipses, and lunar eclipses result from specific positions of the Earth, Sun, and Moon.

Vocabulary: Planetary System, Asteroid, Meteoroid, Comet, Astronomical unit, Rotation, Axis, Revolution, Orbit, Ellipse, Season, Axial tilt, Phases, First quarter, Third quarter, Gravity, Eclipse

Kenai Peninsula Borough School District
Science
6th Grade Unit 3: History of Earth

Pacing: Quarter 2, 2 weeks

NGSS Standards:
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.

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface atvarying time and spatial scales.

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.

ELA/LITERACY:
RST.6.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)

RST.6.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS2-3)

RST.6.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3)

WHST.6.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings) graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
b. Develop the topic with relevant facts,
definitions, concrete details, quotations, or other information and examples.
c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
e. Establish and maintain a formal style and objective tone.
f. Provide a concluding statement or section that follows from and supports the information or explanation presented.
(MS-ESS1-4),(MS-ESS2-2)

SL.8.5 Include multimedia components (e.g. graphics, images, music, sound) and visual displays in presentations to clarify information.(MS-ESS2-2)

MATHEMATIC STANDARDS:

MP.2 Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3)

a. Represent a situation symbolically and carry out its operations

b. Create a coherent representation of the problem

c. Translate an algebraic problem to a real world context

d. Explain the relationship between the symbolic abstraction and the context of the problem

e. Compute using different properties

f. Consider the quantitative values, including units, for the numbers in a problem

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)

6.EE.7. Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

Disciplinary Core Ideas

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). Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems

The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

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)

Essential Questions:

1. How do people figure out that the Earth and life on Earth have changed through time?

2. How does the theory of plate tectonics explain changes seen at the Earth‟s surface?

Big Ideas:

1. Analyzing rock formations and the fossils they contain help us determine a relative timeline for major events in Earth's history.

2. Natural processes change Earth's crust over time.

Vocabulary: Continental shelf, plate tectonics, ridges, fracture zones, trenches, interactions, fossils, weathering, erosion, relative vs. absolute scale

Kenai Peninsula Borough School District
Science
6th Grade Unit 4: Earth's Systems

Pacing: Quarter 2- 5 weeks

NGSS Standards:
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

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.

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.

ELA/LITERACY :
RST.6.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-1)

WHST.6.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings) graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
b. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
e. Establish and maintain a formal style and objective tone.
f. Provide a concluding statement or section that follows from and supports the information or explanation presented.
(MS-ESS3-1)

WHST.6.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1)

SL.6.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ESS2-1)

MATHEMATICS STANDARD:

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-1)
6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Essential Questions:
1. How do the materials in and on Earth's crust change over time?
2. How does Earth's water circulate and how does it shape Earth's surface?
3. How does the movement of tectonic plates impact the surface of Earth?

Big Ideas:
1. All Earth processes are the result of energy flowing and mattercycling within and among Earth's systems.
2. Earth's plates have moved great distances, collided, and spread apart to shape Earth.

Vocabulary: melting, crystallization, weathering, deformation, sedimentation, rock cycle, hydrological cycle, tectonic plates, transpiration, evaporation, condensation, precipitation, ground water, run off

Disciplinary Core Ideas:
ESS2.A: Earth's Materials and Systems
All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)
ESS2.C: The Roles of Water in Earth's Surface Processes
a. 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)
b. Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

ESS3.A: Natural Resources (This is emphasized in topic-"Human Impacts)
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)

Kenai Peninsula Borough School District
Science
6th Grade Unit 5: Weather and Climate

Pacing: Quarter 3- (6 weeks)

NGSS Standards:
MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

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.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

ELA/LITERACY :
RST.6.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5),(MS-ESS3-5)

RST.6.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5)

WHST.6.8 Gather relevant information from multiple print and digital sources using terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5)
SL.6.5 Include multimedia components and visual displays in presentations to clarify information. (MS-ESS2-6)

Mathematics Standards:
MP.2 Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5)

6.NS.5 Understand that positive and negative numbers describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explain the meaning of 0 in each situation. (MS-ESS2-5)

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5)

Essential Questions:
1. How do we know our global climate is changing?
2. How does water influence weather?

3. What factors interact and influence weather?

Big Ideas:
1. Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.
2. Oceans exert a major influence on weather and climate.

Vocabulary: Atmosphere, absorb, redistribute, climate, greenhouse gases, fossil fuels, surface temperature, air masses, air pressure, humidity, latitude, altitude, Coriolis effect, convection cycle

Disciplinary Core Ideas
ESS2.C: The Roles of Water in Earth's Surface Processes
a. The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
b. 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
a. Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
b. Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
c. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

ESS3.D: Global Climate Change
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)

Kenai Peninsula Borough School District
Science
6th Grade Unit 6: Human Impacts

Pacing: Quarter 4

NGSS Standards:
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

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capitaconsumption of natural resources impact.

ELA/LITERACY:
RST.6.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-2),(MS-ESS3-4)

RST.6.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2)

WHST.6.1 Write arguments focused on discipline-specific content. (MS-ESS3-4) a. Introduce claim(s) abut a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence. d. Establish and maintain a formal style. e. Provide a concluding statement or section that follows from and supports the argument presented.

WHST.6.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3)

WHST.6.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format of citation. (MS-ESS3-3)

WHST.6.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4)

MATHEMATICS STANDARDS:

MP.2 Reason abstractly and quantitatively. (MS-ESS3-2)
a. Represent a situation symbolically and carry out its operations
b. Create a coherent representation of the problem
c. Translate an algebraic problem to a real world context
d. Explain the relationship between the symbolic abstraction and the context of the problem
e. Compute using different properties
f. Consider the quantitative values, including units, for the numbers in a problem

6.RP.1 Understand ratio concepts and use ratio reasoning to solve problems. Write and describe the relationship in real life context between two quantities using ratio language. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." (MS-ESS3-3),(MS-ESS3-4)

6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios, and understand equivalencies. b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units between given measurement systems (e.g., convert kilometers to miles); manipulate and transform units appropriately when multiplying or dividing quantities. (MS-ESS3-3),(MS-ESS3-4)

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4)

Essential Questions:
1. How is the availability of needed natural resources related to naturally occurring processes?
2. How can natural hazards be predicted?
3. How do human activities affect Earth systems?

Big Ideas:
1. Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Some of these resources are not renewable or replaceable over human lifetimes.
2. Knowledge of the history of natural hazards in a region, combined with understanding related geologic forces can help forecast future events.
3. Human activities can significantly alter the biosphere. The impact of these changes can have positive and negative effects for different living things.

Vocabulary: Biosphere, atmosphere, resources, renewable

Disciplinary Core Ideas

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)

ESS3.C: Human Impacts on Earth Systems

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of impacts (negative and positive) for different living things. (MS-ESS3-3). 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. (MSESS3-3), (MS-ESS3-4)

Seventh Grade/ Physical Science

Unit 1(The Practice of Science)*

Time: 3-4 weeks

NGSS STANDARD:
MS-ETS1 ENGINEERING DESIGN

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved

ELA/LITERACY:
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3)
RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3)
WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2)
WHST.6-8.8 Gather relevant information from multiple print and digital sources using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ETS1-1)
WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)
SL.7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ETS1-4)

MATHEMATICS:

MP.2 Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4)
In grades 6-8 mathematically proficient students will:
a. represent a situation symbolically and carry out its operations
b. create a coherent representation of the problem
c. translate an algebraic problem to a real world context
d. explain the relationship between the symbolic abstraction and the context of the problem
e. compute using different properties
f. consider the quantitative values, including units, for the numbers in a problem

7.EE.3 Solve real-life and mathematical problems using numerical and algebraic expressions and equations. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

7.SP.1. Use random sampling to draw inferences about a population. Understand that statistics can be used to gain information about a population by examining a reasonably sized sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. (MS-ETS1-4)

Essential Questions:
Why is it important to have lab safety awareness?
How can the scientific method be used to make informed decisions?
What is the difference between experimental repetition and experimental replication?
Why are some statements in science called laws and some called theories?
What information is important to include in a scientific paper?

Big Ideas:
1) Lab safety awareness is essential
2) The scientific method can be used to create and design experiments that answer questions
3) Making accurate measurements help ensure accurate results
4) There is a difference between a scientific law and a scientific theory
5) Document and interpret scientific language/text.

Vocabulary: Observation, qualitative observation, quantitative observation, triple beam balance, graduated cylinder, Temperature, Erlenmeyer flask, beaker, inferring, hypothesis, variables, International System of Units, Mean, limiting factor, scientific law, scientific theory, scientific method, control, microscope, light microscope, objective lens, eyepiece, magnification

*To be embedded throughout each unit

DCI:

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 are likely to limit possible solutions. (MS-ETS1- 1)

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. (MS-ETS1-4). There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3). Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3). Models of all kinds are important for testing solutions. (MS- ETS1-4)

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3). The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

7th Grade Unit 2 – ECOLOGY
(NGSS:MS: Matter and Energy in Organisms and Ecosystems)

Time: 4-5 weeks

NCSS Standard:

MS-LS1 ECOLOGY

DCI:

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
- 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)

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2- 1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

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)

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.

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.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem**.**

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

ELA/LITERACY :

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.(MS-LS1-6), (MS-LS2-1), (MS-LS2-4)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-6)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1)

RI.7.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4)

WHST.6-8.1 Write arguments focused on discipline specific content. (MS-LS2-4) a. Introduce claim(s) abut a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logicallyb. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidenced. Establish and maintain a formal style. Provide a concluding statement or section that follows from and supports the argument presented.

WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.6-8.9
a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings) graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
e. Establish and maintain a formal style and objective tone.
f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

SL.7.5 Include multimedia components and visual displays into presentations to clarify claims and findings and emphasize salient points. (MS-LS1-7),(MS-LS2-3)

MATHEMATICS –

7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct multi-step equations and inequalities to solve problems by reasoning about the quantities.
a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions. (MS-LS1-6),(MS-LS2-3)*

Essential Questions:
1) What is ecology?
2) Describe and give examples of ecosystems including its living and non-living components and their roles in the ecosystem
3) Create a food chain and food web indicating each organism's role in the system
4) Explain how energy is transferred through a food chain and food web
5) Show the path of matter (ie carbon, water and nitrogen) as it is cycled through an ecosystem.

Big Idea:
1) Ecology is the study of interactions between organisms and their environment
2) An ecosystem consists of both living and non-living components
3) Energy is transferred among members of a food chain or a food web
4) Matter is neither created nor destroyed. The water, carbon, and nitrogen are constantly recycled.

Vocabulary: ecology, biotic, abiotic, population, community, ecosystem, biosphere, herbivore, carnivore, omnivore, scavenger, food chain, food web, energy pyramid, habitat, niche, carrying capacity, prey, predator, symbiosis, mutualism, commensalism, parasitism, coevolution, decomposition, succession, pioneer species, biome, carbon cycle, the nitrogen cycle, pH

Seventh Grade
Unit 3 - ORGANISMS

Time: 8 Weeks

NCSS Standard:
MS- LS2 **ORGANISMS: Structure and Processes**

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)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
- 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)

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)

PS3.D: Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)
- 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)

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.

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function**.**

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

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**.**

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.

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.

ELA/LITERACY –:
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3),(MS-LS1-4),(MS-LS1-5),(MS-LS1-6)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5),(MS-LS1-6)

RI.6.8 Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3),(MS-LS1-4)

WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-3),(MS-LS1-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5),(MS-LS1-6)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-LS1-8)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5),(MS-LS1-6)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2),(MS-LS1-7)

MATHEMATICS :
6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-1),(MS-LS1-2),(MS-LS1-3),(MS-LS1-6)

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4),(MS-LS1-5)

6.SP.B.4 Summarize numerical data sets in relation to their context. (MS-LS1-4),(MS-LS1-5)

Essential Questions:

1) What does it mean to be single cellular or multicellular and give examples of each?
2) List the organelles of a cell and their functions.
3) What are the taxonomic groupings and what do they represent?
4) What are the functions of the 11 human body systems?

Big Idea:

1) Organisms are composed of cell(s)
2) Each cell has organelles that function together allowing the organism to live
3) Living organisms are organized into taxonomic groupings
4) The human body is organized into body 11 systems.

Vocabulary: Organisms, organ, tissue, organ system, unicellular, multicellular, cell theory, cell membrane, organelles, eukaryote, prokaryote, cell wall, ribosomes, endoplasmic reticulum, mitochondria, chloroplasts, golgi complex, vacuole, lysosomes, 11 body systems, taxonomy, virus, bacteria

Seventh Grade

Unit 4 – GENETICS

(**Growth, development and reproduction of organisms)**

Time: 6-7 weeks

NGSS STANDARD:

MS-LS3 GENETICS (Growth, development and reproduction of organisms)

DCI:

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)
- 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)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

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)
- 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)
- 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)

LS4.B: Natural Selection

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

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.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

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**.**

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.

MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MATH STANDARDS:

ELA STANDARDS:

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4), (MS-LS1-5), (MS-LS3-1), (MS-LS3-2), (MS-LS4-5)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5)

RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (MS-LS3-1),(MS-LS3-2)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS3-1), (MS-LS3-2)

RI.6-8.8 Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4)

WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-4)

WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings) graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
b. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style and objective tone. f. Provide a concluding statement or section that follows from and supports the information or explanation presented. (MS-LS1-5)

WHST.6-8.8 Gather relevant information from multiple print and digital sources using search terms effectively; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-LS4-5)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-LS3-1),(MS-LS3-2)

Mathematics :

MP.4 Model with mathematics. (MS-LS3-2)

In grades 6-8 mathematically proficient students will:

- apply mathematics to solve problems arising in everyday life and society
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- interpret their mathematical results in the context of the situation and reflect on whether the results make sense
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- analyze quantitative relationships to draw conclusions
- reflect on whether their results make sense
- improve the model if it has not served its purpose

7.SP.1 Understand that statistics can be used to gain information about a population by examining a reasonably sized sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. (MS-LS1-4),(MS-LS1-5)

7.SP.2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.
(MS-LS1-4),(MS-LS1-5)

Essential Question:

How is genetic material transferred from a parent organism to offspring?
Design a punnett square to predict the genotype/phenotype of the offspring.
Find/discuss examples of mutations in organisms that have varying effects.
How does natural selection change species over time?

Big Idea:
1) Genetic material/traits are transferred to offspring
2) Chromosomes are composed of DNA
3) In sexual or asexual reproduction, favorable genetic qualities will be passed down to the offspring to ensure success of the organism
4) Genetic mutations can be harmful, beneficial, or neutral.

Vocabulary: Trait, dominant, recessive, punnett square, Gregor Mendel, alleles, chromosomes, meiosis, mitosis, genotype, phenotype, heredity, probability, DNA, asexual, sexual, nucleotides, adenine, thymine, guanine, cytosine, cloning, pedigree, karyotype, mutation

Unit 5: NATURAL SELECTION AND ADAPTATIONS

Time: 4 weeks

NGSS STANDARD: MS-LS4 NATURAL SELECTION AND ADAPTATIONS

NGS Standards

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.

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.

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.

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.

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.

ELA/LITERACY :
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-LS4-1), (MS-LS4-2), (MS-LS4-3), (MS-LS4-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS4-1),(MS-LS4-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-LS4-3),(MS-LS4-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS4-2), (MS-LS4-4)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS4-2),(MS-LS4-4)

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS4-2), (MS-LS4-4)

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS4-2), (MS-LS4-4)

MATHEMATICS :
MP.4 Model with mathematics. (MS-LS4-6)

- In grades 6-8 mathematically proficient students will:
- apply mathematics to solve problems arising in everyday life and society
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- interpret their mathematical results in the context of the situation and reflect on whether the results make sense
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- analyze quantitative relationships to draw conclusions
- reflect on whether their results make sense
- improve the model if it has not served its purpose

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-LS4-4), (MS-LS4-6)

6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS4-4),(MS-LS4-6)
6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-LS4-1), (MS-LS4-2)
*Note the standards above are 6th grade standards

7.RP.A.2 Recognize and represent proportional relationships between quantities. Make basic inferences or logical predictions from proportional relationships.
a. Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin).
b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships in real world situations. (MS-LS4-4),(MS-LS4-6

Essential Questions:
1) What is natural selection?
2) How do adaptations result in population differences over time
3) What is the significance of the fossil record in providing evidence for biological evolution
4) Describe how humans can influence the traits of a population through artificial selection
5) How do scientists use embryos to show relationships between species

Big Idea:
1) Adaptation by natural selection acting over generations is one important process by which species change over time
2) Humans influence certain characteristics through artificial selection by selective breeding
3) The fossil record provides evidence for the existence, diversity, extinction, and change of life forms throughout history
4) Comparisons of the fossil record with organisms living today as well as embryos of different species enable the reconstruction of evolutionary history and lines of evolutionary descent

Vocabulary: Taxonomy, Charles Darwin, fossil, extinction, cloning, adaptation, species, evolution, fossil record, vestigial structure, trait, selective breeding , natural selection, mutation, speciation, generation time, relative dating, absolute dating, carbon dating, half-life, geologic time scale

Disciplinary Core Ideas *DCI*:
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)

- 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)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

LS4.B: Natural Selection

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

LS4.C: Adaptation

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

Eighth Grade/ Physical Science
Unit 1 (THE PRACTICE OF SCIENCE)*

Pacing: 3-4 weeks

NGSS STANDARD:
MS-ETS1 ENGINEERING DESIGN

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ETS1-1)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2)

SL.8.5 Include multimedia components and visual displays in presentations to clarify information, strengthen claims and evidence and add interest. (MS-ETS1-4)

Mathematics –
MP.2 Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4)
In grades 6-8 mathematically proficient students will:
1. Represent a situation symbolically and carry out its operations.
2. Create a coherent representation of the problem.
3. Translate an algebraic problem to a real world context.
4. Explain the relationship between the symbolic abstraction and the context of the problem.
5. Compute using different properties.
6. Consider the quantitative values, including units, for the numbers in a problem.

7.EE.3 - Seventh Grade Standard
Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

Essential Questions:
Why is it important to have lab safety awareness?
How can the scientific method be used to make informed decisions?
What is the difference between experimental repetition and experimental replication?
Why are some statements in science called laws and some called theories?
What information is important to include in a scientific paper?

Big Ideas:
1) Lab safety awareness is essential
2) The scientific method can be used to create and design experiments that answer questions
3) Making accurate measurements help to ensure accurate results
4) There is a difference between a scientific law and a scientific theory
5) Document and interpret scientific language/text.

Vocabulary:
Observation, qualitative observation, quantitative observation, triple beam balance, graduated cylinder, Erlenmeyer flask, beaker, inferring, hypothesis, variables, International System of Units, mean, control, temperature, limiting factor, scientific law, scientific theory, scientific method

DCI:

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 are likely to limit possible solutions. (MS-ETS1- 1)

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. (MS-ETS1-4). There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3). Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3). Models of all kinds are important for testing solutions. (MS- ETS1-4)

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3). The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)
*To be embedded throughout each unit

UNIT 2 - MATTER AND ITS INTERACTIONS
Pacing: 8-9 weeks

NGSS STANDARD:
MS-PS1 – MATTER AND ITS INTERACTIONS

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

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.

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

ELA/Literacy –

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS1-2)

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-2),(MS-PS1-5)

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)

Mathematics –

MP.2 Reason abstractly and quantitatively. (MS-PS1-2),(MS-PS1-5)

MP.4 Model with mathematics. (MS-PS1-5)

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-2),(MS-PS1-5)

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)

6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2)

6.SP.B.5 Summarize numerical data sets in relation to their context (MS-PS1-2)

Essential Questions:
Which properties define matter?
What are the physical and chemical properties of matter?
Describe how the motion of the atoms can affect the state of matter.
Can you create/draw a model to represent the atomic structure?
Describe how chemical reactions result in substances with different characteristics/properties.

Big Idea:
1) Matter is composed of atoms/molecules

2) Matter has physical and chemical properties
3) Matter has 4 different states
4) Atoms are composed of protons, electrons, and neutrons
5) The chemical combination of elements will result in different characteristics/properties.

Vocabulary:
Atom, molecule, density, mass, volume, mixture, compound, physical change, chemical change, change of state, solid, liquid, gas, plasma, temperature, Boyle's Law, Charles's Law, balanced equation, energy, electrons, protons, neutrons, periodic table, atomic mass, atomic number, period, group, Dmitri Mendeleev, valence shell, conservation of matter, radioactive, man made elements, naturally occurring elements, atomic model, electron microscope, pressure, homozygous, heterozygous, endothermic, exothermic, kinetic energy, crystalline, amorphous, surface tension, condensation, sublimation

DCI:

PS1.A: Structure and Properties of Matter
Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1). Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.)
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). Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1). 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)

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-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.)

PS3.A: Definitions of Energy
The term "heat" as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and radiation (particularly infrared and light). In science, heat is used only for this second meaning; it refers to energy transferred when two objects or systems are at different temperatures. (secondary to MS-PS1-4). The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4)

PS2.B Types of Interactions
Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)

Unit 3 - MOTION AND STABILITY

Pacing: 8-9 weeks

NGSS STANDARD:
MS-PS2 - MOTION AND STABILITY: FORCES AND INTERACTIONS

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

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.

MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

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.

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.

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

Math Standard:

ELA Standard:

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS2-1),(MS-PS2-3)

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-PS2-4)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)

Mathematics

MP.2 Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3)
In grades 6-8 mathematically proficient students will:
1. represent a situation symbolically and carry out its operations
2. Create a coherent representation of the problem
3. Translate an algebraic problem to a real world context
4. Explain the relationship between the symbolic abstraction and the context of the problem
5. Compute using different properties
6. Consider the quantitative values, including units, for the numbers in a problem

6.RP.1. Understand ratio concepts and use ratio reasoning to solve problems.
Write and describe the relationship in real life context between two quantities using ratio language. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." (MS-PS3-1),(MS-PS3-5)

6.RP.2. Understand the concept of a unit rate (a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship) and apply it to solve real world problems (e.g., unit pricing, constant speed). For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (MS-PS3-1)

7.RP.2 7.RP.2. Recognize and represent proportional relationships between quantities. Make basic inferences or logical predictions from proportional relationships.
a. Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin). b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships in real world situations. (MS-PS3-1),(MS-PS3-5)

6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.
a. Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as 5 – y.
b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two

terms. c. Evaluate expressions and formulas. Include formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order with or without parentheses. (Order of Operations) (MS-PS2-1),(MS-PS2-2)

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.(MS-PS2-1),(MS-PS2-2)

7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct multi-step equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?
b. Solve word problems leading to inequalities of the form px + q > r or px + q < r, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions. (MS-PS2-1),(MS-PS2-2)

8.EE.A.1 Work with radicals and integer exponents.

8.EE.1. Apply the properties (product, quotient, power, zero, negative exponents, and rational exponents) of integer exponents to generate equivalent numerical expressions. For example, 32 × 3–5 = 3–3 = 1/33 = 1/27. (MS-PS3-1)

8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. (MS-PS3-1)

8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. (MS-PS3-1), (MS-PS3-5)

6.NS.C.5 Apply and extend previous understandings of numbers to the system of rational numbers. Understand that positive and negative numbers describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explain the meaning of 0 in each situation. (MS-PS2-1)

Essential Questions:
1) What is Newton's 3rd Law and how can the law be used to solve a problem involving two colliding objects?
2) Determine the forces acting on an object and use the information to describe the motion and changes in motion of the object
3) Describe gravity and its influence on objects
4) Define kinetic energy and calculate the total kinetic energy of an object
5) List the forms of potential energy
6) Explain how potential energy of an object can change based on the object's position

Big Ideas:
1) Newton's 3rd Law describes the forces exerted by two interacting objects
2) The motion of an object depends on the forces acting on it and the mass of the object
3) Gravity always pulls and changes based on the masses of the objects involved
4) Kinetic energy is the energy of motion and depends on the speed and mass of the object
5) Potential energy is stored energy and depends on the position of the object

Vocabulary:
Motion, velocity, speed, acceleration, force, newton, net force, friction, gravity, weight, mass, terminal velocity, free fall, inertia, momentum, pressure, energy, kinetic energy, potential energy, Isaac Newton, joule, balanced and unbalanced forces, point of reference

DCI:

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). 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)

PS2.B: Types of Interactions

Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4). Forces that act at a distance (electric and magnetic) can be explained by fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). (MS-PS2-5)

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). A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)

Unit 4 - Energy

Time: 3 weeks

NGSS STANDARD:
MS-PS3 – Energy
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.

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions (MS-PS3-1),(MS-PS3-5)

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3),(MS-PS3-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)

WHST.6-8.1 Write arguments focused on discipline content. (MS-PS3-5)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),(MS-PS3-4)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)

Mathematics –

MP.2 Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5)
In grades 6-8 mathematically proficient students will:
1. Represent a situation symbolically and carry out its operations
2. Create a coherent representation of the problem
3. Translate an algebraic problem to a real world context
4. Explain the relationship between the symbolic abstraction and the context of the problem
5. Compute using different properties
6. Consider the quantitative values, including units, for the numbers in a problem

6.RP.1 Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.1. Write and describe the relationship in real life context between two quantities using ratio language. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes.". (MS-PS3-1),(MS-PS3-5)

6.RP.2 Understand the concept of a unit rate (a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship) and apply it to solve real world problems (e.g., unit pricing, constant speed). For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (MS-PS3-1)

6.SP.5 Summarize numerical data sets in relation to their context, such as by:
a. Reporting the number of observations (occurrences).
b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range), as well as describing any overall pattern and any outliers with reference to the context in which the data were gathered.
d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. (MS-PS3-4)

7.RP.2 Recognize and represent proportional relationships between quantities. Make basic inferences or logical predictions from proportional relationships. a. Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin). b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships in real world situations. (MS-PS3-1),(MS-PS3-5)

8.EE.A.1 Apply the properties (product, quotient, power, zero, negative exponents, and rational exponents) of integer exponents to generate equivalent numerical expressions. For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.(MS-PS3-1)

8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.(MS-PS3-1)

8.F.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. (MS-PS3-1),(MS-PS3-5)

Essential Questions:
1) Describe the forms of energy and explain how energy can be converted
2) How can energy be transferred from one material to another?
3) Explain the relationship between energy and temperature

Big Idea:
1) Energy can be found in different forms and can be converted between the forms
2) Energy can be transferred from one object to another
3) Temperature is the measure of the average kinetic energy of matter
4) The amount of energy needed to change the temperature of a substance depends on the materials involved

Vocabulary:
energy, joule, kinetic energy, potential energy, mechanical energy, thermal energy, chemical energy, electrical energy, sound energy, light energy, nuclear energy, energy conversion, law of conservation of energy, energy resource, non renewable resources, fossil fuels, renewable resources, temperature, thermal expansion, absolute zero, heat, conduction, conductor, insulator, convection, radiation, specific heat capacity, nuclear fusion, nuclear fission, kelvin, fahrenheit, celsius

DCI:

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)
A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2). Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)

PS3.B: 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. (MS-PS3-5). 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), Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

PS3.C: Relationship Between Energy and Forces
When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

Unit 5 - WAVES AND ELECTROMAGNETIC RADIATION

Pacing: 3 weeks

NGS STANDARDS:
MS-PS4 – Waves and Electromagnetic Radiation

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.

ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1),(MS-PS4-2)

Mathematics –

MP.2 Reason abstractly and quantitatively. (MS-PS4-1)

In grades 6-8 mathematically proficient students will:

1. represent a situation symbolically and carry out its operations
2. create a coherent representation of the problem
3. translate an algebraic problem to a real world context
4. explain the relationship between the symbolic abstraction and the context of the problem
5. compute using different properties
6. consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (MS-PS4-1)

In grades 6-8 mathematically proficient students will:

1. apply mathematics to solve problems arising in everyday life and society
2. identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
3. interpret their mathematical results in the context of the situation and reflect on whether the results make sense
4. make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
5. analyze quantitative relationships to draw conclusions
6. reflect on whether their results make sense
7. improve the model if it has not served its purpose

6.RP.1 Write and describe the relationship in real life context between two quantities using ratio language. For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.” (MS-PS4-1)

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).(MS-PS4-1)

7.RP.2. Represent proportional relationships by equations and multiple representations such as tables, graphs, diagrams, sequences, and contextual situations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.

d. Understand the concept of unit rate and show it on a coordinate plane. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate. (MS-PS4-1)

8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.(MS-PS4-1)

Essential Questions:
1) How are waves formed?
2) Define and label the parts of a wave (amplitude, etc)
3) Explain the difference between mechanical waves and electromagnetic waves
4) Describe the behavior of waves given a specific situation (eg. When a wave hits a surface through which it cannot pass, it bounces back) 5) Explain how and give examples of waves being used for communication purposes

Big Idea:
1) A source of energy produces a mechanical wave when it causes a medium to vibrate
2) Mechanical waves need a medium; electromagnetic waves can travel through space
3) Waves demonstrate specific behaviors when they interact with their environment and other waves
4) Waves can be used for communication purposes

Vocabulary:
wave, energy, medium, mechanical wave, vibration, transverse wave, crest trough, longitudinal wave, compression, rarefaction, amplitude, wavelength, frequency, hertz, reflection, law of reflection, refraction, diffraction, interference, constructive interference, destructive interference, standing wave, node, antinode, resonance

DCI

PS4.A: Wave Properties
A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1). A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

PS4.B: Electromagnetic Radiation
When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2). The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2). A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2). However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

PS4.C: Information Technologies and Instrumentation

Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

Kenai Peninsula Borough School District
Science; Biology
UNIT 1 Unit Title: From Molecules to Organisms: Structures and Processes

Pacing:

NGSS Standards:

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.]

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

Literacy

RST.9-	Cite specific textual evidence to support analysis of science and technical texts,

10.1	attending to the precise details of explanations or descriptions.CHS-LS1-6)
WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). (HS-LS1-1),(HS-LS1-6)
WHST.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)
WHST.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)
WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. (HS-LS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1),(HS-LS1-6)
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2),(HS-LS1-4),(HS-LS1-5),(HS-LS1-7)

Mathematics -	
P.4	Model with mathematics. (HS-LS1-4) In grades 9-12 mathematically proficient students will: • apply mathematics to solve problems in everyday life, society, and workplace • identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas • consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense • apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later • make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised • identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas • analyze quantitative relationships to draw conclusions • improve the model if it has not served its purpose
HSF-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)
HSF-BF.A.1	Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

Essential Questions:

What are the goals of science?
What procedures are at the core of scientific methodology?
What scientific attitudes help generate new ideas?
Why is peer review important?
What is a scientific theory?
What is the relationship between science and society?
What characteristics do all living things share?
What are the essential themes of biology?
How do different fields in biology differ in their approach to studying biology?
How id the metric system important in science?
What three subatomic particles make up an atom?

How are isotopes of an element similar?
In what ways do compounds differ from component elements?
What are the three main types of chemical bonds?
How does the structure of water contribute to its unique properties?
How does water's polarity influence its properties as a solvent?
Why is it important for cells to buffer solutions against rapid changes in pH?
What elements does Carbon bond with to make up life's molecules?
What are the functions of each of the four groups of macromolecules?
What happens to chemical bonds during chemical reactions?
How do energy changes affect whether a chemical reaction will occur?
What role do enzymes play in living things and what affects their function?
What is the cell theory?
How do microscopes work?
How are prokaryotic and eukaryotic cells different?
What is the role of the cell nucleus, vacuoles, lysosomes and cytoskeletons
What organelles help make up transport proteins?
What are the functions of the chloroplasts and mitochondria?
What is the function of the cell membrane?
What is passive transport?
What is active transport?
How do individual cells maintain homeostasis?
How do cells of multicellular organisms work together to maintain homeostasis?
Why is ATP useful to cells?
What happens during the process of photosynthesis?
What roles do pigments play in the process of photosynthesis?
What are electron carrier molecules?
What are the reactants and products of photosynthesis?
Where do organisms get energy?
What is cellular respiration?
What is the relationship between photosynthesis and cellular respiration?
What happens during the process of glycolysis?
What happens during the Krebs cycle?
How does electron transport chain use high-energy electrons from glycolysis and the Krebs cycle?
How much ATP does cellular respiration generate?
How do organisms generate energy when oxygen is not available?
How does the body produce ATP during different stages of exercise?
What are some of the difficulties as cell faces as it increases in size?
How do sexual and asexual reproduction compare?
What is the role of chromosomes in cell division?
What are the main events in the cell cycle?
What events occur during the four phases of mitosis?
How do daughter cells split apart after mitosis?
How is the cell cycle regulated?
How do cancer cells differ from other cells?

How do cells become specialized for different functions?
What are the three principal organs of seed plants?
What are the primary functions of the main tissue systems of seed plants?
How do meristems differ from other plant tissues?
What are the main tissues in a mature root?
What are the different functions of roots?
What are the three main functions of stems?
How do primary growth and secondary growth occur in stems?
How is the structure of the leaf adapted to make photosynthesis more efficient?
What role do stomata play in maintaining homeostasis?
What are the main forces that transport water in a plant?
What drives the movement of phloem tissue in a plant?

Big Ideas:
Cellular Basis of Life
Information and Heredity
Matter and Energy
Growth, development and reproduction
Homeostasis
Structure and Function
Evolution
Unity and Diversity of Life
Interdependence in Nature
Science as a way of knowing

Vocabulary: Science, observation, inference, hypothesis, controlled experiment, independent variable, dependent variable, control group, data, theory, bias, biology, DNA, stimulus, sexual production, asexual production, homeostasis, metabolism, biosphere,
LS1-6
Atom, nucleus, electron, element, isotope, compound, ionic bond, ion, covalent bond, molecule, van der Waals forces, hydrogen bond, cohesion, adhesion, mixture, solution, solute, solvent, suspension, pH scale, acid, base, buffer, monomer, polymer, carbohydrate, monosaccharide, lipid, nucleic acid, nucleotide, protein, amino acid, chemical reaction, reactant, product, activation energy, catalyst, enzyme, substrate,
Cell, cell theory, cell membrane, nucleus, eukaryotes, prokaryote, cytoplasm, organelle, vacuole, lysosomes, cytoskeleton, centriole, ribosome, endoplasmic reticulum, Golgi apparatus, chloroplast, mitochondria, cell wall, lipid bilayer, selectively permeable, diffusion, facilitated diffusion, aquaporin, osmosis, isotonic, hypertonic, hypotonic, osmotic pressure, tissue, organ, organ system, receptor,
LS1-5
Adenosine triphosphate (ATP), heterotroph, autotroph, photosynthesis, pigment, chlorophyll, thylakoid, stroma, NADP+, light-dependent reactions, light-independent reactions, photosystem,
LS1-7

Calorie, cellular respiration, aerobic, anaerobic, glycolysis, NAD+, Krebs cycle, matrix, fermentation,
LS1-4
Cell division, chromosome, chromatin, cell cycle, interphase, mitosis, cytokinesis, prophase, centromere, chromatid, centriole, metaphase, anaphase, telophase, cyclin, growth factor, apoptosis, cancer, tumor, embryo, differentiation, totipotent, blastocyst, pluripotent, stem cell, multipotent,
LS1-2, LS1-3 (stomata lab), LS1-5
Epidermis, lignin, vessel element, sieve tube element, companion cell, parenchyma, collenchyma, sclerenchyma, meristem, apical meristem, root hair, cortex, endodermis, vascular cylinder, root cap, Casparian strip, node, bud, vascular bundle, pith, primary growth, secondary growth, vascular cambium, cork cambium, heartwood, sapwood, bark, blade, petiole, mesophyll, palisade mesophyll, spongy mesophyll, stoma, transpiration, guard cell, adhesion, capillary action, pressure-flow hypothesis

Grade Level/Course Kenai Peninsula Borough School District
Science: Biology
UNIT 2 Unit Title: Heredity: Inheritance and Variation of traits

Pacing:

NGSS Standards:
HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]

ELA/Literacy -	
RST.9-10.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.(HS-LS3-1),(HS-LS3-2)
RST.9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.. (HS-LS3-1)
WHST.9-10.1	Write arguments focused on discipline-specific content. (HS-LS3-2) a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion,

	and clarify the relationships between claim(s) and reasons between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from and supports the argument presented.

Mathematic Standards

MP.2	Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

Essential Questions:

Where does an organism get its unique characteristics?
How are different forms of a gene distributed to offspring?
How can we use probability to predict traits?
How do alleles segregate when more than one gene is involved?
What did Mendel contribute to our understanding of genetics?
What are some exceptions to Mendel's principles?
Does the environment have a role in how genes determine traits?
How many sets of genes are found in most adult organisms?
What events occur during each phase of meiosis?
How is meiosis different from mitosis?
How can two alleles from different genes be inherited together?
) What clues did bacterial transformation yield about the gene?
What role did bacterial viruses play in identifying genetic material?
What is the role of DNA in heredity?
What are the chemical components of DNA?
What clues helped scientists solve the structure of DNA?
What does the double-helix model tell us about DNA?
How does RNA differ from DNA?
How does the cell make RNA?
What is the genetic code, and how is it read?

What role does the ribosome play in assembling proteins?
What is the "central dogma" of molecular biology?
What are mutations?
How do mutations affect genes?
What is a karyotype?
What patterns of inheritance do human traits follow?
How can pedigrees be used to analyze human inheritance?
How do small changes in DNA molecules affect human traits?
What are the effects of errors in meiosis?
What techniques are used to study human DNA?
What are the goals of the Human Genome Project, and what have we learned so far?
What is selective breeding used for?
How do people increase genetic variation?
How do scientists copy the DNA of living things?
How is recombinant DNA used?
How can genes from one organism be inserted into another organism?
How can genetic engineering benefit agriculture and industry?
How can recombinant-DNA technology improve human health?
How is DNA used to identify individuals?
What privacy issues does biotechnology raise?
Are GM foods safe?
Should genetic modifications to humans and other organisms be closely regulated?

Big Ideas:
How does cellular information pass from on generation to another?
What is the structure of DNA, and how does it function in genetic inheritance?
How does information flow from the cell nucleus to direct the synthesis of proteins in the cytoplasm?
How can we use genetics to study human inheritance?
How and why do scientists manipulate DNA in living cells?

Vocabulary: Selective breeding, hybridization, inbreeding, biotechnology, polymerase chain reaction, recombinant DNA, plasmid, genetic marker, transgenic, clone, gene therapy, DNA microarray, DNA fingerprinting, forensics,

LS3-3, LS3-2

Genetics, fertilization, trait, hybrid, gene, allele, principle of dominance, segregation, gamete, probability, homozygous, heterozygous, phenotype, genotype, Punnett square, independent assortment, incomplete dominance, codominance, multiple allele, polygenic inheritance, homologous, diploid, haploid, meiosis, tetrad, crossing-over, zygote

LS1-1

Transformation, bacteriophage, base pairing, replication, DNA polymerase, telomere

LS1-1, LS3-1, LS3-2

RNA, messenger RNA, ribosomal RNA, transfer RNA, transcription, RNA polymerase, promoter, intron, exon, polypeptide, genetic code, codon, translation, anticodon, gene expression, mutation, point mutation, frameshift mutation, mutagen, polyploidy, operon, operator, RNA interference,

differentiation, homeotic gene, homeobox gene, Hox gene

LS3-2

Genome, karyotype, sex chromosome, autosome, sex-linked gene, pedigree, no disjunction, restriction enzyme, gel electrophoresis, bioformatics, genomics,

Kenai Peninsula Borough School District
Science: Biology
UNIT 3 Unit Title: Biological Evolution: Unity and Diversity

Pacing:

NGSS Standards:

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.]

HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

ELA/LITERACY:	
RST-9.10.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(HS-LS4-1)*,(HS-LS4-

	2),*(HS-LS4-3)*,(HS-LS4-4)
RST-9.10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS4-5)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **a.** Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. **b.** Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. **c.** Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. **d.** Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. **e.** Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. **f.** Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic). *(HS-LS4-1)*,(HS-LS4-2),*(HS-LS4-3)*,(HS-LS4-4)
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. *(HS-LS4-6)*
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. *(HS-LS4-6)*
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-LS4-1)*,(HS-LS4-2),*(HS-LS4-3)*,(HS-LS4-4),(HS-LS4-5)
SL.11-12.4	Present information, findings, supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development , substance, and style are appropriate to the purpose audience, and task. *(HS-LS4-1),(HS-LS4-2)*
MATHEMATICS STANDARDS:	
MP.2	Reason abstractly and quantitatively. *(HS-LS4-1)*,(HS-LS4-2),(HS-LS4-3),*(HS-LS4-4),(HS-LS4-5)* • decontextualize to abstract a given situation and represent it symbolically and

	manipulate the representing symbols. • reflect during the manipulation process in order to probe into the meanings for the symbols involved • create a coherent representation of the problem • make sense of quantities and their relationships in problem situations • attend to the meanings of quantities • use flexibility with different properties of operations and objects • translate an algebraic problem to a real world context • explain the relationship between the symbolic abstraction and the context of the problem • compute using different properties • consider the quantitative values, including units, for the numbers in a problem
MP.4	Model with mathematics. *(HS-LS4-2)* **In grades 9-12 mathematically proficient students will:** • apply mathematics to solve problems in everyday life, society, and workplace • identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas • consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense • apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later • make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised • identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas • analyze quantitative relationships to draw conclusions • improve the model if it has not served its purpose

Essential Questions:
What was Charles Darwin's contribution to science?
What three patterns of biodiversity did Darwin note?
What did Hutton and Lyell conclude about Earth's history?
How did Lamarck propose that species evolve?
What was Malthus' view of population growth?
How is inherited variation used in artificial selection?
Under what conditions does natural selection occur?
What does Darwin's mechanism for evolution suggest about living and extinct species?
How does the geographic distribution of species today relate to their evolutionary history?
How do fossils help to document the descent of modern species from ancient ancestors?

How do homologous structures and similarities in embryonic development suggest about the process of evolutionary change?
How can molecular biology be used to trace the process of evolution?
What dose recent research on the Galapagos finches show about natural selection?
How is evolution defined in genetic terms?
What are the sources of genetic variation?
What determines the number of phenotypes for a given trait?
How does natural selection affect single-gene and polygenic traits?
What is genetic drift?
What conditions are required to maintain genetic equilibrium?
What types of isolation lead to the formation of new species?
What is the current hypothesis about Galapapos finches?
What are molecular clocks?
Where do new genes come from?
How may Hox genes be involved in evolutionary change?
What are the goals of binomial nomenclatures and systematics?
How did Linnaeus group species into larger taxa?
What is the goal of evolutionary classification?
What is a cladogram?
How are DNA sequences used in classification?
What are the six kingdoms of life as they are now identified?
What does the tree of life show?
What do fossils reveal about ancient life?
How do we date events in Earth's history?
How was the geological time scale established, and what are its major divisions?
How have our planet's environment and living things affected each other to shape the history of life on Earth?
What processes influence whether species and clades survive or become extinct?
How fast does evolution take place?
What are two patterns of macroevolution?
What evolutionary characteristics are typical of coevolving species?
What do scientists hypothesize about early Earth and the origin of life?
What theory explains the origin of eukaryotic cells?
What is the evolutionary significance of sexual reproduction?
How do viruses reproduce?
What happens after a virus infects a cell?
How are prokaryotes classified?
How do prokaryotes vary in their structure and function?
What roles do prokaryotes play in the living world?
How do bacteria cause disease?
How do viruses cause disease?
Why are emerging diseases particularly threatening to human health?
What are protists?
How are protists related to other eukaryotes?

How do protists move in the environment?
How do protists reproduce?
What is the ecological significance of photosynthetic protists?
How do heterotrophic protists obtain food?
What types of symbiotic relationships involves protists?
When did the first animals evolve?
What does the cladogram of invertebrates illustrate?
What are the most ancient chordates?
What can we learn by studying the cladogram of chordates?

Big Ideas:
What is natural selection?
How can populations evolve to form new species?
What is the goal of biologists who classify living things?
How do fossils help biologists understand the history of life on Earth?
Are microbes that make us sick made of living cells?
How do protists and fungi affect the homeostasis of other organisms and ecosystems?
How have animals descended from earlier forms through the process of evolution?

Vocabulary:
LS4-1, LS4-2 evolution, fossil, artificial selection, adaptation, fitness, natural selection, biogeography, homologous structure, analogous structure, vestigial structure,
LS4-3 gene pool, allele frequency, single-gene trait, polygenic trait, directional selection, stabilizing selection, disruptive selection, genetic drift, bottleneck effect, founder effect, genetic equilibrium, Hardy-Weinberg principle, sexual selection, species, speciation, reproductive isolation, geographic isolation, temporal isolation, molecular clock
binomial nomenclature, genus, systematics, taxon, family, order, class, phylum, kingdom, Phylogeny, clade, monophyletic group, cladogram, derived character, domain, Bacteria, Archaea, Eukarya,
LS 4-4, LS4-5 extinct, paleontologist, relative dating, index fossil, radiometric dating, half-life, geologic time scale, era, period, plate tectonics, macroevolutionary patterns, background extinction, gradualism, punctuated equilibrium, adaptive radiation, convergent evolution, coevolution, endosymbiotic theory,
virus, capsid, bacteriophage, lytic infection, lysogenic infection, prophage, retovirus, prokaryote, bacillus, coccus, spirillum, binary fission, endospore, conjugation, pathogen, vaccine, antibiotic, emerging disease, prion
pseudopod, cilium, flagellum, spore, conjugation, sporangium
appendage, larva, trocophore, cartilage, tetrapod

Kenai Peninsula Borough School District
Science: Biology
UNIT 4 Unit Title: Ecosystems: Interactions, Energy, and Dynamics

Pacing:

NGSS Standards:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

ELA/LITERACY:	
RST.9-10.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (HS-LS2-1),(HS-LS2-2),(HS-LS2-3),(HS-LS2-6),(HS-LS2-8)
RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual from (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
	a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.

	b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
	c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
	d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
	e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
	f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)

MATHEMATICS STANDARDS:

MP.2	Reason abstractly and quantitatively. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-6),(HS-LS2-7)
	In grades 9-12 mathematically proficient students will:
	• decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
	• reflect during the manipulation process in order to probe into the meanings for the symbols involved
	• create a coherent representation of the problem
	• make sense of quantities and their relationships in problem situations
	• attend to the meanings of quantities
	• use flexibility with different properties of operations and objects
	• translate an algebraic problem to a real world context
	• explain the relationship between the symbolic abstraction and the context of the problem
	• compute using different properties
	• consider the quantitative values, including units, for the numbers in a problem

MP.4	Model with mathematics. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4)
	• apply mathematics to solve problems in everyday life, society, and workplace
	• identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
	• consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
	• apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
	• make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
	• identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
	• analyze quantitative relationships to draw conclusions
	• improve the model if it has not served its purpose
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
HSS-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots). (HS-LS2-6)
HSS-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)
HSS-IC.B.6	Evaluate reports based on data. (HS-LS2-6)

Essential Questions (Student Friendly language)

What is ecology?

What are biotic and abiotic factors?

What methods are used in ecological studies?
What are primary producers?
How do consumers obtain energy and nutrients?
How does energy flow through ecosystems?
What do the three types of ecological pyramids illustrate?
How does matter move through the biosphere?
How does water cycle through the biosphere?
What is the importance of the main nutrient cycles?
How does nutrient availability relate to the primary productivity of an ecosystem?
What is climate?
What factors determine global climate?
What is a niche?
How does competition shape communities?
How do predation and herbivory shape communities?
What are the three primary ways that organisms depend on each other?
How do communities change over time?
Do ecosystems return to "normal" following a disturbance?
What abiotic and biotic factors characterize biomes?
What areas are not easily classified into major biomes?
What factors affect life in aquatic environments?
What are the major categories of freshwater ecosystems?
Why are estuaries important?
How do ecologists usually classify marine ecosystems?
How do ecologists study populations?
What factors affect population growth?
What happens during exponential growth?
What is logistic growth?
What factors determine the carrying capacity?
What limiting factors depend on population density?
What limiting factors do not typically depend on population density?
How has human population size changes over time?
Why do population growth rates differ among countries?
How do our daily activities affect the environment?
What is the relationship between resource use and sustainable development?
What is soil important and how do we protect it
What are the primary sources of water pollution?
What are the major forms of air pollution?
Why is biodiversity important?
What are the most significant threats to biodiversity?
How do we preserve biodiversity?
How does the average ecological footprint in America compare to the world's average?
How can ecology guide us to a sustainable future?
When did the first animals evolve?
What does the cladogram of invertebrates illustrate?

What are the most ancient chordates?
What can we learn about studying the cladogram of chordates?
What is the significance of behavior in the evolution of animal species?
What is an innate behavior?
What are the major types of learning?
How do many complex behaviors arise?
How do environmental changes affect animal behavior?
How do social behaviors increase an animal's evolutionary fitness?
How do animals communicate with others in their environment?

How is the human body organized?
What is homeostasis?
What are the structures and functions of the eleven human body systems?

Big Ideas:
How do living and nonliving parts of the Earth interact and affect the survival of organisms
How do abiotic and biotic factors shape ecosystems?
What factors contribute changes in populations?
How have human activities shaped local and global ecology?
How have animals descended from earlier forms through the process of evolution?
How do the structures of animals allow them to obtain essential materials and eliminate wastes?

Vocabulary: epithelial tissue, connective tissue, nervous tissue, muscle tissue, homeostasis, feedback inhibition, nervous system, integumentary system, lymphatic/immune system, muscular system, skeletal system, circulatory system, respiratory system, digestive system, excretory system, endocrine system, reproductive system.
LS2-4, LS2-5: biosphere, species, population, community, ecology, ecosystem, biome, biotic factor, abiotic factor, autotroph, primary producer, photosynthesis, chemosynthesis, heterotroph, consumer, carnivore, herbivore, scavenger, omnivore, decomposer, detritivore, food chain, phytoplankton, food web, zooplankton, trophic level, ecological pyramid, biomass, biogeochemical cycles, nutrient, nitrogen fixation, denitrification, limiting nutrients.
LS2-3, LS2-6: weather, climate, microclimate, greenhouse effect, tolerance, habitat, niche, resource, competitive exclusion principle, predation, herbivory, keystone species, symbiosis, mutualism, parasitism, commensalism, ecological succession, primary succession, pioneer species, secondary succession canopy, understory, deciduous, coniferous, humus, taiga, permafrost, photic zone, aphotic zone, benthos, plankton, wetland, estuary
LS2.1: populations density, age structure, immigration, emigration, exponential growth, logistic growth carrying capacity, limiting factor, density-dependent limiting factor, density-independent limiting factor, demography, demography transition,
LS2.2, LS2-7: monoculture, renewable resource, nonrenewable resource, sustainable development, desertification, deforestation, pollutant, biological magnification, smog, acid rain, biodiversity, ecosystem diversity, species diversity, genetic diversity, habitat fragmentation, ecological hot spot, ecological footprint, ozone layer, aquaculture, global warming,
appendage, larva, trochophore, cartilage, tetrapod

LS2-8 behavior, innate behavior, learning, habituation, classical conditioning, operant conditioning, insight learning, imprinting, circadian rhythm, migration, courtship, territory, aggression, society, kin selection, communication, language

Kenai Peninsula Borough School District
Science: Chemistry
Unit 1: Introduction to chemistry and data analysis

Pacing:

Title NGSS Standards:

HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]

Mathematics Standards:

MP.2 Reason abstractly and quantitatively. (HS-PS1-7)

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-7)

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-7)

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-7)

ELA Standards: - I will write in these

Essential Questions:

Define matter.
Compare and contrast mass and weight.
Why does chemistry involve the study of the changes in the world at a submicroscopic level?
Explain why a scientist must be cautious when a new chemical that has many potential uses is synthesized.
What is the scientific method? What are its steps?
You are asked to study the effect of temperature on the volume of a balloon. Identify the independent and dependent variable.
Compare and contrast pure and applied research.
What is technology? Give examples of technology that you use every day.
Explain the reason behind each of the following: wear goggles and an apron in the lab even if you are only an observer, report all accident to the teacher, do not return unused chemicals to the stock bottles.
List the SI (Metric) units for length, time, mass and temperature.
Describe the relationship between mass, volume and density of a material.
What is the difference between a base unit and a derived unit?
How many milliseconds are in a second?

Why does oil float on water?
Which of these measurements was made with the most precise measuring devise: 8.1956 m, 8.20 m or 8.19 m? Explain your answer.
Explain why graphing can be an important tool for analyzing data.

Big Ideas:
Chemistry is the study of matter and the changes it undergoes.
Matter is anything that has mass and take up space.
Mass is a measure of the amount of matter
Weight is a measure of not only of an amount of matter but also the effect of Earth's gravitational pull on that matter.
There are five traditional branches of chemistry: inorganic, physical analytical and biochemistry.
Macroscopic observations of matter reflect the actions of atoms on a submicroscopic scale.
Typical steps of the scientific method include observations, hypothesis, data analysis and conclusion.
Qualitative data describe an observation: quantitative data use numbers.
Any independent variable is a variable you change in an experiment and a dependent variable changes in response to a change in the independent variable.
A theory is a hypothesis that has been supported by many experiments.
A scientific law describes relationship in matter.
Scientific methods can be used in research.
Laboratory safety is the responsibility of anyone who conducts and experiment.
Many of the conveniences we enjoy today are technological applications of chemistry.
SI (metric) measurement units allow scientists to report data that can be reproduced by other scientists.
Adding prefixes to SI units extends the range of possible measurements.
SI units for length, time, mass and temperature.
Volume and density have derived units.
Scientific notation makes it easier to handle extremely large or small measurements.
Dimensional analysis often uses conversion factors.
An accurate measurement is close to the accepted value and precise measurement show little variation over a series of trails.
Graphs are visual representations of data.

Vocabulary: Chemistry, Conclusion, Control, Variable, Experiment, Hypothesis, Mass, Matter, Model, Research, Data, Law, Scientific method, Technology, Weight, Accuracy, Base unit. Conversion factor, Density, Unit, Dimensional analysis, Graph, Metric units (SI), Error, Precision, Scientific notation, Temperature scales, Macroscopic, Microscopic

Kenai Peninsula Borough School District
Science: Chemistry
Unit 2: Properties and Changes, Structure of the Atom

NGSS Standards:

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]

HS-PS1-2 HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]

HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.]

Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. [Clarification

HS-PS4-1	Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth.] [Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.]
HS-PS4-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. [Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.] [Assessment Boundary: Assessment does not include using quantum theory.]
HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. [Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is limited to qualitative descriptions.]
ELA Literacy	RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1)
	RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-PS4-3),(HS-PS4-4)
	RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3)
	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS4-1),(HS-PS4-4)
	RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical

text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.(HS-PS4-3),(HS-PS4-4)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3)

Mathematics Standards:

MP.2 Reason abstractly and quantitatively.(HS-PS1-7)

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (HS-PS4-1)

- apply mathematics to solve problems in everyday life, society, and workplace
- identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- apply knowledge, making assumptions and approximations to simplify a complicated

situation, realizing that these may need revision later
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- analyze quantitative relationships to draw conclusions
- improve the model if it has not served its purpose

N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-7)

A.SSE.1. Interpret expressions that represent a quantity in terms of its context. (HS-PS4-1),(HS-PS4-3)

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS4-1),(HS-PS4-3)

a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example,* $x^2 + 4x + 3 = (x + 3)(x + 1)$.

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
For example, $x^2 + 4x + 3 = (x + 2)^2 - 1$.

c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*(HS-PS4-1),(HS-PS4-3)

a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example,* $x^2 + 4x + 3 = (x + 3)(x + 1)$.

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
For example, $x^2 + 4x + 3 = (x + 2)^2 - 1$.

c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

N-Q.2. Define appropriate quantities for the purpose of descriptive modeling. HS-PS1-7)

N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when

reporting quantities. (HS-PS1-2),(HS-PS1-7)

Essential Questions:
Describe the characteristics that identify a sample of matter as being a substance.
Classify a list of properties of matter as physical or chemical.
Create a table that describes the three common states of matter in terms of their shape, volume and compressibility.
Describe the results of a physical change and list three examples of a physical change. (Do the same for a chemical change)
Classify a list of changes in matter as physical or chemical.
How do mixtures and substance differ?
Consider a mixture of water, sand and oil. How many phases are present? How could you separate these three substances?
Classify a list of mixtures as either homogenous or heterogeneous.
How are elements and compound similar? How are they different?
What is the basic organizing feature of the periodic table of elements?
Explain how the law of definite proportions applies to compounds.
Compare and contrast the early models of the atom.
Define atom in your own words.
Describe the structure of a typical atom. Be sure to identify where each subatomic particle is located.
Make a table comparing the relative charge and mass of each subatomic particle.
List and describe the characteristics properties of waves.
Explain the difference between the continuous spectrum of light and the atomic emission spectrum of an element.
Compare and contrast Bohr's atomic model with the modern atomic model.
What is a valence electron? Draw electron dot structures of the first ten elements.

Big Ideas:
A substance is a form of matter with a uniform and unchanging composition.
Physical properties can be observed without changing a substances composition.
Chemical properties describe a substances ability to combine with or change intone or more new substances.
The three common states of matter are solid, liquid and gas.
In chemical reactions reactants form products.
Matter is neither created nor destroyed in a chemical reaction.
A mixture is a physical blend of two or more pure substances.
Solutions are homogenous mixtures
Mixtures can be separated by physical means. Common separation techniques.
Elements are substances that cannot be broken down in to simpler substances by chemical or physical means.
The elements are organized in the periodic table of elements.
A compound is chemical combination of two or more elements.
Early theories of matter

Subatomic particles and the nuclear atom.
The number of protons or atomic number of an atom uniquely identifies an atom.
Atoms of equal numbers of protons and electrons, and thus, no overall electrical change.
An atom's mass number is equal to its total number of protons and neutrons.
Atoms of the same element with different numbers of neutrons and different mass are called isotopes.
All waves can be described by their wavelength, frequency, amplitude and speed.
Energy is emitted and absorbed by matter in quanta.
In contrast to the continuous spectrum produced by white light, and element'' atomic emission spectrum is a series of fine lines.
Bohr's model
Quantum mechanical model of an atom.
Electrons occupy a three dimensional region of space called atomic orbitals.
The arrangement of electron in an atom is called the atom's electron configuration.
Valence electrons determine the chemical properties of an atom.

Vocabulary: Chemical change and property, Physical change and property, Compound, Element, Mixture: heterogeneous and homogenous, Law of conservation of mass, Law of proportions, Mixture, Percent by mass, Periodic table, States of matter, Reactant, Product, Atom, Atomic mass, Atomic mass unit (amu), Atomic number, Dalton's atomic theory, Electron, Isotope, Mass number, Neutron, Nucleus, Proton, Radioactivity, Amplitude, Atomic orbital, Electromagnetic radiation, Electromagnetic, spectrum, Electron configurations, Electron dot structure, Energy level, Frequency, Ground states, Photon, Principle energy level, Quantum number, Valence electron, Wavelength

Kenai Peninsula Borough School District
Science; Chemistry
Unit 3; The Periodic Table and the Periodic Law, Elements

Pacing:

NGSS Standards:

HS-PS1.1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]

HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]

HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]
HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.[Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [*Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.*

Math Standards:

MP.2 Reason abstractly and quantitatively. *(HS-ESS3-1)*,(HS-ESS3-2),(HS-ESS3-3),*(HS-ESS3-4)*(HS-PS1-3)

In grades 9-12 mathematically proficient students will:

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. (HS-ESS3-3) (HS-PS1-3) In grades 9-12 mathematically proficient students will:

- apply mathematics to solve problems in everyday life, society, and workplace
- identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- analyze quantitative relationships to draw conclusions
- improve the model if it has not served its purpose

N-Q.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3)*

N.Q.3

Choose a level of accuracy appropriate to limitations on measurement when reporting

quantities. *(HS-PS1-2),(HS-PS1-3)*

ELA STANDARDS:

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2)

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3) (HS-ESS3-2)

WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-3)

WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*

Essential Questions

Describe the development of the modern periodic table.
Sketch a simplified version of the periodic table and indicate the location of groups, periods, metals nonmetals and metalloids.
Describe the general characteristics of metals, nonmetals and metalloids.
Explain why elements in the same group have similar chemical characteristics.

Describe how group number and valence electrons are related.
Describe how period is related to energy levels.
Sketch a simplified periodic table and use arrows and label to compare period and group trends in atomic and ionic radii, ionization energies and electronegativites.
Explain how the period and group trends are related to electron configuration.
Why are the elements in groups 1A through 8A called the representative elements?
What determines the chemical behavior of an element?
In general how do s, p, d and f blocks differ?
What is an allotrope? Describe the allotropes of carbon.
How do a mineral and ore differ?
What factor determines the magnetic properties of an element and the color of its compounds?
What is metallurgy?
Compare and contrast the actinide and lanthanide series.

Big Ideas:
Periodic law states that when the elements are arranged by increasing atomic number there is a periodic repetition of their chemical and physical properties.
History of the development of the periodic table.
Organization of the periodic table into groups and periods.
Element classification by element type.
Elements in the same group on the periodic table of similar chemical properties due to their electron configuration.
How the periodic table is organized.
The energy level of at atom's valance electrons equals its period number.
For group A elements, an atom's group number equals its number of valence electrons.
Periodic trends of atomic radii, ion size, ionization energy, valance electrons, electronegativity and bond type.
The octet rule states that atoms gain, lose or share electrons in order to acquire the stable electron configurations of a noble gas.
The number and location of valence electrons determines and elements position of the periodic table and its chemistry.
Properties and uses of s, p, d and f- block elements.
Know the most abundant elements of the earth's crust.

Vocabulary: Alkali metal**,** Alkaline earth metal**,** Electronegativity**,** Group, Metallurgy**,** Mineral**,** Ore, Halogen, Inner transition metal, Ion, Ionization energy**,** Metal**,** Metalloid**,** Noble gas**,** Nonmetal**,** Octet rule**,** Period**,** Periodic law**,** Representative elements**,** Transition element**,** Transition metal**,** Actinide series**,** Allotrope**,** Diagonal relationship**,** Ferromagnetism**,** Lanthanide series

Kenai Peninsula Borough School District
Science; Chemistry
Unit 4: Ionic Compounds and Covalent Bonding

Pacing:

NGSS Standards:

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.[Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*]

HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]

ELA/LITERACY -

RST.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. *(HS-PS1-1)*
RST.11-12.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. (HS-PS1-3)
WHST.9-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. (HS-PS1-2)
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12.) (HS-PS1-2)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3)
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS1-4)*

Mathematics -

MP.2	Reason abstractly and quantitatively. (HS-PS1-7)

In grades 9-12 mathematically proficient students will:

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. *(HS-PS1-4),*

In grades 9-12 mathematically proficient students will:

- apply mathematics to solve problems in everyday life, society, and workplace
- identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- analyze quantitative relationships to draw conclusions
- improve the model if it has not served its purpose

HSN-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),*(HS-PS1-7)

HSN-Q.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7)*

HSN-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4), (HS-PS1-7)*

Essential Questions:
What is a chemical bond?
Why do ions form?
What family of elements is relatively unreactive and why?
Describe the formation of both positive and negative ions.
What is an ionic bond and how does it form?
List three physical properties associated with an ionic bond.
What is lattice energy and how is it involved in an ionic bond?
What is the difference between a monoatomic and polyatomic ion? Give an example of each.
How do you determine the correct subscripts in a chemical formula?
How are metals name in an ionic compound? Nonmetals? polyatomic ions? Oxyanions?
What is a metallic bond?
Explain the properties of metals based on metallic bonding.
What is an alloy?
What is a covalent bond and how does it form?
What is a binary molecular compound?
Compare and contrast naming binary acids and other binary covalent molecules.
What is the role of the central atom when drawing the Lewis structure for a molecule?
What is resonance?
What is the VSPER model and how is it used to determine molecular shape?
Define electronegativity?
How is electronegativity used to determine bond type?
What is a polar molecule?
List three properties of a covalent compound.

Big Ideas:
A chemical bond is the force that holds two atoms together.
Formation of ions.
The formation and nature of ionic bonds.
Lattice energy is needed to break the force of attraction between oppositely charged ions.
Physical properties of ionic solids.
Names and formula for ionic compounds.
Metallic bonds and properties of metals
The electron sea model can explain the properties of metallic solids.
Metal alloys are formed when a metal is mixed with one or more other elements.
Formation of a covalent bond and its properties.
Naming molecules.
The Lewis structure is used to show the distribution of shared and lone pairs in a molecule.
Resonance occurs when more than one valid Lewis structure exists for the same molecule.
VSEPR and how it determines the shape of a molecule.
How electronegativity can help determine the polarity of a molecule.

Vocabulary: Alloy, Anion, Cation, Chemical bond, Delocalized electrons, Electrolyte, Electron sea model, Formula unit, Ionic bond, Lattice energy, Metallic bond, Monoatomic ion, Oxidations number

Oxyanion, Polyatomic ion, Covalent bond, Endothermic, Exothermic, Hybridization, Lewis structure, Molecule, Oxyacid, Resonance, Structural formula, VSEPR model

Kenai Peninsula Borough School District
Science; Chemistry
Unit 5: Chemical reactions

Pacing:
NGSS Standards:

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.[Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.[Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*]

HS-PS1- Apply scientific principles and evidence to provide an explanation aboutthe effects of

5. changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.[Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [*Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*]

HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*[Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]

HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]

ELA/LITERACY:

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),*(HS-PS1-5)*

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),*(HS-PS1-6)*

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS1-4)*

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)
In grades 9-12 mathematically proficient students will:

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

MP.4 Model with mathematics. *(HS-PS1-4)*
In grades 9-12 mathematically proficient students will:

- apply mathematics to solve problems in everyday life, society, and workplace
- identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- consistently interpret mathematical results in the context of the situation and

reflect on whether the results make sense
- apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- analyze quantitative relationships to draw conclusions
- improve the model if it has not served its purpose

HSN-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),(HS-PS1-5)*,(HS-PS1-7)

HSN-Q.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7)*,

HSN-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7)*

Essential Questions
List three types of evidence that indicate that a chemical reaction has occurred.
Why is it important that a chemical equation be balanced?
Name and describe the classes of chemical reactions.
Describe and aqueous solution.
Use coefficients to balance the following equations ……
What are the three common types of products produced by reactions that occur in aqueous solutions?

Big Ideas:
Evidences for a chemical reaction. (Changes in heat, light, precipitate, odor etc.)
Types of chemical reactions- single replacement, double replacement, syntheses and decomposition
Balancing chemical reactions using coefficients.
Chemical reactions in aqueous solutions.
Types of products produced in a chemical reaction.

Vocabulary: Solution**,** Chemical equation**,** Chemical reaction**,** Coefficient**,** Ionic equations**,** Double replacement reaction**,** Precipitate**,** Product**,** Reactant**,** Single replacement reaction**,** Synthesis reaction

Kenai Peninsula Borough School District
Science; Chemistry
Unit 6: The Mole

Pacing:
NGSS Standards:

HS-PS1-7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]
ELA/LITERACY:	
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*
MATHEMATICS STANDARDS:	
MP.2	Reason abstractly and quantitatively. (HS-PS1-7) • decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols. • reflect during the manipulation process in order to probe into the meanings for the symbols involved • create a coherent representation of the problem • make sense of quantities and their relationships in problem situations • attend to the meanings of quantities • use flexibility with different properties of operations and objects • translate an algebraic problem to a real world context • explain the relationship between the symbolic abstraction and the context of the problem • compute using different properties • consider the quantitative values, including units, for the numbers in a problem
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-7)

HSN-Q.2	Define appropriate quantities for the purpose of descriptive modeling. *(HS-PS1-7)*
HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-7)*

Essential Questions:
How is mole similar to a dozen?
What is the relationship between a mole and Avogadro's number?
Explain how you convert for the number of representative particles to the moles of a substance.
Explain what is meant by molar mass.
What conversion factor should be used to convert form mass to moles? Moles to mass?
Explain the steps needed to convert the mass of an element to the number of atoms of the element.
Describe how to determine the molar mass of a compound.
What three conversion factors are often used in mole conversions?
Explain how percent composition data for a compound are related to the massed of the element in the compound.
What is the difference between an empirical formula and a molecular formula?
What is a hydrate? What does its name indicate about its composition?
Describe the experimental procedure for determining the formula for a hydrate. Explain the reason for each step.

Big Ideas:
The mole as a unit for measuring the amount of a substance.
The molar mass of an element is the numerical equivalent of the atomic mass (amu) in grams.
The molar mass and its relationship to Avogadro's number.
Subscripts in a chemical formula indicate how many moles of each element are in one mole of the compound.
Empirical and molecular formulas and how to determine them.
The formula of a hydrate and how to determine it.

Vocabulary: Avogadro's number**,** Empirical formula**,** Hydrate**,** Molar mass**,** Mole**,** Molecular formula**,** Percent composition

Kenai Peninsula Borough School District
Science; Chemistry
Unit 7: Stoichiometry

Pacing:

NGSS Standards:

HS-PS1-1.	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]
HS-PS1-2.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]
HS-PS1-3.	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]
HS-PS1-4.	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.[Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*]
HS-PS1-5.	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.[Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [*Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*]

HS-PS1-6.	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*[Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]
HS-LS1-5.	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.[Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [*Assessment Boundary: Assessment does not include specific biochemical steps.*]

ELA/LITERACY -	
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),*(HS-PS1-5)*
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)
WHST.9-	Conduct short as well as more sustained research projects to answer a question

12.7	(including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),*(HS-PS1-6)*
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS1-4)*
Mathematics -	
MP.2	Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7) In grades 9-12 mathematically proficient students will: • decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols. • reflect during the manipulation process in order to probe into the meanings for the symbols involved • create a coherent representation of the problem • make sense of quantities and their relationships in problem situations • attend to the meanings of quantities • use flexibility with different properties of operations and objects • translate an algebraic problem to a real world context • explain the relationship between the symbolic abstraction and the context of the problem • compute using different properties • consider the quantitative values, including units, for the numbers in a problem
MP.4	Model with mathematics. *(HS-PS1-4)* In grades 9-12 mathematically proficient students will: • apply mathematics to solve problems in everyday life, society, and workplace • identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas • consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense • apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later

	• make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised • identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas • analyze quantitative relationships to draw conclusions • improve the model if it has not served its purpose
HSN-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),(HS-PS1-5)*,(HS-PS1-7)
HSN-Q.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7)*
HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7)*

Essential Questions:
What is stoichiometry?
List three ways a balanced chemical reaction can be interpreted.
What is a mole ratio?
Why is a balanced chemical reaction needed in solving stoichiometric calculations?
List the four steps used in solving stoichiometric problems.
What is meant by the limiting reactants? Why is it necessary to identify the limiting reactant when you want to determine the amount of product formed?
Describe how the mass of the product can be calculated when one reactant is in excess.
Distinguish between theoretical yield and actual yield.
Explain how percent yield is calculated.

Big Ideas:
What is stoichiometry?
Balanced equations can be interpreted in terms of representative particles, moles and mass.
The law of conservation of mass and chemical reactions.
Stoichiometric calculations
Stoichiometric calculations must be based on the amount of the limiting reactant.
Percent yield is the ration of actual yield to theoretical yield expressed as a percent.

Vocabulary: Actual yield**,** Excess reactant**,** Limiting reactant**,** Mole ration**,** Percent yield**,** Stoichiometry**,** Theoretical yield

Kenai Peninsula Borough School District
Science; Chemistry
Unit 8: States of matter and gases

Pacing:

NGSS Standards:

HS-PS1-6.	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*[Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]
HS-PS1-7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]

HS-PS2-2.	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.[Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [*Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.*]
HS-PS2-5.	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.[Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.]

ELA/LITERACY:	
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. *(HS-PS1-6)*

Mathematics -	
MP.2	Reason abstractly and quantitatively. (HS-PS1-7)
HSN-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-7)
HSN-Q.2	Define appropriate quantities for the purpose of descriptive modeling. *(HS-PS1-7)*
HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-7)*

Essential Questions:
Explain the kinetic molecular theory in terms of the properties of ideal and real gases.
How does the mass of a gas particle affect its rate of effusion?
Explain how changes in atmospheric pressure affect the height of the column of mercury in a barometer.
Compare and contrast the different types of intermolecular forces.
Explain how hydrogen bonds affect the viscosity of a liquid. How do changes in temperature affect viscosity?
What effect does soap have on the surface tension of water?
Explain why most solids are denser than most liquids ate the same temperature.
What information does a phase diagram supply?
What is the major difference between the processes of melting and freezing?
Draw and label the phase diagram for water explaining all areas and points.
State Boyle's, Charles', Gay-Lussac's, ideal and combined gas Laws using sentences and the equations.
Which of the three variables that apply to equal amounts of gasses are directly proportional? Which are inversely proportional?
List common units for each variable in the ideal gas law.
How do mole ratios compare to volume ratios?

Big Ideas:
The kinetic molecular theory explains the properties of gasses.
The total pressure of a gas mixture is the sum of the partial pressures of each of the gasses in the mixture.
The different force of attraction – intramolecular, intermolecular, dispersion, dipole- dipole, and hydrogen.
Properties of solids and liquids based in the intermolecular forces.
Phase changes and phase diagrams.
The gas laws- Boyle's, Charles', Ideal, Gay-Lussac, combined
The combined gas law and Avogadro's principle.
Gas stoichiometry

Vocabulary: Amorphous solid**,** Boiling point**,** Condensation**,** Crystalline solid**,** Dalton's law of partial pressures**,** Deposition**,** Diffusion**,** Dipole-dipole forces**,** Dispersion forces**,** Evaporation**,** Freezing point Graham's law of effusion, Hydrogen bond, Kinetic molecular theory, Melting point, Phase diagram, Pressure, Sublimation, Surface tension, Temperature, Triple point, Vaporization, Viscosity, Avogadro's principle, Boyle's law, Charles' law, Combined gas law, Gay- Lussac's law, Ideal gas constant, Ideal gas law, Molar volume

Kenai Peninsula Borough School District
Science; Chemistry
Unit 9: Solutions, acids and bases

Pacing:

NGSS Standards:

HS-PS1-1.	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]
HS-PS1-2.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]
HS-PS1-3.	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure*.]
HS-PS1-4.	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.[Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*]
HS-PS1-5.	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.[Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [*Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*]

HS-PS1-6.	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*[Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]
HS-PS1.7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]
HS-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).]
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 migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]
HS-ESS3-3.	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.[Clarification

	Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

ELA/LITERACY :	
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*
RST.11-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. *(HS-ESS3-5)*
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. *(HS-ESS3-5)*
WHST.9-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. (HS-ESS3-1)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),*(HS-PS1-6)*
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning,

	and evidence and to add interest. *(HS-PS1-4)*
Mathematics -	
MP.2	Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7) (HS-ESS3-1) In grades 9-12 mathematically proficient students will: • decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols. • reflect during the manipulation process in order to probe into the meanings for the symbols involved • create a coherent representation of the problem • make sense of quantities and their relationships in problem situations • attend to the meanings of quantities • use flexibility with different properties of operations and objects • translate an algebraic problem to a real world context • explain the relationship between the symbolic abstraction and the context of the problem • compute using different properties • consider the quantitative values, including units, for the numbers in a problem
MP.4	Model with mathematics. *(HS-PS1-4),*(HS-ESS3-1) In grades 9-12 mathematically proficient students will: • apply mathematics to solve problems in everyday life, society, and workplace • identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas • consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense • apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later • make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised • identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas • analyze quantitative relationships to draw conclusions • improve the model if it has not served its purpose
HSN-Q. 1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),(HS-PS1-5)*,(HS-PS1-7), (HS-ESS3-1) (HS-ESS3-3)
HSN-Q. 2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7)*,(HS-PS1-8)

HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7(HS-ESS3-1)*

HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-ESS3-1),(HS-ESS3-4),*(HS-ESS3-5),(HS-ESS3-6)

Essential Questions:
Describe the characteristics of a solution and identify the various types.
What is solubility? Describe two factors that affect solubility.
Distinguish between a dilute solution and a concentrated solution.
Compare and contrast five quantitative ways to describe the composition of solutions.
Explain the nature of colligative properties.
Describe four colligative properties of solutions.
Distinguish between suspensions and colloids.
Compare the properties of acidic solutions and basic solutions.
How do the concentrations of hydrogen ion and hydroxide ion determine the acidity of a solution?
Identify the acid- base pairs based on the following equations …….
What is the relationship between PpH and the concentration of hydrogen ions?
If you know the pOH of a solution how do you determine the pH?
Write the formula equation and net ionic equation for the neutralization reaction between hydroiodic acid and potassium hydroxide.
Explain the difference between equivalence p[point and end point.

Big Ideas:
What are solutions?
Every substance has a characteristic solubility in a given solvent.
Henry's Law.
Solution concentration based on mass, volume percentage, molarity, molality and mole fraction.
Colligative properties of solutions.
Differences between solutions, colloids and suspensions.
Definition of acid and base based on the Arrhenius and Bronsted- Lowry models.
Strength of acids and bases
Determination of pH and pOH mathematically and in the lab.
Neutralization reactions and their products.

Vocabulary: Boiling point elevations**,** Colligative property**,** Colloid**,** Concentration**,** Freezing point depression**,** Heat of solution**,** Henry's law**,** Immiscible**,** Insoluble**,** Miscible**,** Molarity
Molality, Mole fraction, Saturated solution, Solubility, Soluble, Solvation, Supersaturated solution, Suspension, Unsaturated solution, Vapor pressure lowering, Acid base indicator, Acidic solution, Amphoteric, Arrhenius model, Basic solutions, Bronsted- Lowry model, Buffer, Conjugate acid and base, End point, Neutralization reaction, pH, pOH, Salt, Titration

Kenai Peninsula Borough School District
Science: Chemistry
Unit 10: Redox reactions and electrochemistry

Pacing:
NGSS Standards:

HS-PS1-1.	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]
HS-PS1-2.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]
HS-PS1-3.	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.[Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*]
HS-PS1-4.	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.[Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [*Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*]
HS-PS1-5.	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.[Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [*Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*]

HS-PS1-6.	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*[Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [*Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*]
HS-PS1.7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.[Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [*Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.*]
HS-PS3-3.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*[Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [*Assessment Boundary: Assessment for quantitative evaluations is limited to total output for a given input. Assessment is limited to devices constructed with materials provided to students.*]

ELA/LITERACY -	
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or

	mathematically (e.g., in an equation) into words. *(HS-PS1-1)*
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),*(HS-PS1-6)*
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)*
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS1-4)(HS-PS3-1)(HS-PS3-3)*
Mathematics -	
MP.2	Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7) (HS-PS3-1)(HS-PS3-3) In grades 9-12 mathematically proficient students will: • decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols. • reflect during the manipulation process in order to probe into the meanings for the symbols involved • create a coherent representation of the problem • make sense of quantities and their relationships in problem situations • attend to the meanings of quantities • use flexibility with different properties of operations and objects • translate an algebraic problem to a real world context • explain the relationship between the symbolic abstraction and the context of the problem • compute using different properties • consider the quantitative values, including units, for the numbers in a problem
MP.4	Model with mathematics. *(HS-PS1-4)* (HS-PS3-1)(HS-PS3-3) In grades 9-12 mathematically proficient students will: • apply mathematics to solve problems in everyday life, society, and workplace • identify important quantities in a practical situation and map the relationships

	using such tools as diagrams, two-way tables, graphs, flowcharts and formulas • consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense • apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later • make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised • identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas • analyze quantitative relationships to draw conclusions • improve the model if it has not served its purpose
HSN-Q. 1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),(HS-PS1-5)*,(HS-PS1-7), (HS-PS3-1)(HS-PS3-3)
HSN-Q. 2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7)* (HS-PS3-1)(HS-PS3-3)
HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7)* (HS-PS3-1)(HS-PS3-3)

Essential Questions:

Describe the process of oxidation and reduction.

Explain the role of oxidizing agents and reducing agents in a redox reaction. How is each changed in the reaction?

Determine the oxidation numbers in the following compounds ……

Balance the following equations using the oxidation number method …….

Balance the following equations using the half reaction method …….

Under what conditions can a redox reaction be used to cause an electric current to flow through a wire?

What are the components of a voltaic cell? What is the role of each component?

Explain how primary and secondary batteries differ and give an example of each type.

Define electrolysis and relate the definition to the spontaneity of redox reactions.

Big Ideas:

An oxidation reductions (redox) reaction is an chemical reaction in which electrons are transferred from one atom to another.

The oxidation- number method can used to balance more difficult redox reactions.
The oxidation reduction processes of a redox reaction can be represented by half reactions.
Definition of voltaic ell
Types of batteries and their uses
Electrolysis and electroplating.

Vocabulary: Half reaction**,** Oxidation**,** Oxidation-number method**,** Oxidation reduction reaction Oxidizing agent, Redox reaction, Reducing agent, Reduction, Species, Anode, Battery, Cathode Corrosion, Dry cell, Electrochemical cell, Electrolysis, Electrolytic cell, Fuel cell, Reduction potential, Salt bridge, Standard hydrogen electrode, Voltaic cell

Kenai Peninsula Borough School District
Science: Chemistry
Unit 11: Hydrocarbons (organic chemistry)

Pacing:
NGSS Standards:
HS-LS1-6,7
HS-ES2-6

HS-PS1-1.	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]
HS-PS1-2.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]
HS-PS1-7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.]
HS-LS1-6.	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.[Clarification Statement: Emphasis is on using evidence from models and simulations to

	support explanations.] [*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*]
HS-LS1-7.	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [*Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.*]
HS-ESS2-6.	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.[Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]

ELA/LITERACY -	
RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. *(HS-PS1-1)*
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5)(HS-LS1-6)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),*(HS-PS1-5)* (HS-LS1-6)

WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),*(HS-PS1-6)*
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS1-3)* (HS-LS1-6)
MATHEMATIC STANDARD	
MP.2	Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7)(*HS-ES2-6)*
MP.4	Model with mathematics. *(HS-PS1-4),(HS-PS1-8) (HS-ES2-6)*
HSN-Q.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),*(HS-PS1-3),(HS-PS1-4),(HS-PS1-5)*,(HS-PS1-7), *(HS-ES2-6)*
HSN-Q.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),*(HS-PS1-7), (HS-ES2-6)*
HSN-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-ES2-6)*

Essential Questions

Use the IUPAC rules to name the following structures ……..

Given the IUPAC names draw the hydrocarbons …….

In what major way do the chemical properties of alkenes, alkanes and alkynes differ?

List the different types of isomers and explain their differences.

Draw all the structural isomers pliable of octane.

Explain how the physical properties of hydrocarbons make fractional distillation possible.

What is the purpose of cracking hydrocarbons?

Draw the structures for the following molecules …….
Name the functional group present in each of the following molecules ……
What are the products of the condensation reaction between a carboxylic acid and an alcohol?
Classify each of the following reactions as substitution, elimination, addition or condensation ……
Draw the structure of the polymer made from each of these monomers…….

Big Ideas:
Naming and properties of hydrocarbons (alkanes, alkenes, alkynes, cyclic etc.)
Isomers of hydrocarbons
Aromatic hydrocarbons and petroleum
Naming and properties of functional groups (alcohol, ketone, amides, amines, carboxyl esters, ethers etc.)
Reactions of organic compounds
Uses of polymers and their properites.

Vocabulary:, Alkane**,** Alkene**,** Alkyne**,** Aromatic**,** Chirality**,** Cracking**,** Cyclic hydrocarbon**,** Cycloalkane**,** Fractional distillation**,** Geometric isomer**,** Homologous series**,** Hydrocarbon**,** Isomer**,** Optical isomer**,** Organic compound**,** Parent chain**,** Saturated hydrocarbon**,** Stereoisomer**,** Structural isomer**,** Substituent group**,** Unsaturated hydrocarbon**,** Addition polymerization**,** Alcohol**,** Aldehyde**,** Alkyl halide**,** Amide Amine, Aryl halide, Condensation polymerization, Carbonyl, Carboxyl, Dehydration reaction, Dehydrogenation reaction, Elimination reaction, Ester, Ether, Functional group, Halocarbon, Halogenation, Hydration reaction, Hydrogenation reaction, Hydroxyl, Ketone, Monomer, Plastic Polymer, Polymerization, Substitution

Kenai Peninsula Borough School District
Science: Chemistry
Unit 12: Nuclear chemistry

Pacing:
NGSS Standards:

HS-PS1-1.	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.[Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [*Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*]
HS-PS1-2.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.[Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [*Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.*]
HS-PS1-7.	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.[Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [*Assessment Boundary: Assessment does not include complex chemical reactions.*]
HS-PS1-8.	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.[Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [*Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.*]

HS-PS3-3.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*[Clarification Statement: Emphasis is on both qualitative and quantitative evaluations of devices. Examples of devices could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and generators. Examples of constraints could include use of renewable energy forms and efficiency.] [*Assessment Boundary: Assessment for quantitative evaluations is limited to total*

	output for a given input. Assessment is limited to devices constructed with materials provided to students.]
HS-PS4-4.	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.[Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [*Assessment Boundary: Assessment is limited to qualitative descriptions.*]
ELA/LITERACY -	
RST.11-12.1 **RST.11-12.8** **WHST.9-12.2** **WHST.9-12.5**	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. *(HS-PS3-4)* Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-PS4-4) Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2) Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. *(HS-PS3-3) (HS-PS3-4)*

WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS4-4)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-PS3-4),(HS-PS3-5)*
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS3-1),*
MATHEMATICS STANDARDS	
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS3-1)
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-1),(HS-PS3-3)
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-1)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. *(HS-PS3-3)*
MP.2	Reason abstractly and quantitatively. HS-PS3-3)(HS-PS1-7)
MP.4	Model with mathematics. (HS-PS3-3) (HS-PS1-8)
HSN.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS3-3) (HS-PS1-2) (HS-PS1-7),(HS-PS1-8)
HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-3) (HS-PS1-7),(HS-PS1-8)
HSN.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-3) (HS-PS1-2)(HS-PS1-7),(HS-PS1-8)

Essential Questions:

Describe the contributions of Roentgen, Becquerel, Rutherford and Curies to the field of nuclear chemistry.

What subatomic particles are involved in nuclear reactions?

Qualitatively compare and contrast alpha, beta and gamma radiation in terms of composition, energy, mass and penetrating power.
Write the nuclear equation for the alpha decay of astatine – 213.
Describe the process of transmutation. Give two examples.
Compare and contrast fission and fusion reactions in terms of the particles involved and the changes they undergo.
Describe the process that occurs during a nuclear chain reaction.
Explain how a nuclear power works.
Describe several methods used to detect and measure radiation.
Explain one way in which nuclear chemistry is used to diagnose or treat disease.

Big Ideas:
History of nuclear radiation
Radioactive decay equations
The conversion of an atom of one element into an atom by another element by radioactive decay is transmutation.
A half-life is the time required for half the atoms in a radioactive sample to decay.
Difference between fission and fusion.
Applications and effects of nuclear reactions.

Vocabulary: Band of stability, Breeder reactor, Critical mass, Electron capture, Half life, Induced transmutation, Ionizing radiation, Mass defect, Nuclear fission, Nuclear fusion, Nucleon, Position, Radioactive decay, Radioisotope, Transmutations, Trans-uranium element, Gamma ray, Alpha particle, Beta particle