Title: Soil, Rocks, and Landforms **Grade: 4th Grade**

Length: 30 Days

Enduring Understandings:

- Soils can be described by their properties and are composed of different kinds and amounts of earth materials and humus.
- Weathering (physical and chemical) is the breakdown of rocks and minerals at or near Earth's surface.
- Weathered rock material can be reshaped into new landforms by the slow processes of erosion and deposition.
- Fossils provide evidence of organisms that lived long ago as well as clues to changes in the landscape and past environments
- A topographic map uses contour lines to show the shape and elevation of the land.
- Catastrophic events have the potential to change Earth's surface quickly.
- Natural resources are natural materials taken from the environment and used by humans.
- Some natural resources are renewable (sunlight, air and wind, water, soil, plants, and animals) and some are nonrenewable (minerals and fossil fuels).
- Alternative sources of energy include solar, wind, and geothermal energy.

Standards to be addressed: NGSS, CCSS ELA, CCSS Math

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.*

CCSS.ELA-LITERACY.RI.4.1
CCSS.ELA-LITERACY.RI.4.2
CCSS.ELA-LITERACY.RI.4.3
CCSS.ELA-LITERACY.RI.4.4
CCSS.ELA-LITERACY.RI.4.5
CCSS.ELA-LITERACY.RI.4.6
CCSS.ELA-LITERACY.RI.4.7
CCSS.ELA-LITERACY.RI.4.8
CCSS.ELA-LITERACY.RI.4.9
CCSS.ELA-LITERACY.RI.4.10
CCSS.ELA-LITERACY.RF.4.4
CCSS.ELA-LITERACY.W.4.1
CCSS.ELA-LITERACY.W.4.1.A
CCSS.ELA-LITERACY.W.4.1.B
CCSS.ELA-LITERACY.W.4.1.C
CCSS.ELA-LITERACY.W.4.1.D
CCSS.ELA-LITERACY.W.4.2
CCSS.ELA-LITERACY.W.4.2.A
CCSS.ELA-LITERACY.W.4.2.B
CCSS.ELA-LITERACY.W.4.2.C
CCSS.ELA-LITERACY.W.4.2.D
CCSS.ELA-LITERACY.W.4.2.E
CCSS.ELA-LITERACY.W.4.3.C
CCSS.ELA-LITERACY.W.4.3.E
CCSS.ELA-LITERACY.W.4.4
CCSS.ELA-LITERACY.W.4.5

	CCSS.ELA-LITERACY.W.4.6 **CCSS.ELA-LITERACY.W.4.7** **CCSS.ELA-LITERACY.W.4.8** **CCSS.ELA-LITERACY.W.4.9** **CCSS.ELA-LITERACY.W.4.9.B** **CCSS.ELA-LITERACY.W.4.10** **CCSS.MATH.CONTENT.4.OA.C.5** **CCSS.MATH.CONTENT.4.MD.B.4**

Essential Questions:

What provocative questions will foster inquiry, understanding, and transfer learning? What questions can you use to connect this unit to Cross-Cutting Concepts?

Investigation 1:

- What is soil?
- What causes big rocks to break down into smaller rocks?
- How are rocks affected by acid rain?
- What's in our schoolyard soils?

Investigation 2:

- How do weathered rock pieces move from one place to another?
- How does slope affect erosion and deposition?
- How do floods affect erosion and deposition?
- Where are erosion and deposition happening in our schoolyard?
- How do fossils get in rocks and what can they tell us about the past?

Investigation 3:

- How can we represent the different elevations of landforms?
- How can we draw a profile of a mountain from a topographic map?
- How can scientists and engineers help reduce the impacts that events like volcanic eruptions might have on people?
- What events can change Earth's surface quickly?

Investigation 4:

- What are natural resources and what is important to know about them?
- How are natural resources used to make concrete?
- How do people use natural resources to make or build things?

Disciplinary Core Ideas:	**Scientific & Engineering Practices:**	**Crosscutting Concepts:**
Investigation 1: ESS2.A: Earth materials and	**Investigation 1:** ● Asking questions	**Investigation 1:** ● Patterns

systems ESS2.E: Biogeology **<u>Investigation 2:</u>** ESS1.C: The history of planet Earth ESS2.A: Earth materials and systems ESS2.B: Plate tectonics and large-scale system interactions **<u>Investigation 3</u>**: ESS1.C: The history of planet Earth ESS2.A: Earth materials and systems ESS2.B: Plate tectonics and large-scale system interactions ESS3.B: Natural hazards E TS1.B: Developing possible solutions **<u>Investigation 4:</u>** ESS3.B: Natural resources ETS1.A: Defining and delimiting engineering problems	● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data ● Constructing explanations ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information **<u>Investigation 2:</u>** ● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data • ● Constructing explanations ● Obtaining, evaluating, and communicating information **<u>Investigation 3:</u>** ● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data ● Using mathematics and computational thinking	● Cause and effect ● Systems and system models **<u>Investigation 2:</u>** ● Patterns ● Cause and effect ● Scale, proportion, and quantity ● Systems and system models ● Stability and change **<u>Investigation 3</u>**: ● Patterns ● Cause and effect ● Scale, proportion, and quantity ● Stability and change **<u>Investigation 4:</u>** ● Scale, proportion, and quantity ● Structure and function

	● Constructing explanations ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information **<u>Investigation 4:</u>** ● Planning and carrying out investigations ● Constructing explanations and designing solutions ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	

Big Ideas-I want students to understand:

What scientific explanations and/or models are critical for student understanding of the content?
So what? Who cares?
What is the most important for students to understand about this topic?

<u>Investigation 1:</u>

- Soils can be described by their properties.
- Soils are composed of different kinds and amounts of earth materials and humus.
- Weathering is the breakdown of rocks and minerals at or near Earth's surface.
- The physical-weathering processes of abrasion and freezing break rocks and minerals into smaller pieces.
- Chemical weathering occurs when exposure to water and air changes rocks and minerals into something new.

<u>Investigation 2:</u>

- Weathered rock material can be reshaped into new landforms by the slow processes of erosion and deposition.
- Erosion is the transport (movement) of weathered rock material (sediments) by moving water or wind.
- Deposition is the settling of sediments when the speed of moving water or wind declines.
- The rate and volume of erosion relate directly to the amount of energy in moving water or wind.
- The energy of moving water depends on the mass of water in motion and its velocity. The greater the mass and velocity, the greater the energy.
- Fossils provide evidence of organisms that lived long ago as well as clues to changes in the landscape and past environments

<u>Investigation 3</u>:

- A topographic map uses contour lines to show the shape and elevation of the land.
- The change in elevation between two adjacent contour lines is always uniform. The closer the contour lines, the steeper the slope and vice versa.
- A profile is a side view or cross-section representation of a landform, and can be derived from the information on a topographic map.
- The surface of Earth is constantly changing; sometimes those changes take a long time to occur and sometimes they happen rapidly.
- Catastrophic events have the potential to change Earth's surface quickly.
- Scientists and engineers can do things to reduce the impacts of natural Earth processes on humans.

<u>Investigation 4:</u>

- Natural resources are natural materials taken from the environment and used by humans.
- Rocks and minerals are natural resources important for shelter and transportation.
- Concrete is an important building material made from earth materials (limestone to make cement, sand and gravel for aggregates, and water for mixing).
- Some natural resources are renewable (sunlight, air and wind, water, soil, plants, and animals) and some are nonrenewable (minerals and fossil fuels).
- Alternative sources of energy include solar, wind, and geothermal energy.
- Scientists and engineers work together to improve the use of natural resources to make them more durable and useful.

Do-I want students to be able to:

What scientific practices will we explicitly focus on in this unit?
What key knowledge and skills will students develop as a result of this unit?

(Use verb phrases)

Investigation 1:

- Investigate properties of soil by comparing four different soils.
- Examine soils and how they are composed of essentially the same types of materials (inorganic earth materials and humus), but the amounts of the materials vary.
- Explore how rocks break into smaller pieces through physical and chemical weathering.

Investigation 2:

- Investigate stream-table models to observe that water moves earth materials from one location to another.
- Investigate the variables of slope and water quantity and plan and conduct their own stream-table investigations. Students look for evidence of erosion and deposition outdoors.
- Explore what happens to sediments over long periods of time as sediments layer on top of each other.
- Examine the different processes that can result in fossils and how fossils provide evidence of life and landscapes from the ancient past

Investigation 3:

- Build a model of a landform to study topography.
- Use a model of Mount Shasta to create a topographic map, and use this map to produce another representation of the landforms— a profile of the mountain.
- Analyze the impact of the Mount St. Helens eruption.
- Explore the processes that cause rapid changes to Earth's surface: landslides, earthquakes, floods, and volcanoes

Investigation 4:

- Explore how earth materials are renewable and nonrenewable natural resources.
- Identify the importance of earth materials as resources.

Know-What are the basics?:

What vocabulary formations or other facts do students need to know in order to understand the big ideas?

Investigation 1:

Abrasion, Acid rain, Basalt, Calcite, Chemical reaction, Chemical weathering, Clay, Conglomerate, Earth material, Expand, Freeze, Granite, Gravel, Humus, Limestone, Marble, Model, Pebble, Physical weathering, Rock, Sand, Sandstone, Silt, Soil, System, Weathering

Investigation 2:
Alluvial fan, Basin, Canyon, Cast, Delta, Deposition, Erosion, Flood, Floodplain, Fossil, Imprint, Landform, Meander, Mold, Mountain, Petrification, Preserved remains, River channel, River mouth, Sediment, Sedimentary rock, Slope, Superposition, Valley

Investigation 3:
Contour, interval, Contour line, Crust, Earthquake, Elevation, Landslide, Lava, Magma, Mantle, Profile, Satellite cone, Sea level, Topographic map, Volcano

Investigation 4:
Aggregate, Cement, Concrete, Fossil fuel, Geothermal power, Natural resource, Nonrenewable resource, Renewable resource, Solar energy, Wind power

How do I reinforce or build literacy or mathematics skills?

Literacy:
Reading skills supported through reading the science resources book: reading fluency, reading comprehension, determining main ideas, integrating information from multiple texts, drawing evidence from informational texts, determining the meaning of domain specific vocabulary.

Writing skills supported through writing in the science notebooks: produce clear and coherent writing ,gather relevant information, recall relevant information from experiences, take notes, draw evidence from informational texts

Mathematics:
Creating tables and graphs
Using metric measurements
Using critical and higher order thinking to solve problems
Measurement and Scale

Assessment: How will I know what students have learned?

Performance Expectations:
Does the formative or summative assessment require students to show their understanding in an observable way?
Does it make students' thinking visible?
Are there criteria and are the criteria relevant to the big ideas for the unit?

Other evidence:
Include multiple types of learning to give a more accurate picture of learning.

Embedded Formative Assessments for all Investigations:

- Survey prior to starting module
- Science notebook entries
- Response sheets
- Performance Assessments
- Class discussions
- Reflections

Summative Assessments:

- I-Check after each investigation:
- Post-test after all investigations are completed

Investigation 1: Soils and Weathering

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What is soil?
- Benchmark Assessment : Survey

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What causes big rocks to break down into smaller rocks?
- Embedded Assessment: Response Sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How are rocks affected by acid rain?
- Benchmark Assessment :Performance Assessment

Part 4:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What's in our schoolyard soils?
- Benchmark Assessment : Investigation 1 I-Check

<u>Investigation 2:</u> Landforms

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How do weathered rock pieces move from one place to another?

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - How does slope affect erosion and deposition?
    - How do floods affect erosion and deposition?
- Embedded Assessment: Performance Assessment

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - Where are erosion and deposition happening in our schoolyard?
- Embedded Assessment: Response Sheet

Part 4:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How do fossils get in rocks and what can they tell us about the past?
- Embedded Assessment: Response sheet
- Benchmark Assessment : Investigation 2 I-Check

<u>Investigation 3:</u> Mapping Earth's Surface

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can we represent the different elevations of landforms?

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can we draw the profile of a mountain from a topographic map?
- Embedded Assessment: Response sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can scientists and engineers help reduce the impacts that events like volcanic eruptions might have on people?
- Embedded Assessment: Performance Assessment

Part 4:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What events can change Earth's surface quickly?
- Embedded Assessment: Response sheet
- Benchmark Assessment : Investigation 3 I-Check

<u>Investigation 4:</u> Natural Resources

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What are natural resources and what is important to know about them?
- Embedded Assessment: Response Sheet

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How are natural resources used to make concrete?

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How do people use natural resources to make or build things?
- Embedded Assessment: Performance Assessment
- Benchmark Assessment : Post-Test

What some ways we could possibly differentiate instruction to reach all learners?

How shall we teach for understanding?
Incorporate different learning styles as well hands-on and engaging activities?

Graphic organizers
Provide students with tools for discovering vocabulary
Online activities
Written directions
Small group instruction
Visual cues to assist with organizing science notebook
Specific roles for group work
Sentence starters for answering focus questions
Shared slides and documents on Google
Leveled readings
Student choice for how they receive information or show their learning

Differentiated Resources

Title: Environments **Grade: 4**

Length: 30 days

Enduring Understandings:

- An environment is everything living and nonliving that surrounds and influences an organism.
- A relationship exists between environmental factors and how well organisms grow.
- Animals have structures and behaviors that function to support survival, growth, and reproduction.
- Every organism has a set of preferred environmental conditions
- The interaction of organisms with one another and with the nonliving environment is an ecosystem. Organisms may compete for resources in an ecosystem.
- Organisms have sensory systems to gather information about their environment and act on

Standards to be addressed: NGSS, CCSS ELA, CCSS Math

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

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.

CCSS.ELA-LITERACY.RI.4.1

it. ● When environments change, some plants and animals survive and reproduce; others move to new locations; and some die. ● Adaptations are structures and behaviors of an organism that help it survive and reproduce. ● Fossils are important evidence about extinct organisms and past environments	**CCSS.ELA-LITERACY.RI.4.2** **CCSS.ELA-LITERACY.RI.4.3** **CCSS.ELA-LITERACY.RI.4.4** **CCSS.ELA-LITERACY.RI.4.5** **CCSS.ELA-LITERACY.RI.4.6** **CCSS.ELA-LITERACY.RI.4.7** **CCSS.ELA-LITERACY.RI.4.8** **CCSS.ELA-LITERACY.RI.4.9** **CCSS.ELA-LITERACY.RI.4.10** **CCSS.ELA-LITERACY.RF.4.4** **CCSS.ELA-LITERACY.W.4.1** **CCSS.ELA-LITERACY.W.4.1.A** **CCSS.ELA-LITERACY.W.4.1.B** **CCSS.ELA-LITERACY.W.4.1.C** **CCSS.ELA-LITERACY.W.4.1.D** **CCSS.ELA-LITERACY.W.4.2** **CCSS.ELA-LITERACY.W.4.2.A** **CCSS.ELA-LITERACY.W.4.2.B** **CCSS.ELA-LITERACY.W.4.2.C** **CCSS.ELA-LITERACY.W.4.2.D** **CCSS.ELA-LITERACY.W.4.2.E** **CCSS.ELA-LITERACY.W.4.3.A** **CCSS.ELA-LITERACY.W.4.3.C** **CCSS.ELA-LITERACY.W.4.3.D** **CCSS.ELA-LITERACY.W.4.3.** **CCSS.ELA-LITERACY.W.4.4** **CCSS.ELA-LITERACY.W.4.5** **CCSS.ELA-LITERACY.W.4.6** **CCSS.ELA-LITERACY.W.4.7** **CCSS.ELA-LITERACY.W.4.8** **CCSS.ELA-LITERACY.W.4.9** **CCSS.ELA-LITERACY.W.4.9.B** **CCSS.ELA-LITERACY.W.4.10** **CCSS.MATH.CONTENT.4.OA.C.5** **CCSS.MATH.CONTENT.4.MD.B.4**

Essential Questions:

What provocative questions will foster inquiry, understanding, and transfer learning? What questions can you use to connect this unit to Cross-Cutting Concepts?

Investigation 1:

- How do mealworm structures and behaviors help them grow and survive?
- What moisture conditions do isopods prefer?
- What light conditions do isopods prefer?
- What are the characteristics of animals living in the leaf-litter environment?

Investigation 2:

- What are the environmental factors in an aquatic system?
- What are the roles of organisms in a food chain?

- How does food affect a population in its home range?
- How do animals use their sense of hearing?

Investigation 3:
- How can we find out if salinity affects brine shrimp hatching?
- How does salinity affect the hatching of brine shrimp eggs?
- Does changing the environment allow the brine shrimp eggs to hatch?
- What are some benefits of having variation within a population?

Investigation 4
- How much water is needed for early growth of different kinds of plants?
- What is the salt tolerance of several common farm crops?
- How does mapping the plants in the schoolyard help us to investigate environmental factors?
- What are some examples of plant adaptations?

Disciplinary Core Ideas:	**Scientific & Engineering Practices:**	**Crosscutting Concepts:**
Investigation 1: LS1.A: Structure and function LS1.D: Information processing LS2.C: Ecosystem dynamics, functioning, and resilience LS4.D: Biodiversity and humans **Investigation 2:** LS1.A: Structure and function. LS1.D: Information processing LS2.C: Ecosystem dynamics, functioning, and resilience LS4.D: Biodiversity and humans **Investigation 3**: LS1.A: Structure and function LS2.C: Ecosystem dynamics, functioning, and resilience LS4.B: Natural selection	**Investigation 1:** • Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations • Obtaining, evaluating, and communicating information **Investigation 2:** • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information **Investigation 3:**	**Investigation 1:** • Cause and effect • Systems and system models • Structure and function **Investigation 2:** • Systems and system models • Energy and matter • Stability and change **Investigation 3**: • Cause and effect • Scale, proportion, and quantity • Systems and system models **Investigation 4** • Patterns • Cause and effect • Structure and function

LS4.D: Biodiversity and humans ESS3.A: Natural resources **<u>Investigation 4</u>** LS1.A: Structure and function LS2.C: Ecosystem dynamics, functioning, and resilience LS4.D: Evidence of common ancestry and diversity LS4.B: Natural selection LS4.D: Biodiversity and humans	• Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information **<u>Investigation 4</u>** • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	

Big Ideas-I want students to understand:

What scientific explanations and/or models are critical for student understanding of the content?
So what? Who cares?
What is the most important for students to understand about this topic?

<u>Investigation 1:</u>

- An environment is everything living and nonliving that surrounds and influences an organism.
- A relationship exists between environmental factors and how well organisms grow.
- Animals have structures and behaviors that function to support survival, growth, and reproduction.
- Every organism has a set of preferred environmental conditions

<u>Investigation 2:</u>

- Aquatic environments include living and nonliving factors (water and

temperature).
- The interaction of organisms with one another and with the nonliving environment is an ecosystem. Organisms may compete for resources in an ecosystem.
- Organisms interact in feeding relationships in ecosystems (food chains and food webs).
- Producers (plants, algae, phytoplankton) make their own food, which is also used by animals (consumers).
- Decomposers eat dead plant and animal materials and recycle the nutrients in the system.
- Organisms have sensory systems to gather information about their environment and act on it.

Investigation 3:
- Organisms have ranges of tolerance for environmental factors. Within a range of tolerance, there are optimum conditions that produce maximum reproduction and growth.
- Brine shrimp eggs can hatch in a range of salt concentrations, but more hatch in environments with optimum salt concentration.
- When environments change, some plants and animals survive and reproduce; others move to new locations; and some die.
- Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

Investigation 4
- Organisms have ranges of tolerance for environmental factors. Within a range of tolerance, there are optimum conditions that produce maximum growth.
- Organisms have specific requirements for successful growth, development, and reproduction. A relationship exists between environmental factors and how well organisms grow.
- Adaptations are structures and behaviors of an organism that help it survive and reproduce.
- Fossils are important evidence about extinct organisms and past environments

Do-I want students to be able to:

What scientific practices will we explicitly focus on in this unit?
What key knowledge and skills will students develop as a result of this unit?
(Use verb phrases)

Investigation 1:
- Observe and describe the living and nonliving components (biotic and abiotic

factors) in terrestrial environments.
- Observe life cycles over time.
- Set up isopod environment and investigate how isopods respond to environmental factors.
- Investigate small animals that live in leaf-litter and study their structures.

Investigation 2:
- Set up a freshwater aquarium with different kinds of fish, plants, and other organisms
- Monitor environments the environmental factors in a system and look for feeding interactions among populations
- Examine the role of producers, consumers, and decomposers in food chains and food webs in terrestrial and aquatic systems, including a marine ecosystem.
- Explore how animals receive information from their environment through their sensory system and use information to guide their actions.

Investigation 3:
- Conduct a controlled experiment to determine which of four salt concentrations allow brine shrimp eggs to hatch.
- Determine the range of tolerance and optimum condition for brine shrimp to hatch.

Investigation 4:
- Set up and monitor experiments to determine the range of tolerance for germination of 4 kinds of seeds: corn, pea, barley, and radish.
- Test the effect of salinity on seeds.
- Examine plant adaptations and study local plants

Know-What are the basics?:

What vocabulary formations or other facts do students need to know in order to understand the big ideas?

Investigation 1:
Adult, Antennae, Behavior, Condition, Darkling beetle, Environment, Environmental factor, Function, Inference, Isopod, Larva, Life cycle, Living, Mealworm, Molting, Nonliving, Observation, Organism, Pill bug, Preferred environment, Pupa, Pupate, Sow, bug, Stage, Structure

Investigation 2:
Algae, Aquarium, Aquatic environment, Carnivore, Carrying capacity, Competition, Consumer, Decomposer, Ecosystem, Elodea, Energy, Food chain, Food web, Freshwater environment, Herbivore, Home range, Interaction, Microorganism, Omnivore, Phytoplankton, Population, Predator, Prey, Producer, Zooplankton

Investigation 3:

Brine, Brine shrimp, Concentration, Controlled experiment, Inherited trait, Migrate, Optimum, Range of tolerance, Reproduce, Salinity, Salt lake, Survive, Thrive, Tolerance, Variation, Viable

<u>Investigation 4</u>:

Adaptation, Dominant plant, Drought, Irrigate, Plant distribution, Salt-sensitive, Salt-tolerant

How do I reinforce or build literacy or mathematics skills?

<u>Literacy:</u>

Reading skills supported through reading the science resources book: reading fluency, reading comprehension, determining main ideas, integrating information from multiple texts, drawing evidence from informational texts, determining the meaning of domain specific vocabulary.

Writing skills supported through writing in the science notebooks: produce clear and coherent writing ,gather relevant information, recall relevant information from experiences, take notes, draw evidence from informational texts

<u>Mathematics:</u>

Creating tables and graphs
Using metric measurements
Using critical and higher order thinking to solve problems

Assessment: How will I know what students have learned?

<u>Performance Expectations:</u>
Does the formative or summative assessment require students to show their understanding in an observable way?
Does it make students' thinking visible?
Are there criteria and are the criteria relevant to the big ideas for the unit?

<u>Other evidence:</u>
Include multiple types of learning to give a more accurate picture of learning.

Embedded Formative Assessments for all Investigations:

- Survey prior to starting module
- Science notebook entries
- Response sheets
- Performance Assessments
- Class discussions
- Reflections

Summative Assessments:

- I-Check after each investigation:
- Post-test after all investigations are completed

<u>Investigation 1:</u> Environmental Factors

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How do mealworm structures and behaviors help them grow and survive?
- Benchmark Assessment : Survey

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - What moisture conditions do isopods prefer?
    - What light conditions do isopods prefer?
- Embedded Assessment: Response Sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What are the characteristics of animals living in the leaf-litter environment?
- Benchmark Assessment : Investigation 1 I-Check

<u>Investigation 2:</u> Ecosystems

Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What are the environmental factors in an aquatic system?

Part 2:

- Student notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - What are the roles of organisms in a food chain?
- Embedded Assessment: Response Sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How does food affect a population in its home range?

Part 4:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How do animals use their sense of hearing?
- Embedded Assessment: Response sheet
- Benchmark Assessment : Investigation 2 I-Check

<u>Investigation 3:</u> Brine Shrimp Hatching
Part 1:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can we find out if salinity affects brine shrimp hatching?
- Embedded Assessment: Performance Assessment

Part 2:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How does salinity affect the hatching of brine shrimp eggs?

Part 3:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - Does changing the environment allow the brine shrimp eggs to hatch?
- Embedded Assessment: Response sheet

Part 4:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What are some benefits of having variation within a population?
- Embedded Assessment: Response sheet
- Benchmark Assessment : Investigation 3 I-Check

<u>Investigation 4:</u> Range of Tolerance
Part 1:

- Student notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - How much water is needed for early growth of different kinds of plants?
    - What is the salt tolerance of several common farm crops?
- Embedded Assessment: Performance Assessment

Part 2:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How does mapping the plants in the schoolyard help us to investigate environmental factors?
- Embedded Assessment: Response Sheet

Part 3:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What are some examples of plant adaptations?
- Benchmark Assessment : Post-Test

What some ways we could possibly differentiate instruction to reach all learners?

How shall we teach for understanding?
Incorporate different learning styles as well hands-on and engaging activities?

Graphic organizers
Provide students with tools for discovering vocabulary
Online activities
Written directions
Small group instruction
Visual cues to assist with organizing science notebook
Specific roles for group work
Sentence starters for answering focus questions
Shared slides and documents on Google
Leveled readings
Student choice for how they receive information or show their learning

Title: Energy **Grade: 4**

Length: 30 Days

Enduring Understandings:

- Energy is evident whenever there is motion, electric current, sound, light, or heat. Energy can transfer from place to place.
- An electric circuit is a system that includes a complete pathway through which electric current flows from an energy source to its components.
- Magnets interact with each other and with some materials.
- Magnets stick to (attract) objects that contain iron. Iron is the only common metal that sticks to magnets.
- The magnetic force acting between magnets declines as the distance between them increases.
- Earth has a magnetic field
- The amount of electric current flowing in an electromagnet circuit affects the strength of the magnetism in the core (more current = stronger magnetism).
- Energy is evident whenever there is motion, electric current, sound, light, or heat. Energy can be transferred from place to place.
- Objects in motion have energy. The faster a given object is moving, the more kinetic energy it has.
- When objects collide, energy can transfer from one object to another, thereby changing their motion.
- Waves are a repeating pattern of motion that transfer energy from place to place.
- Matter can absorb light.

Standards to be addressed: NGSS, CCSS ELA, CCSS Math

4-PS3-1.
Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-2.
Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-3.
Ask questions and predict outcomes about the changes in energy that occur when objects collide.
[Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.]
4-PS3-4.
Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*
4-ESS3-1.
Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
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-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*

CCSS.ELA-LITERACY.RI.4.1
CCSS.ELA-LITERACY.RI.4.2
CCSS.ELA-LITERACY.RI.4.3
CCSS.ELA-LITERACY.RI.4.4
CCSS.ELA-LITERACY.RI.4.5
CCSS.ELA-LITERACY.RI.4.6
CCSS.ELA-LITERACY.RI.4.7
CCSS.ELA-LITERACY.RI.4.8
CCSS.ELA-LITERACY.RI.4.9
CCSS.ELA-LITERACY.RI.4.10
CCSS.ELA-LITERACY.RF.4.4
CCSS.ELA-LITERACY.W.4.1

	CCSS.ELA-LITERACY.W.4.1.A **CCSS.ELA-LITERACY.W.4.1.B** **CCSS.ELA-LITERACY.W.4.1.C** **CCSS.ELA-LITERACY.W.4.1.D** **CCSS.ELA-LITERACY.W.4.2** **CCSS.ELA-LITERACY.W.4.2.A** **CCSS.ELA-LITERACY.W.4.2.B** **CCSS.ELA-LITERACY.W.4.2.C** **CCSS.ELA-LITERACY.W.4.2.D** **CCSS.ELA-LITERACY.W.4.2.E** **CCSS.ELA-LITERACY.W.4.3.C** **CCSS.ELA-LITERACY.W.4.3.E** **CCSS.ELA-LITERACY.W.4.4** **CCSS.ELA-LITERACY.W.4.5** **CCSS.ELA-LITERACY.W.4.6** **CCSS.ELA-LITERACY.W.4.7** **CCSS.ELA-LITERACY.W.4.8** **CCSS.ELA-LITERACY.W.4.9** **CCSS.ELA-LITERACY.W.4.9.B** **CCSS.ELA-LITERACY.W.4.10** **CCSS.MATH.CONTENT.4.OA.C.5** **CCSS.MATH.CONTENT.4.MD.B.4**

Essential Questions:

What provocative questions will foster inquiry, understanding, and transfer learning? What questions can you use to connect this unit to Cross-Cutting Concepts?

Investigation 1:

- What is needed to light a bulb?
- What is needed to make a complete pathway for current to flow in a circuit?
- How can you light two bulbs brightly with one D-cell?
- Which design is better for manufacturing long strings of lights—series or parallel?

Investigation 2:

- What materials sticks to magnets?
- What happens when two or more magnets interact?
- What happens when a piece of iron comes close to or touches a permanent magnet?
- What happens to the force of attraction between two magnets as the distance between them changes?

Investigation 3:

- How can you turn a steel rivet into a magnet that turns on and off?
- How does the number of winds of wire around a core affect the strength of the magnetism?
- How can you reinvent the telegraph using your knowledge of energy and electromagnetism?

Investigation 4:

- What do we observe that provides evidence that energy is present?
- How does the starting position affect the speed of a ball rolling down a ramp?
- What happens when objects collide?

<u>Investigation 5</u>:

- How are waves involved in energy transfer?
- How does light travel?
- How can you make a motor run faster using solar cells?

Disciplinary Core Ideas:	**Scientific & Engineering Practices:**	**Crosscutting Concepts:**
<u>Investigation 1:</u> **PS3.A:** Definitions of energy energy and energy transfer **PS3.D:** Energy in chemical processes and everyday life **ETS1.A:** Defining and delimiting engineering problems **ETS1.B:** Developing possible solutions **ETS1.C:** Optimizing the design solution **<u>Investigation 2:</u>** **PS2.B:** Types of interactions **PS3.B:** Conservation of energy and energy transfer **PS3.D:** Energy in chemical processes and everyday life **<u>Investigation 3</u>:** PS2.B: Types of interactions **<u>Investigation 4</u>**: PS3.A: Definitions of energy **<u>Investigation 5</u>**: ETS1.A: Defining and delimiting engineering problems	**<u>Investigation 1-5</u>** ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. ● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. ● Make predictions about what would happen if a variable changes. ● Represent data in tables and/or various graphical displays to reveal patterns that indicate relationships. ● Analyze and interpret data to make sense of phenomena using logical reasoning. ● Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. ● Use data to evaluate and refine design solutions. ● Use evidence (e.g., observations, patterns) to support an explanation.	**<u>Investigation 1:</u>** Cause and effect Systems and system models Energy and Matter **<u>Investigation 2:</u>** Patterns Cause and effect Energy and matter **<u>Investigation 3</u>**: Patterns Cause and effect Systems and system models Energy and matter **<u>Investigation 4</u>**: Patterns Cause and effect Systems and system models Energy and matter **<u>Investigation 5</u>**: Patterns Cause and effect Systems and system models Energy and matter

	● Identify the evidence that supports particular points in an explanation. ● Apply scientific ideas to solve design problems. ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. ● Construct and/or support an argument with evidence, data, and/or models. ● Obtain and combine information from books and other reliable media to explain phenomena. ● Communicate scientific information orally and/or in written formats.	

Big Ideas-I want students to understand:

What scientific explanations and/or models are critical for student understanding of the content?
So what? Who cares?
What is the most important for students to understand about this topic?

Investigation 1:

- Energy is evident whenever there is motion, electric current, sound, light, or heat. Energy can transfer from place to place.
- An electric circuit is a system that includes a complete pathway through which electric current flows from an energy source to its components.
- Conductors are materials through which electric current can flow; all metals are conductors.
- In a series circuit, there is a single pathway from the energy source to the components; in a parallel circuit, each component has its own direct pathway to the energy source.
- The energy of two energy sources (D-cells or solar cells) adds when they are wired in series, delivering more power than a single source. Two cells in parallel have the same power as a single cell.

Investigation 2:

- Magnets interact with each other and with some materials.
- Magnets stick to (attract) objects that contain iron. Iron is the only common metal that sticks to magnets.

- All magnets have two poles, a north pole at one end (side) and a south pole at the other end (side). Like poles of magnets repel each other, and opposite poles attract.
- Magnets are surrounded by an invisible magnetic field, which acts through space and through most materials.
- When an iron object enters a magnetic field, the field induces magnetism in the iron object, and the object becomes a temporary magnet.
- The magnetic force acting between magnets declines as the distance between them increases.
- Earth has a magnetic field

Investigation 3:

- A magnetic field surrounds a wire through which electric current is flowing.
- The magnetic field produced by a current-carrying wire can induce magnetism in a piece of iron or steel.
- An electromagnet is made by sending electric current through an insulated wire wrapped around an iron core.
- The number of winds of wire in an electromagnet coil affects the strength of the magnetism induced in the core (more winds = more magnetism).
- The amount of electric current flowing in an electromagnet circuit affects the strength of the magnetism in the core (more current = stronger magnetism).
- A telegraph system is an electromagnet- based technology used for long-distance communication.

Investigation 4:

- Energy is evident whenever there is motion, electric current, sound, light, or heat. Energy can be transferred from place to place.
- Objects in motion have energy. The faster a given object is moving, the more kinetic energy it has.
- When objects collide, energy can transfer from one object to another, thereby changing their motion.
- Kinetic energy is energy of motion; potential energy is energy of position. For identical objects at rest, the objects at higher heights have more potential energy than the objects at lower heights.

Investigation 5:

- Waves are a repeating pattern of motion that transfer energy from place to place. Some electromagnetic waves can be detected by humans (light); others can be detected by designed technologies (radio waves, cell phones).
- There are sound waves, light waves, radio waves, microwaves, and ocean waves.
- Waves have properties—amplitude, wavelength, and frequency.
- Light travels in straight lines and can reflect (bounce) off surfaces.
- Light can refract (change direction) when it passes from one transparent material into another.

- Matter can absorb light.
- An object is seen only when light from that object enters and is detected by an eye.
- White light is a mixture of all colors (wavelengths) of visible light.
- Solar cells are designed technologies to transfer visible light into electricity.
- The energy of two energy sources (D-cells or solar cells) adds when they are wired in series, delivering more power than a single source.
- Two cells in parallel have the same power as a single cell

Do-I want students to be able to:

What scientific practices will we explicitly focus on in this unit?
What key knowledge and skills will students develop as a result of this unit?
(Use verb phrases)

<u>Investigation 1:</u>

- Investigate electric current and circuits, the pathways through which electricity flows.
- Work with a variety of components—D-cells, lightbulbs, motors, switches, and wires—and explore conductors and insulators. They explore series and parallel circuits and compare the functioning of the components in each circuit
- Formulate and justify their predictions, based on their observations of electricity transferring energy to produce light and motion.

<u>Investigation 2:</u>

- Investigate the properties of magnets and their interactions with materials and each other
- Conduct an investigation to determine if like or opposite poles of a magnet attract
- Construct a simple compass and use it to detect magnetic effects
- Discover that magnetism can be induced in a piece of iron
- Investigate the strength of the force of attraction between two magnets by graphing data to look for patterns of interaction
-

<u>Investigation 3</u>:

- Explore using electricity to make an electromagnet
- Explore the variables that influence the strength of the magnetism produced by their electromagnets
- Use all the concepts they have learned to engineer a simple telegraph system and communicate using a click code.

<u>Investigation 4</u>:

- Observe energy transfer that results in heat, light, sound, and motion and they are introduced to sources of energy and components that store energy
- Conduct structured investigations with steel balls and ramps to discover how the variable of starting position on the ramp affects the speed of the rolling ball

- Test the variables of mass and release position to find out how these variables affect energy transfer.

<u>Investigation 5</u>:

- Experience waves through firsthand experiences using ropes, demonstrations with waves in water, spring toys, and a sound generator
- Use videos, animations, and readings to gather information
- Design series and parallel solar cell circuits and observe the effect on the speed of a motor
- Observe that cells in series make the motor run faster, but cells in parallel do not deliver additional power to the motor
- Read about alternative energy sources

Know-What are the basics?:

What vocabulary formations or other facts do students need to know in order to understand the big ideas?

<u>Investigation 1:</u>
Battery, Bulb base, Bulb casing, Circuit, Closed circuit, Component, Conductor, Contact point, D-cell, Electric current, Electricity, Energy, Energy source, Filament, Insulator, Light, Lightbulb, Metal, Motion, Motor, Open circuit, Parallel circuit, Series circuit, Shaft, Short circuit, Switch, System, Terminal, Transfer, Wire

<u>Investigation 2:</u>
Attract, Compass, Force, Gravity, Induced magnetism, Interact, Iron, Magnet, Magnetic field, Magnetism, North pole, Opposite Permanent magnet, Pole, Repel, South pole, Steel, Temporary magnet

<u>Investigation 3</u>:
Code, Coil, Core, Electromagnet, Electromagnetism, Key, Rivet, Telegraph

<u>Investigation 4</u>:
Collide, Collision, Friction, Fuel, Heat, Kinetic energy, Potential energy, Sound, Stationary, Transfer of energy

<u>Investigation 5</u>:
Amplitude, Compression, Cycle, Frequency, Mirror, Peak, Ray, Reflect, Reflection, Refract, Refraction, Solar cell, Trough, Wave, Wavelength

How do I reinforce or build literacy or mathematics skills?

<u>Literacy:</u>
Reading skills supported through reading the science resources book: reading fluency,

reading comprehension, determining main ideas, integrating information from multiple texts, drawing evidence from informational texts, determining the meaning of domain specific vocabulary.

Writing skills supported through writing in the science notebooks: produce clear and coherent writing ,gather relevant information, recall relevant information from experiences, take notes, draw evidence from informational texts

Mathematics:
Creating tables and graphs
Using metric measurements
Using critical and higher order thinking to solve problems

Assessment: How will I know what students have learned?

Performance Expectations:
Does the formative or summative assessment require students to show their understanding in an observable way?
Does it make students' thinking visible?
Are there criteria and are the criteria relevant to the big ideas for the unit?

Other evidence:
Include multiple types of learning to give a more accurate picture of learning.

Embedded Formative Assessments for all Investigations:
- Survey prior to starting module
- Science notebook entries
- Response sheets
- Performance Assessments
- Class discussions
- Reflections

Summative Assessments:
- I-Check after each investigation:
- Post-test after all investigations are completed

Investigation 1: Energy and Circuits
Part 1:
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What is needed to light a bulb?
- Benchmark Assessment : Survey
- Embedded Assessment: Science notebook entry

Part 2:

- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - What is needed to make a complete pathway for current to flow in a circuit?
- Embedded Assessment: Science notebook entry

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can you light two bulbs brightly with one D-cell?
- Embedded Assessment: Response Sheet

Part 4:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - Which design is better for manufacturing long strings of lights—series or parallel?
- Embedded Assessment: Performance assessment
- Benchmark Assessment : Investigation 1 I-Chack

<u>Investigation 2: The Force of Magnetism</u>

Part 1:

- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What materials stick to magnets?
- Embedded Assessment: Science notebook entry

Part 2:

- Science notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - What happens when two or more magnets interact?
    - What happens when a piece of iron comes close to or touches a permanent magnet?
- Embedded Assessment: Response sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What happens to the force of attraction between two magnets as the

distance between them changes?
- Embedded Assessment: Performance assessment
- Benchmark Assessment: Investigation 2 I-Check

<u>Investigation 3: Electromagnets</u>

Part 1:
- Science notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can you turn a steel rivet into a magnet that turns on and off?
- Embedded Assessment: Response sheet

Part 2:
- Science notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - How does the number of winds of wire around a core affect the strength of the magnetism?
- Embedded Assessment: Performance assessment

Part 3:
- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can you reinvent the telegraph using your knowledge of energy and electromagnetism?
- Embedded Assessment: Science notebook entry
- Benchmark Assessment: Investigation 3 I-Check

<u>Investigation 4: Energy Transfer</u>

Part 1:
- Science notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What do we observe that provides evidence that energy is present?
- Embedded Assessment: Performance assessment

Part 2:
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - How does the starting position affect the speed of a ball rolling down a ramp?
- Embedded Assessment: Science notebook entry

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - What happens when objects collide?
- Embedded Assessment: Response sheet
- Benchmark Assessment: Investigation 4 I-Check

<u>Investigation 5: Waves</u>

Part 1:

- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How are waves involved in energy transfer?
- Embedded Assessment: Science notebook entry

Part 2:

- Science notebook entry
- Student participation and discussion
- Student response to the focus questions, using evidence from investigations:
    - How does light travel?
- Embedded Assessment: Response sheet

Part 3:

- Student notebook entry
- Student participation and discussion
- Student response to the focus question, using evidence from investigations:
    - How can you make a motor run faster using solar cells?
- Embedded Assessment: Performance assessment
- Benchmark Assessment: Post-test

What some ways we could possibly differentiate instruction to reach all learners?

How shall we teach for understanding?
Incorporate different learning styles as well hands-on and engaging activities?

Graphic organizers
Provide students with tools for discovering vocabulary
Online activities
Written directions
Small group instruction
Visual cues to assist with organizing science notebook
Specific roles for group work
Sentence starters for answering focus questions
Shared slides and documents on Google

Leveled readings
Student choice for how they receive information or show their learning

Differentiated Resources