K-5 Elementary Science Curriculum

East Penn School District

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Committee Members:

Name	Position	School
Karen Gennaro	Grade K	Lincoln Elementary School
MaryAnne Stella	Grade K	Alburtis Elementary School
Patrice Arnold	Grade 1	Shoemaker Elementary School
Stephanie Yoder	Grade 1	Macungie Elementary School
Krista Glick	Grade 2	Shoemaker Elementary School
Tanya Hacker	Grade 2	Jefferson Elementary School
Doug Barndt	Grade 3	Lincoln Elementary School
Samantha Moyer	Grade 3	Wescosville Elementary School
Robyn Healy	Grade 4	Wescosville Elementary School
Cynthia Hynes	Grade 4	Jefferson Elementary School
Amanda Huebner	Grade 5	Alburtis Elementary School
Ryan Peters	Grade 5	Willow Lane Elementary School
Michael Mauro	Grade 5/Science Leader	Wescosville Elementary School
Michele James	Supervisor of Curriculum & Instruction	Administrative Offices

Science and Engineering Practices

A Framework for K–12 Science Education (National Research Council, 2012) describes eight science and engineering practices as essential elements of a K–12 science and engineering curriculum. These practices are integrated into the K-5 curriculum and are identified throughout the curriculum as standards beginning with "ETS" (Engineering, Science, Technology Standards).

1. **Asking questions and defining problems**
    - Ask questions that can be investigated based on patterns such as cause-and-effect relationships.
    - Define a simple design problem that can be solved through the development of a new or improved object or tool.

2. **Developing and using models**
    - Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
    - Develop and/or use models to describe phenomena.
    - Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.
    - Use a model to test cause-and-effect relationships or interactions concerning the functioning of a natural system.

3. **Planning and carrying out investigations**
    - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
    - 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.

4. **Analyzing and interpreting data**
    - 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 claims about cause and effect.

5. **Using mathematics and computational thinking**
    - Describe, measure, estimate, and/or graph quantities such as weight to address scientific and engineering questions.

6. **Constructing explanations and designing solutions**
    - Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
    - 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.

7. **Engaging in argument from evidence**
    - Construct an argument with evidence, data, and/or models.
    - Use data to evaluate claims about cause and effect.

8. **Obtaining, evaluating, and communicating information**
    - Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.
    - Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.
    - Communicate scientific and/or technical information orally and/or in written formats, including various forms of media, such as tables, diagrams, and charts.

Useful Links

Next Generation Science Standards

How to Read the Standards

Next Generation Science Standards K-2 Parent Guide

Next Generation Science Standards 3-5 Parent Guide

East Penn School District-Elementary Science Curriculum
Grade K Trees and Weather

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.A: Structure and function
• All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and see, find, and take in food, water, and air. Plants also have different parts that help them survive, grow, and produce more plants.

LS1.C: Organization for matter and energy flow in organisms
• All animals need food in order to live grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

ESS2.D: Weather and Climate
• Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.

ESS2.E: Biogeology
• Plants and animals (including humans) depend on the land, water, and air to live and grow. They in turn can change their environment (e.g., the shape of land, the flow of water).

ESS3.A: Natural resources
• Living things need water, air, and resources from the land, and they try to live in places that have the things they need. Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans.

ESS3.B: Natural hazards
• Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that communities can prepare for and respond to these events.

PS3.B: Conservation of energy and energy transfer
• Sunlight warms Earth's surface.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. To design something complicated, one may need to break the problem into parts and attend to each part separately but must then bring the parts together to test the overall plan.

Big Ideas/Transfer

- The Earth is a complex and dynamic set of interconnected systems that interact over a wide range of temporal and spatial scales.
- The Earth's surface processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- How and why is the Earth constantly changing?
- How do Earth's processes and human activities affect each other?

Knowledge
Students will know...

•Weather is the condition of the air outside; weather changes.

• Temperature is how hot or cold it is, and can be measured with a thermometer.

• Wind is moving air; wind socks indicate direction and speed.

• Each season has typical weather conditions that can be observed, compared, and predicted.

• Trees change through the seasons.

• The Sun warms Earth's surface.

• Trees are living plants and have structures.

• Plants have basic needs—water, light, nutrients, and space.

• Trees go through predictable stages through the seasons as the weather changes.

• A habitat is a place where animals live and their needs are met.
• There are many different kinds of habitats.

• Animals eat plants and other animals.

• Living things can survive only where their needs are met.

• Plants can change their environment.

Skills
Students will do (Science & Engineering Practices)

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

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

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

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

K–2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

East Penn School District-Elementary Science Curriculum
Grade K Materials and Motion

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS1.A: Structure and properties of matter
• Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties, by its uses, and by whether it occurs naturally or is manufactured. Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces. Objects or samples of a substance can be weighed, and their size can be described and measured.

PS2.A: Forces and motion
• Objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. An object sliding on a surface or sitting on a slope experiences a pull due to friction on the object due to the surface that opposes the object's motion.

PS2.B: Types of interactions
• When objects touch or collide, they push on one another and can change motion or shape.

PS3.B: Conservation of energy and energy transfer
• Sunlight warms Earth's surface.

PS3.C: Relationship between energy and forces
• A bigger push or pull makes things go faster. Faster speeds during a collision can cause a bigger change in shape of the colliding objects; secondary to K-PS2-1.

ESS3.A: Natural resources
• Living things need water, air, and resources from the land, and they try to live in places that have the things they need. Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans.

ESS3.C: Human impacts on Earth systems
• Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things—for example, by reducing trash through reuse and recycling.

ETS1.A: Defining and delimiting an engineering problem
• A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem.

ETS1. B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. To design something complicated, one may need to break the problem into parts and attend to each part separately but must then bring the parts together to test the overall plan.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare designs, test them, and discuss their strengths and weaknesses.

Big Ideas/Transfer

- Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.
- Interactions between any two objects can cause changes in one or both.
- Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions
Students will keep considering...

- How can one explain the structure, properties, and interactions of matter?
- How can one explain and predict interactions between objects within systems?
- How is energy transferred and conserved?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Pushes and pulls can have different strengths and directions. • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. • A bigger push or pull makes things go faster. • When objects touch or collide, they push on one another and can change motion. • Sunlight warms Earth's surface. •Wood, paper, and fabric are examples of solid materials. •Solid objects are made of solid materials. •Solid objects have properties. •Wood, paper, and fabric can be changed by sanding, coloring, tearing, and so forth. •Common materials can be changed into new materials (papermaking, weaving, etc.).	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. 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-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 K–2 ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. K–2 ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K–2 ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

East Penn School District-Elementary Science Curriculum
Grade K Animals Two by Two

Stage 1 Desired Results		
NGSS Standards and Disciplinary Core Ideas **LS1.A: Structure and function** • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and see, find, and take in food, water, and air. Plants also have different parts that help them survive, grow, and produce more plants. **LS1.C: Organization for matter and energy flow in organisms** • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. **ESS2.E: Biogeology** • Plants and animals (including humans) depend on the land, water, and air to live and grow. They in turn can change their environment (e.g., the shape of land, the flow of water). **ESS3.A: Natural resources** • Living things need water, air, and resources from the land, and they try to live in places that have the things they need. Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans.	***Big Ideas/Transfer***	
	• All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	
	Essential Questions Students will keep considering...	
	• How do organisms live, grow, respond to their environment, and reproduce?	
	Knowledge Students will know...	***Skills Students will do (Science & Engineering Practices)***
	• Animals have identifiable structures and behaviors. • Animals have basic needs. Land animals need air, water, food, and space with shelter. Water animals need the appropriate kind of water, oxygen from the water, food, and space with shelter. • Adult animals and plants can have offspring. • A habitat is a place where animals live and their needs are met. There are many different kinds of habitats. • Animals eat plants and other animals. • Living things can survive only where their needs are met. • Organisms can change their environment.	K-LS1-1. 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.

East Penn School District-Elementary Science Curriculum
Grade 1 Air and Weather

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS1.A: Structure and properties of matter
• Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.

ESS1.A: The universe and its stars
• Patterns of the motion of the Sun, Moon, and stars in the sky can be observed, described, and predicted.

ESS1.B: Earth and the solar system
• Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

ESS2.D: Weather and climate
• Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (Extended from kindergarten)

PS3.B: Conservation of energy and energy transfer
• Sunlight warms Earth's surface.

ESS3.A: Natural resources
• Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

ETS1.A: Defining and delimiting engineering problems
• Before beginning to design a solution, it is important to clearly understand the problem.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solution to other people.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Big Ideas/Transfer

- The universe is composed of a variety of different objects which are organized into systems each of which develops according to accepted physical processes and laws.

Essential Questions
Students will keep considering...

- What is the universe, and what is Earth's place in it?

Knowledge
Students will know...

• Air is matter (gas) and takes up space.

• Weather describes conditions in the air outside.

• Weather conditions can be measured using tools such as thermometers, wind vanes, anemometers, and rain gauges.

• Clouds are made of liquid water drops.

• The Sun heats Earth during the day.

• Wind is moving air.

• Daily changes in temperature and weather type can be observed, compared, and predicted.

• Each season has typical weather conditions that can be compared and predicted.

• Weather affects animals and plants.
The Moon can be seen sometimes at night and sometimes during the day. It looks different every day, but looks the same again about every 4 weeks.

• There are more stars in the sky than anyone can easily see or count.

• The Sun can be seen only in the daytime.
The Sun and Moon can be observed moving across the sky; we see them at different locations in the sky, depending on the time of day or night.

• The Sun appears to rise in the east, move across the sky during the day, and set in the west.

• The hours of daylight changes with the seasons.

Skills
Students will do (Science & Engineering Practices)

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 the year to relate the amount of daylight to the time of year.

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

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.

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

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

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

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

East Penn School District-Elementary Science Curriculum
Grade 1 Sound and Light

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS4.A: Wave properties
• Sound can make matter vibrate, and vibrating matter can make sound.

PS4.B: Electromagnetic radiation
• Objects can be seen only when light is available to illuminate them. Some objects give off their own light.
• Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.

PS4.C: Information technologies and instrumentation
• People also use a variety of devices to communicate (send and receive information) over long distances.

LS1.D: Information processing
• Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive.

ETS1.A: Defining and delimiting engineering problems
• Before beginning to design a solution, it is important to clearly understand the problem.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solution to other people.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Big Ideas/Transfer

- Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.

Essential Questions
Students will keep considering...

- How are waves used to transfer energy and information?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Sound comes from vibrating objects; vibrations are rapid back-and-forth motions. • Volume is how loud or soft a sound is; loud sounds have more energy. • Large objects vibrate slowly and produce low-pitched sounds; small objects vibrate quickly and produce high-pitched sounds. • Light sources are objects or systems that radiate light; light travels away from a source in all directions. Eyes are light detectors or receivers. Objects can be seen if light is available to illuminate them or if they give off their own light. • Shadows are the dark areas that result when light is blocked. The length and direction of a shadow depends on the position of the light source. • Mirrors can be used to redirect light. • Communication devices use light and sound.	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. 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. K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

East Penn School District-Elementary Science Curriculum
Grade 1 Plants and Animals

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.A: Structure and function
• All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in good water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

LS1.B: Growth and development of organisms
• Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

LS1.D: Information processing
• Animals have body parts that capture and convey different kinds of information needed for growth and survival Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.

LS3.B: Variation of traits
• Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

LS3.A: Inheritance of traits
• Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents.

Big Ideas/Transfer

- All organisms are made of cells and can be characterized by common aspects of their structure and functioning.
- Organisms have external structures that help thems urvive, grow and meet their needs.
- Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.
- Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to their parents.

Essential Questions
Students will keep considering...
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- How do the structures of organisms enable life's functions?
- How do organisms grow and develop?
- How do organisms detect, process, and use information about the environment?
- How are the characteristics of one generation related to the previous generations?
- Why do individuals of the same species vary in how they look, function, and behave?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Plants and animals have structures and behaviors that function in growth, survival, and reproduction. • Animals have sensory structures that provide the animals with information about their surroundings. • Reproduction is essential to the continued existence of every kind of organism. New plants can grow from seeds, stems, bulbs, and roots. • Plants and animals grow and change and have predictable characteristics at different stages of development. • Adult plants and animals can have offspring. Animal parents and their young engage in survival behaviors. • Plants make their own food. Plants depend on air, water, nutrients in the soil, and light to grow. • Plants and animals are very much, but not exactly, like their parents and resemble other plants and animals of the same kind. • A habitat is a place where animals live and their needs are met. There are many different kinds of habitats.	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. K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

East Penn School District-Elementary Science Curriculum
Grade 2 Pebbles, Sand and Silt

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS1.A: Structure and properties of matter
• Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
• Different properties are suited to different purposes.
• A great variety of objects can be built up from a small set of pieces.

ESS1.C: The history of planet Earth
• Some events happen very quickly; others occur very slowly over a time period much longer than one can observe.

ESS2.A: Earth materials and systems
• Wind and water can change the shape of the land.

ESS2.B: Plate tectonics and large scale system interactions
• Maps show where things are located. One can map the shapes and kinds of land and water in any area.

ESS2.C: The roles of water in Earth's surface processes
• Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

ETS1.A: Defining and delimiting engineering problems
• Before beginning to design a solution, it is important to clearly understand the problem.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Big Ideas/Transfer

- The Earth is a complex and dynamic set of interconnected systems that interact over a side range of temporal and spatial scales.
- The Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- How and why is Earth constantly changing?
- How do Earth's processes and human activities affect each other?

Knowledge
Students will know...

• Rocks are earth materials composed of minerals; rocks can be described by their properties.

• Rock sizes include clay, silt, sand, gravel, pebbles, cobbles, and boulders.

• The properties of different earth materials (natural resources) make each suitable for specific uses.

• Natural sources of water include streams, rivers, ponds, lakes, marshes, and the ocean. Sources of water can be fresh or saltwater.

• Water can be a solid, liquid, or gas.

• Landforms and bodies of water can be represented in models and maps.

•Smaller rocks (sand) result from the breaking (weathering) of larger rocks.

• Water carries soils and rocks from one place to another—erosion.

• Some Earth events happen very quickly; others occur very slowly.

• Wind and water can change the shape of the land.

• Soil is made partly from weathered rock and partly from organic material.

• Soils vary from place to place. Soils differ in their ability to support plants.

• Earth materials are commonly used in the construction of buildings and streets.

Skills
Students will do (Science & Engineering Practices)

2-ESS1-1. Make observations from media to construct an evidence-based account 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.

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.

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

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

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

East Penn School District-Elementary Science Curriculum
Grade 2 Solid and Liquids

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">NGSS Standards and Disciplinary Core Ideas

PS1.A: Structure and properties of matter
• Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
• Different properties are suited to different purposes.
• A great variety of objects can be built up from a small set of pieces.

PS1.B: Chemical reactions
• Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

ETS1.A: Defining and delimiting engineering problems
• Before beginning to design a solution, it is important to clearly understand the problem.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</td><td colspan="2">Big Ideas/Transfer</td></tr>
<tr><td colspan="2">• Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.</td></tr>
<tr><td colspan="2">Essential Questions
Students will keep considering...</td></tr>
<tr><td colspan="2">• How can one explain the structure, properties, and interactions of matter?</td></tr>
<tr><td>Knowledge
Students will know...</td><td>Skills
Students will do (Science & Engineering Practices)</td></tr>
<tr><td>• Common matter is known to us as solid, liquid, and gas.

• Solid matter has definite shape.

• Liquid matter has definite volume but flows to fill a container to a level.

• Gas matter has neither definite shape nor definite volume and expands to fill containers.

• Intrinsic properties of matter can be used to organize objects (e.g., color, shape, etc.). Solids have properties that determine how they can be used for construction.

• Solids have properties that determine how they can be used for construction.

• Liquids have properties that determine their behavior when agitated or tipped.

• Solids interact with water in various ways: float, sink, dissolve, swell, change.

• Liquids interact with water in various ways: layer, mix, change color.

• Substances change state (e.g., melt or freeze) when heated or cooled.

• Some changes to matter due to heating are reversible and some are irreversible.</td><td>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.

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

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.</td></tr>
</table>

East Penn School District-Elementary Science Curriculum
Grade 2 Insects and Plants

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.A: Structure and function
• All organisms have external parts. Different animals use their body parts in different ways to see, hear grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems leaves, flowers, fruits) that help them survive and grow. (Extended from grade 1)

LS1.B: Growth and development of organisms
• Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (From grade 3)

LS2.A: Interdependent relationships in ecosystems
• Plants depend on water and light to grow.
• Plants depend on animals for pollination or to move their seeds around.

LS4.D: Biodiversity and humans
• There are many different kinds of living things in any area, and they exist in different places on land and in water.

ETS1.A: Defining and delimiting engineering problems
• Before beginning to design a solution, it is important to clearly understand the problem.

ETS1.B: Developing possible solutions
• Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solution to other people.

ETS1.C: Optimizing the design solution
• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Big Ideas/Transfer

- Organisms grow, reproduce, and perpetuate in their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.
- Biological evolution explains both the unity and diversity of specifies and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions
Students will keep considering...

- How and why do organisms interact with their environment and what are the effects of these interactions?
- How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Insects need air, food, water, and space including shelter, and different insects meet these needs in different ways. • Plants and insects have structures that function in growth, survival, and reproduction. • Reproduction is essential to the continued existence of every kind of organism. Organisms have diverse life cycles. • Plants and insects grow and change and have predictable characteristics at different stages of development. • Adult plants and animals can have offspring. • Bees and other insects help some plants by moving pollen from flower to flower. • Animals interact with plants using them as food. They also assist in plant reproduction through seed dispersal and pollination. • Plants depend on the environment for water and light to grow. • There are many different kinds of living things and they exist in different places on land and in water.	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. (From Grade 3) 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. K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

East Penn School District-Elementary Science Curriculum
Grade 3 Water and Climate

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

ESS3.A: Natural resources
• Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (Extended from kindergarten) ESS3.B: Natural hazards
• A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

ESS3.B: Natural Hazards
• A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1)

ESS2.C: The roles of water in Earth's surface processes
• Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (Extended from grade 2) Nearly all of Earth's available water is in the ocean. (From grade 5)

ESS2.D: Weather and climate
• Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.
• Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

ESS3.C: Human impacts on Earth systems
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (From grade 5)

PS1.A: Structures and properties of matter
• Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (Extended from grade 2)

ETS1.A: Defining and delimiting engineering problems
• Possible solutions are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B: Developing possible solutions
• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

ETS1.C: Optimizing the design solution
• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Big Ideas/Transfer

- The Earth is a complex and dynamic set of interconnected systems that interact over a wide range of temporal and spatial scales.
- The Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- How and why is the Earth constantly changing?
- How do Earth's processes and human activities affect each other?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Water is found almost everywhere on Earth (e.g., vapor, clouds, rain, snow, ice). Most of Earth's water is in the ocean. • Water expands when heated, contracts when cooled, and expands when it freezes. • Cold water is more dense than warmer water; liquid water is more dense than ice. • Scientists observe, measure, and record patterns of weather to make predictions. • Soils retain more water than rock particles alone. • Water flows downhill; the steeper the slope, the faster water moves. Flowing water can do work. • Ice melts when heated; water freezes when cooled. • The water cycle is driven by the Sun and involves evaporation, condensation, precipitation, and runoff. • High temperatures, greater surface area, and moving air (wind) increase the rate of evaporation. • Density determines whether objects float or sink in water. A material that floats in water is less dense than the water. • Climate is the range of an area's typical weather. • A variety of natural hazards result from weather-related phenomena.	3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. 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. 2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid. 2-PS1-1: Plan and conduct an investigation to describe and classify kinds of materials by their observable properties. 5-PS1-1: 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. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

East Penn School District-Elementary Science Curriculum;
Grade 3 Motion and Matter

Stage 1 Desired Results		
NGSS Standards and Disciplinary Core Ideas **PS1.A: Structures and properties of matter** • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. • Measurements of a variety of properties can be used to identify materials. **PS1.B: Chemical reactions** • When two or more different substances are mixed, a new substance with different properties may be formed. • No matter what reaction or change in properties occurs, the total weight of the substances does not change. **PS2.A: Forces and motion** • The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. **PS2.B: Types of interactions** • Objects in contact exert forces on each other. • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. **ETS1.A: Defining and delimiting engineering problems** • Possible solutions are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. **ETS1.B: Developing possible solutions** • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. **ETS1.C: Optimizing the design solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	***Big Ideas/Transfer*** ● Interactions between any two objects can cause changes in one or both. ***Essential Questions*** ***Students will keep considering...*** ● How can one explain and predict interactions between objects within systems? ***Knowledge*** ***Students will know...*** • Magnetic forces between a pair of objects do not require that the objects be in contact. The strength of the force depends on the properties of the objects and their distance apart. • How magnets interact depends on their orientation (sometimes they attract and sometimes they repel). • Gravity is the force that pulls masses toward the center of Earth. • Any change of motion requires a force. Each force has a strength and direction. • Patterns of motion can be observed; when there are regular patterns of motion, future motions can be predicted. • A wheel-and-axle system with two sizes of wheels describes a curved path. • A twirly bird is a simple winged system that spins when it interacts with air; variables affect twirler performance. • Tops exhibit rotational motion (spinning) when torque is applied to the axial shaft; variables affect top performance. Measurement can be used to confirm that the mass of the whole is equal to the mass of its parts. • A mixture is two or more intermingled substances. • A solution results when a solid material dissolves in a liquid. • Mass is conserved when objects or materials are mixed. • During chemical reactions, starting materials change into new materials.	***Skills*** ***Students will do (Science & Engineering Practices)*** 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-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. The performance expectations above were developed using the following elements

East Penn School District-Elementary Science Curriculum
Grade 3 Structures of LIfe

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.A: Structure and function
• All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (Extended from grade 1)

LS1.B: Growth and development of organisms
• Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

LS2.C: Ecosystem dynamics, functioning, and resilience
• When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

LS2.D: Social interactions and group behavior • Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

LS3.A: Inheritance of traits
• Many characteristics of organisms are inherited from their parents
• Other characteristics result from individuals' interactions with the environment. Many characteristics involve both inheritance and environment.

LS3.B: Variation of traits
• Different organisms vary in how they look and function because they have different inherited information.
• The environment also affects the traits that an organism develops.

LS4.A: Evidence of common ancestry and diversity
• Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environment

LS4.B: Natural selection
• Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

LS4.C: Adaptation
• For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

LS4.D: Biodiversity and humans
• Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Big Ideas/Transfer

- All organisms are made of cells and can be characterized by common aspects of their structure and functioning.
- Organisms grow, reproduce and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.
- Heredity refers to specifics mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to their parents.
- Biological evolution explains both the unity and diversity of species and provide a unifying principle for the history and diversity of life on Earth.

Essential Questions
Students will keep considering...

- How do organisms live, grow, respond to their environment and reproduce?
- How and why do organisms interact with their environment and what are the effects of these interactions?
- How are the characteristics of one generation passed to the next?
- How can individuals of the same species and even siblings have different characteristics?
- How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• A seed is a living organism, containing the embryo of a plant. • Plants and animals have structures that function in growth, survival, and reproduction. • Reproduction is essential to the continued existence of every kind of organism. • Organisms have diverse life cycles. • Plants and animals grow and change and have predictable characteristics at different stages of development. • Behavior of animals is influenced by internal and external cues. • Bones have several functions: support, protection, and movement. • Organisms are related in food chains. • Animals exhibit different kinds of behaviors. • Being part of a social group may help individuals in that group survive. • Different organisms can live in different environments; organisms have adaptations that allow them to survive in that environment. • Changes in an organism's habitat are sometimes beneficial to it and sometimes harmful. • Many characteristics of organisms are inherited from parents; other characteristics result from interaction with the environment. • A skeleton is a system of interacting bones. The skeletons of humans and other mammals have many similarities. • Differences in characteristics between individuals of the same species might provide advantage in surviving and reproducing. • Fossils provide evidence of organisms that lived long ago and the nature of their environments.	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. 3-LS2-1. Construct an argument that some animals form groups that help members survive. 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. 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment. 3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. 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. 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. 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.

East Penn School District-Elementary Science Curriculum
Grade 4 Soils, Rocks, and Landforms

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

ESS1.C: The history of planet Earth
• Local, regional, and global patterns of rock formations reveal changes over time due to Earth's forces such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.

ESS2.A: Earth materials and systems
• Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

ESS2.B: Plate tectonics and large-scale system interactions
• The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features of Earth.

ESS2.E: Biogeology
• Living things affect the physical characteristics of their regions.

ESS3.A: Natural resources
• Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

ESS3.B: Natural hazards
• A variety of hazards result from natural processes. Humans cannot eliminate the hazards but can take steps to reduce their impact.

ETS1.A: Defining and delimiting engineering problems
• Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B: Developing possible solutions
• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Big Ideas/Transfer

- The universe is composed of a variety of different objects, which are organized into system each of which develops according to accepted physical processes and laws.
- The Earth is a complex and dynamic set of interconnected systems that interact over a wide range of temporal and spatial scales.
- The Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- What is the universe, and what is Earth's place in it?
- How and why is Earth constantly changing?
- How do Earth's surface processes and human activities affect each other?

Knowledge
Students will know...

• Soils are composed of different kinds and amounts of earth materials and humus; they can be described by their properties.

• Water exists in three states.

• Earth materials are natural resources. Some resources are renewable, others are not.

• Humans can use scientific knowledge and engineering design to reduce the impact of Earth's hazards.

• Landforms and bodies of water can be represented in models and maps.

• Physical and chemical weathering breaks rock into smaller pieces (sediments).

• Downhill movement of water as it flows to the ocean shapes land.

• Erosion is the movement of sediments; deposition is the process by which sediments come to rest in another place.

• Sediments usually form flat, horizontal layers. Sediments turn into solid rock over time. The presence and location of certain fossil types indicate the order in which rock layers were formed.

• Landslides, earthquakes, and volcanoes can produce significant changes in landforms in a short period of time.

• Some changes to Earth's surface happen quickly, others more slowly.

• Some events happen in cycles; others have a beginning and an end.

Skills
Students will do (Science & Engineering Practices)

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-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

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

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

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

East Penn School District-Elementary Science Curriculum
Grade 4 Energy

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS2.B: Types of interactions
• Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

PS3.A: Definitions of energy
• Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of energy and energy transfer
• Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

PS3.C: Relationship between energy and forces
• When objects collide, the contact forces transfer so as to change the objects' motions.

PS3.D: Energy in chemical processes and everyday life
• The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.

PS4.A: Wave properties
• Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets the beach.
• Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

PS4.B: Electromagnetic radiation
• An object can be seen when light reflected from its surface enters the eyes.

PS4.C: Information technologies and instrumentation •
Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.

ESS3.A: Natural resources
• Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

ETS1.A: Defining and delimiting engineering problems
• Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B: Developing possible solutions
• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

ETS1.C: Optimizing the design solution
• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Big Ideas/Transfer

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- Interactions between any two objects can cause changes in one or both.
- Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.
- Waves are a repeating pattern of motion that transfer energy from place to place without overall displacement of matter.
- The Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- How can one explain and predict interactions between objects within systems?
- How is energy transferred and conserved?
- How are waves used to transfer energy and information?
- How do Earth's surface processes and human activities affect each other?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
•Magnets interact with each other and with materials that contain iron. •Like poles of magnets repel each other; opposite poles attract. The magnetic force declines as the distance between the magnets increases. •Conductors are materials through which electric current can flow; all metals are conductors. •Any change of motion requires a force. • Gravity is a pulling force that acts between all masses. • Energy is present whenever there is motion, electric current, sound, light, or heat. •Electricity (electric current) transfers energy that can produce heat, light, sound, and motion. Electricity can be produced from a variety of sources. •A circuit is a system that includes a complete pathway through which electric current flows from a source of energy to its components. •Energy can be generated by burning fossil fuels or harnessing renewable energy sources such as solar, wind, hydroelectric, and geothermal. •The faster an object is moving, the more energy it has. •Motion of one object can transfer to motion of other objects in a collision; a larger force causes a larger change. •Kinetic energy is energy of motion; potential energy is energy of position. •Waves are a repeating pattern of motion that transfer energy. •An object is seen when light from an object enters and is detected by the eye.	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. 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. 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. 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. 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

East Penn School District-Elementary Science Curriculum
Grade 4 Environments

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.A: Structure and function
• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

LS1.D: Information processing
•Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions.

LS2.C: Ecosystem dynamics, functioning, and resilience
•When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (Extended from grade 3)

LS4.B: Natural selection
• Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

LS4.D: Biodiversity and humans
•Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (Extended from grade 3)

ESS3.C: Human impacts on Earth systems
• Human activities in agriculture, industry, and everyday life have had major effects on land, vegetation, streams, oceans, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Big Ideas/Transfer

- All organisms are made of cells and can be characterized by common aspects of their structure.
- Organisms grow, reproduce and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.
- The Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- How do organisms live, grow, respond to their environment, and reproduce?
- How and why do organisms interact with their environment and what are the effects of those interactions?
- How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?
- How do Earth's surface processes and human activities affect each other?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Plants and animals have structures and behaviors that function in growth, survival, and reproduction. • Producers make their own food. • Animals obtain food from eating plants or eating other animals. • An ecosystem is the interactions of organisms with one another and the abiotic environment. • Organisms have ranges of tolerance for environmental factors. • Organisms interact in feeding relationships in ecosystems (food chains and food webs). • Individuals of the same kind differ in their characteristics; differences may give individuals an advantage in surviving and reproducing in changing environmental conditions. • Fossils provide evidence of organisms that lived long ago and the nature of their environments.	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. 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. 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. 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

East Penn School District-Elementary Science Curriculum
Grade 5 Earth and Sun

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

ESS1.A: The universe and its stars
• The Sun is a star that appears larger and brighter than other stars because it is closer.
• Stars range greatly in their size and distance from Earth.

ESS1.B: Earth and the solar system
• The orbits of Earth around the sun and of the moon around earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns– including day and night, daily changes in the length and direction of shadows, and different positions of the sun, moon, and stars at different times of the day, month, and year.
• Some objects in the solar system can be seen with the naked eye.Planets in the night sky change positions and are not always visible from Earth as they orbit the Sun. Stars appear in patterns called constellations, which can be used for navigation and appear to move together across the sky because of Earth's rotation.

ESS2.A: Earth materials and systems
• Earth's major systems are the geosphere (solid and molten rock, soil,and sediments), the hydrosphere (water and ice), the atmosphere (air),and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms,and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms,and gravity break rocks, soils,and sediments into smaller particles and move them around. Human activities affect Earth's systems and their interactions at its surface.

ESS2.C: The roles of water in Earth's surface processes
• Water is found almost everywhere on Earth: as vapor;as fog or clouds in the atmosphere;as rain or snow falling from clouds;as ice, snow,and running water on land and in the ocean;and as groundwater beneath the surface. The downhill movement of water as it flows to the ocean shapes the appearance of the land. Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands,and the atmosphere.

ESS3.C: Human impacts on Earth systems
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

PS1.A: Structure and properties of matter
• Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means.

PS2.B: Types of Interactions
• The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center

ETS1.B: Developing solutions
• Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

ETS1.C: Optimizing design solutions
• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Big Ideas/Transfer

- The universe is composed of a variety of different objects, which are organized into systems each of which develops according to accepted physical processes and laws.
- The Earth is a complex and dynamic set of interconnected systems that interact over a wide range of temporal and spatial scales.
- the Earth's processes affect and are affected by human activities.

Essential Questions
Students will keep considering...

- What is the universe, and what is the Earth's place in it?
- How and why is Earth constantly changing?
- How do Earth's processes and human activities affect each other?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Most of Earth's air resides in the troposphere, where weather happens. • Most of Earth's water is in the ocean; most of Earth's fresh water is in glaciers and underground. • Weather is described in terms of variables including temperature, humidity, precipitation, wind, and air pressure. • Scientists observe, measure, and record patterns of weather to make predictions. • The Sun is the major source of energy that heats earth. • The different energy-transferring properties of earth materials lead to uneven heating of Earth's surface and convection currents. • The water cycle is driven by the sun and involves evaporation and condensation. • Energy transfers to Earth materials by radiation, conduction, and convection. • Climate—the range of an area's typical weather conditions—is changing globally; this change will affect all life.	5-ESS1-1 Support an argument that the apparent brightness of the sun and stars is due to their relative distance 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. 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-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

East Penn School District-Elementary Science Curriculum
Grade 5 Mixtures and Solutions

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

PS1.A Structure and Properties of matter
• Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model shows that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. Measurements of a variety of properties can be used to identify materials.

PS1.B Chemical Reactions
• When two or more different substances are mixed, a new substance with different properties may be formed. Such occurrences depend on the substances and the temperature. No matter what reaction or change in properties occurs, the total weight of the substance does not change.

ETS1.A: Defining and delimiting engineering problems
• Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B: Developing possible solutions
• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

ETS1.C: Optimizing the design solution
• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Big Ideas/Transfer

- Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.
- Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions
Students will keep considering...

- How can one explain the structure, properties, and interactions of matter?
- How is energy transferred and conserved?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Solid matter can break into pieces too small to see. • Mass is conserved (not created or lost) during changes. • Properties can be used to identify substances. (eg solubility). • Relative density can be used to seriate solutions of different concentrations. • A mixture is two or more intermingled substances. • Dissolving occurs when one substance disappears in a second substance. • A chemical reaction occurs when a substance is mixed and new products result. • Melting is an interaction between one substance and heat.	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. 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

East Penn School District-Elementary Science Curriculum
Grade 5 Living Systems

Stage 1 Desired Results

NGSS Standards and Disciplinary Core Ideas

LS1.C: Organization for matter and energy flow in organisms
• Animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals; anaerobic life, such as bacteria in the gut, functions without air. Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night).

LS1.D: Information processing
• Different sense receptors are specialized for particular kinds of information, which may then be processed and integrated by an animal's brain, with some information stored as memories. Animals are able to use their perceptions and memories to guide their actions. Some responses to information are instinctive—that is, animals' brains are organized so that they do not have to think about how to respond to certain stimuli.

LS2.A: Interdependent relationships in ecosystems
• The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Either way, they are "consumers." Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil for plants to use. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

LS2.B: Cycles of matter and energy transfer in ecosystems
• Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment.

PS3.D: Energy in chemical processes and everyday life
• The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use—for example, the stored energy of water behind a dam is released so that it flows downhill and drives a turbine generator to produce electricity. Food and fuel also release energy when they are burned or digested. When machines or animals "use" energy, most often the energy ends up transferred to heat in the surrounding environment. The energy released by burning fuel or digested food was once energy from the Sun that was captured by plants. (Boundary: The fact that plants capture energy from sunlight is introduced at this level, but details of photosynthesis are not.)

ESS2.A: Earth materials and systems
• Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems, and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

ESS3.C: Human impact on Earth systems
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Big Ideas/Transfer

- All organisms are made of cells and can be characterized by common aspects of their structure and functioning.
- Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.

Essential Questions
Students will keep considering...

- How do organisms live, grow, respond to their environment, and reproduce?
- How and why do organisms interact with their environment and what are the effects of these interactions?

Knowledge *Students will know...*	*Skills* *Students will do (Science & Engineering Practices)*
• Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and to move. • Humans and other animals have systems made up of organs that are specialized for particular body functions. • Animals detect, process, and use information about their environment to survive. • Organisms obtain gases, water, and minerals from the environment and release waste matter back into the environment. • Matter cycles between air and soil, and among plants, animals, and microbes as these organisms live and die. • Organisms are related in food webs. • Some organisms, such as fungi and bacteria, break down dead organisms, operating as decomposers. • Animals exhibit instinctive behaviors and learned behaviors.	5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water. 5-LS2-1 Use a model to describe the movement of matter among plants, animals, decomposers, and the environment 5-PS31 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once from the sun. 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.