

Science Curriculum

Diocese of Spokane



2017

PHILOSOPHY

The Diocese of Spokane believes that the engagement in science and engineering practices, integrated with our Catholic faith, will foster a respect for God's creation through understanding, exploration, and application of scientific concepts.

Students will learn fundamental scientific principles by engaging in science and engineering practices and utilizing technology to become responsible and ethical stewards who contribute to our global society.

GOALS

Based on Catholic ethical and moral principles, the students will:

- Understand the scientific core ideas through the use of inquiry, exploration, and experimentation.
- Observe and gather information to develop questions about the natural and designed world.
- Collect, organize, and analyze data to draw conclusions.
- Use models to explore and communicate scientific concepts.
- Apply engineering and technology design to provide opportunities for deepening understanding of science.
- Communicate conclusions with the use of evidence.
- Integrate scientific concepts across content areas.

The Diocese of Spokane would like to thank the members of the Diocesan School Science Curriculum Committee for their expertise in formulating this document: Amanda Holland, Debbie Rizzuto, Devon Rapp, Jeanie Spiering, Jim McCollum, Karen Round, Kathy Hicks, Katie Rieckers, Molly May, Pat Mills, TJ Romano.

Science Curriculum, Diocese of Spokane 2017

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**** Engineering and Design is incorporated within all grade levels and found in bold print.**

**** Vocabulary, underlined, within the standards is the minimum expectation. Teachers are encouraged to use their primary science resource for expanded vocabulary use.**

****English Language Arts Connections: ELA and Literacy in History and Science**

(i.e.: SL: Speaking and Listening Standard; WHS: Writing, History, Science Standard)

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**** Engineering and Design is incorporated within all grade levels and found in bold print.**

**** Vocabulary, underlined, within the standards is the minimum expectation. Teachers are encouraged to use their primary science resource for expanded vocabulary use.**

****English Language Arts Connections: ELA and Literacy in History and Science
(i.e.: SL: Speaking and Listening Standard; WHS: Writing, History, Science Standard)**

Kindergarten

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

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

Kindergarten

Physical Science

Forces and Interactions: Pushes and Pulls

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that <u>motion</u> is defined as a change in position over time.</p> <p>Recognize when objects touch or collide, they push on one another and can change motion.</p> <p>Recognize <u>pushes</u> and <u>pulls</u> can have different strengths and directions.</p>	<p>Conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.</p> <p>Examples of pushes or pulls could include:</p> <ul style="list-style-type: none"> ● A string attached to an object being pulled ● A person pushing an object ● A person stopping a rolling ball ● Two objects colliding and pushing on each other <p>ELA SL.K.3</p>
<p>Recognize pushing or pulling on an object can change the <u>speed</u> or <u>direction</u> of its motion and can start or stop it.</p>	<p>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.</p> <ul style="list-style-type: none"> ● Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. ● Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn. <p>ELA SL.K.3</p>
<p>Recognize that there is a relationship between <u>energy</u> and forces (e.g, a bigger push or pull makes things speed up or slow down more quickly).</p>	<p>Design and conduct tests to gather evidence to support or refute student ideas about causes.</p> <p>Give examples of cause and effect in relationship to forces and interactions</p> <ul style="list-style-type: none"> ● The harder the ball is kicked the further it will travel <p>ELA W.K.7</p>

Kindergarten

Life Science

Interdependent Relationships in Ecosystems: Animals, Plants and Their Environment

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that all animals need food in order to live and <u>grow</u> which they obtain from plants or from other animals.</p> <p>Recognize that plants need water and light to live and grow.</p>	<p>Use observations to describe patterns of what plants and animals (including humans) need to survive.</p>
<p>Understand that plants and animals can impact their environment to meet their needs.</p>	<p>Provide an opinion supported by evidence for how animals (including humans) can impact the environment to meet their needs.</p> <ul style="list-style-type: none"> ● Squirrels dig holes for their nuts ● Tree roots break concrete <p>ELA RI 3-5 W1,4-6,7-9 SL1-2,4-6</p>
<p>Plants, animals and their surroundings make up a system.</p> <p>Understand that 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.</p>	<p>Use a model (sketch, drawing, dramatization, storyboard) to show the relationship between the needs of different plants or animals (including human).</p> <ul style="list-style-type: none"> ● Deer live in the forest to eat buds and leaves ● Grass grows in meadows to receive sunlight ● Humans use natural resources for everything they do <p>ELA W.K.1 W.K.2 SL.K.5</p>
<p>Understand people impact their environment to live comfortably and can affect the world around them.</p> <p>People can make choices that reduce their impact on the land, water, air and other living things on both local and global levels.</p>	<p>Communicate solutions that will reduce the impact of humans on the land, water, air and/or other living things in the local and global environment.</p> <ul style="list-style-type: none"> ● Turn lights out when leaving a room ● Pick up trash and don't litter ● Turn water off when done <p>ELA RI.K.1</p>

Weather and Climate

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that <u>weather</u> is the combination of sunlight, wind, snow or rain, and <u>temperature</u> in a particular region at a particular time.</p> <ul style="list-style-type: none"> ● People measure these conditions to describe and record the weather and to notice patterns over time. ● People depend on technology to predict and prepare for various weather conditions. ● Scientists look for patterns and order when making observations about the world. 	<p>Use and share observations of local weather conditions to describe patterns over time (e.g. weather and temperature varies throughout the day).</p> <ul style="list-style-type: none"> ● Compare and contrast weather conditions ● Graph weather ● Identify the four seasons <p>ELA R1.K1</p>
<p>Understand that weather conditions have various causes and effects on people, plants and animals.</p>	<p>Make observations to determine the effect of sunlight on Earth's surface (e.g. sand, soil, rocks and water).</p> <ul style="list-style-type: none"> ● Sunlight warms Earth's surface <p>Design a structure, using tools and materials that will reduce the warming effects of sunlight on an area.</p> <ul style="list-style-type: none"> ● Represented as a drawing or physical structure ● Examples may include canopies, umbrella, shade, tent
<p>Understand that some kinds of severe weather are more likely than others in a given region.</p> <p>Understand weather scientists forecast severe weather so that the communities can prepare for and respond to these events</p>	<p>Describe and share the types of inclement weather that are commonly expected in our region.</p> <ul style="list-style-type: none"> ● Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. <p>ELA W.K.7</p>

First Grade

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

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

First Grade

Physical Science

Waves: Light and Sound

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that <u>sound</u> can make matter vibrate, and vibrating matter can make sound. **introduces the concept of wave property</p>	<p>Make observations or conduct an investigation to provide evidence that vibrating materials can make sound and that sound can make material vibrate.</p> <ul style="list-style-type: none"> ● Tuning fork ● Guitar string
<p>Understand objects can be seen if <u>light</u> is available to illuminate them or if they give off their own light. **introduces the concept of electromagnetic radiation.</p>	<p>Make observations that objects can be seen only when illuminated.</p> <ul style="list-style-type: none"> ● Flashlight in a dark space or area ● Pinhole box
<p>Understand that 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. **introduces the concept of transparent, translucent, opaque</p> <p>Recognize mirrors can be used to redirect a light beam.</p>	<p>Conduct an investigation to determine the effect of placing objects made with different materials in path of a beam of light.</p> <ul style="list-style-type: none"> ● Plastic, wax paper, cardboard ● Mirror to reflect light

First Grade

Life Science

Structure, Function and Information Processing

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize 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.</p> <p>Plants have external structures that help them survive and grow (roots, stems, leaves, flowers, fruits).</p>	<p>Provide examples of how plants and animals use their unique body parts to survive in their environment.</p> <p>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.</p>

	<ul style="list-style-type: none"> ● Bike helmet mimics a turtle shell ● Camouflage clothing ● Stabilizing structure mimics legs and tails
Recognize plants and animals respond to their environment with behaviors that help them survive.	<p>Explain behaviors of animal and plant parts that help them survive.</p> <ul style="list-style-type: none"> ● Thorns on plants ● Plant's roots travel to find water source ● Porcupine quills ● Camouflage
Understand that adult plants and animals can reproduce. In many kinds of animals, parent and the offspring engage in behaviors that help the offspring survive.	<p>Communicate behavior of parents and offspring that help offspring survive.</p> <ul style="list-style-type: none"> ● Feeding chirping birds ● Marsupials in a pouch ● Some animals carry babies on backs ● Baby crying
<p>Recognize that plant and animal offspring are similar to their parents.</p> <p>Recognize individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.</p>	<p>Make observations of similarities and differences between parents (plant and animal) and their offspring(s).</p> <ul style="list-style-type: none"> ● Size and shapes of leaf ● Animal coloring evolves with maturity ● Eye and hair color ● Stages of insect growth (larval state with no wings to adult insect with wings)

First Grade

Earth Science

Space Systems: Patterns and Cycles

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
Understand patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.	<p>Use observations of the sun, moon, and stars to describe patterns that can be predicted.</p> <ul style="list-style-type: none"> ● Pattern of movement of the sun and moon ● Stars, other than the sun, are visible only at night

<p>Understand seasonal patterns of sunrise and sunset can be observed, described, and predicted.</p>	<p>Make observations at different times of year to relate the amount of daylight to the time of year.</p> <ul style="list-style-type: none">• Emphasize relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.
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Second Grade

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

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

Second Grade

Physical Science

Structure and Properties of Matter

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that <u>matter</u> can be described and classified by its observable <u>properties</u>.</p> <p>Recognize different kinds of matter can be either solid, liquid, or gas depending on temperature.</p>	<p>Conduct an investigation to describe and classify different kinds of materials by their observable properties (e.g color, texture, hardness, flexibility).</p> <p>Make an observation on state of matter of a substance (e.g ice melting, water freezing, production of steam).</p>
<p>Understand that different properties of matter are suited for different purposes.</p>	<p>Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.</p> <ul style="list-style-type: none"> ● Absorption of types of materials ● Building using appropriate materials such as bricks, blocks, and other support objects
<p>Understand heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible and sometimes they are not.</p> <p>**introduces the concept of chemical reactions</p>	<p>Construct an argument/explanation with evidence that some changes caused by heating or cooling can be reversed and some cannot.</p> <ul style="list-style-type: none"> ● Reversible changes could include butter and water at different temperatures ● Irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper <p>ELA RI 3-5 W1,4-6,7-9 SL1-2,4-6</p>

Second Grade

Life Science

Interdependent Relationships in Ecosystems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
Understand that plants depend on water and light to grow (interdependent relationships) in ecosystems.	Plan, conduct, and communicate an investigation to determine if plants need sunlight and water to grow.
Understand that plants depend on animals for pollination or to disperse their seeds.	Develop a simple model that shows how an animal can disperse seeds or pollinate plants.
Understand that there are many different kinds of living things in any area, and they exist in different places on land and in water (biodiversity and humans).	Make observations of plants and animals to compare the diversity of life in different habitats.

Second Grade

Earth Systems

Processes that Shape the Earth

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
Recognize that some events happen very quickly while others occur over a period of time.	Communicate with evidence information that Earth events can occur quickly or slowly (e.g. earthquakes and volcanoes, erosion). ELA RII-4 W 2,7-8
Describe how wind and water can change the shape of the land over time.	Compare and contrast solutions to slow or prevent wind or water from changing the shape of the land (e.g. erosion, dam). ELA RI 6
Understand that water is found in the ocean, rivers, lakes and ponds and can exist as solid ice or in liquid form.	Identify where water is found on earth in both liquid and solid form (e.g. glaciers, lakes, rivers, marshes).

Third grade

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

Third grade students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems; developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information.

Third Grade

Physical Science

Forces and Interaction

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that objects in contact exert forces on each other.</p> <p>Understand that a force acts on an object and has both strength and a direction.</p> <ul style="list-style-type: none"> • An object at rest typically has multiple forces acting on it • An <u>unbalanced</u> force will cause the object to be in motion (a push or a pull) • A <u>balanced</u> force will not produce any motion at all 	<p>Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.</p> <ul style="list-style-type: none"> • An unbalanced force on one side of a ball can make it start moving • Balanced forces pushing on a box from both sides will not produce any motion at all • Balanced forces pulling on a rope from both sides will not produce any motion at all
<p>Understand that patterns of an object’s motion in various situations can be observed and measured; the past motion exhibits a regular pattern, future motion can be predicted from it.</p>	<p>Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.</p> <ul style="list-style-type: none"> • Child swinging in a swing • A ball rolling back and forth in a bowl • Two children on a see-saw
<p>Understand that <u>electric</u> and <u>magnetic forces</u> between a pair of objects do not require that the objects be in contact.</p>	<p>Define a simple design problem by determining cause and effect relationships of electric or magnetic interaction between two objects not in contact with each other.</p> <ul style="list-style-type: none"> • Place a barrier between two magnets • Create an open circuit by removing a wire which will cause the bulb to turn off

Third Grade

Life Science

Interdependent Relationships in Ecosystems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that when the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of</p>	<p>Construct an argument with evidence that in a particular habitat some organisms can survive, relocate, and some cannot survive.</p>

<p>resources, some organisms react in three different ways:</p> <ul style="list-style-type: none"> ● <u>Adapt</u> to survive and reproduce ● Relocate to a different environment ● Don't survive 	<p>ELA RI 3-5 W1,4-6,7-9 SL1-2,4-6</p>
<p>Understand that animals work in groups or form into new groups to help obtain food, defend themselves, and cope with changes.</p>	<p>Identify animal groups in the wild and describe how they support their survival.</p>
<p>Understand that some kinds of plants and animals that once lived on Earth are no longer found anywhere (<u>extinct</u>).</p> <p>Understand <u>fossils</u> provide evidence about the types of organisms that lived long ago and also about the nature of the environments.</p>	<p>Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.</p> <ul style="list-style-type: none"> ● Marine fossils on dry land ● Tropical plant fossils found in the arctic
<p>Recognize populations live in a variety of habitats, and change in those habitats affect the organisms living there.</p>	<p>Develop an argument using evidence 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.</p> <ul style="list-style-type: none"> ● Water distribution, floods/draughts ● Temperature ● Food ● Organisms <p>ELA RI 3-5 WH1-2,7 SL1-2,4-6</p>

Third Grade

Life Science

Inheritance and Variations of Traits: Life Cycles

<p><i>Students will:</i></p>	<p><i>Students who demonstrate understanding can:</i></p>
<p>Understand reproduction is essential to the continued existence of every kind of organism.</p> <p>Understand organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.</p>	<p>Develop models to demonstrate that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.</p> <ul style="list-style-type: none"> ● Compare the life cycle of a frog to a butterfly to a mammal

	**does not include details of human reproduction.
<p>Understand many traits of organisms are <u>inherited</u> from their parents.</p> <p>The variations of inherited traits exist in a group of similar organisms. ** introduces the concept of species</p>	<p>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.</p> <ul style="list-style-type: none"> ● Emphasize organisms other than humans ● Compare and contrast different traits from one or two separate puppy litters ● Compare and contrast different trees and their traits
<p>Understand that different organisms vary in how they look and function because they have different inherited information.</p>	<p>Use evidence to support the explanation that different organisms vary because they have different inherited information.</p> <ul style="list-style-type: none"> ● Most birds have wings and fly and fish have fins and swim <p>ELA RI 1-4 WHS 1-2,4-6,8-9</p>
<p>Recognize other characteristics result from individuals' interactions with the environment, which can range from diet to learning.</p>	<p>Use evidence to support the explanation that traits can be influenced by the environment.</p> <ul style="list-style-type: none"> ● Normally plants grown with insufficient water, overcrowded, and lack of sunshine are stunted <p>ELA RI 1-4 WHS 1-2,4-6,8-9</p>
<p>Understand that in <u>Natural Selection</u>, sometimes the differences in characteristics between individuals of the same <u>species</u> provide advantages in surviving, finding mates and reproducing.</p>	<p>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.</p> <ul style="list-style-type: none"> ● Plants that have larger thorns than other plants may be less likely to be eaten by predators ● Animals that have better camouflage coloration than other animals may be more likely to survive <p>ELA RI 1-4 WHS 1-2,4-6,8-9</p>

Third Grade

Earth Space Science

Weather and Climate

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
Understand <u>climate</u> describes a range of an area’s typical weather conditions and the extent to which those conditions vary over years.	<p>Research and communicate information to describe climates in different regions.</p> <p>ELA RST1-2,7 WH1-2,7-8</p>
Recognize water can have various properties: solid, liquid, and gas. Water occurs in the air as rain, snow, hail, fog and clouds.	<p>Draw and explain the water cycle.</p> <p>Describe the various states of water on Earth as liquids, solids, and gases</p> <ul style="list-style-type: none"> ● Liquid in morning dew, rain, lakes streams, and oceans ● Solid ice at the North and South Poles, the tops of mountains and snow ● Gas as clouds and fog
Recognize 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.	<p>Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.</p> <ul style="list-style-type: none"> ● Average temperature, precipitation, wind direction
Understand that a variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.	<p>Develop an argument using evidence about the merit of a designed solution that reduces the impacts of a weather-related hazard.</p> <ul style="list-style-type: none"> ● Barriers to prevent flooding ● Wind resistant roofs ● Lightning rods <p>ELA RI 3-5 WH 1-2,7 SL1-2,4-6</p>

Fourth Grade

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

The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas.

In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information.

Energy

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that <u>energy</u> has many forms (heat, light, sound, motion, chemical and electrical).</p> <p>Understand energy can be moved from place to place by moving objects or through sound, light heat, or electric currents.</p> <p>Understand electric currents can be used to produce motion, sound, heat or light.</p>	<p>Make observations that energy can be transferred from place to place by sound, light, heat, and electric currents.</p> <ul style="list-style-type: none"> ● Sound - speech (e.g. sonar or echolocation) ● Light - plant’s growth (e.g. photosynthesis) ● Heat - cooking ● Electric - static, circuit, lightning <p>Plan and conduct an investigation or create a model for the transfer of energy from electric currents to result in light, motion, sound or heat.</p> <ul style="list-style-type: none"> ● Examples of transfer of energy could include electric circuits that convert electrical energy into light and heat.
<p>Understand energy is present whenever there are moving objects, sound, light, or heat.</p> <p>Understand that the faster a given object is moving, the more energy it possesses.</p>	<p>Use evidence to construct an explanation relating the speed of an object to the energy of that object.</p> <ul style="list-style-type: none"> ● Examples of objects include derby cars, paper airplanes, and balls. <p>ELA RI 1-4 WHS 1-2,4-6,8-9</p>
<p>Recognize when objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.</p>	<p>Predict outcomes about the changes in energy that occur when objects collide.</p> <ul style="list-style-type: none"> ● Emphasize the change in the energy due to the changes in speed. ● Examples could include a foot kicking a ball or cars colliding.
<p>Recognize the expression “produce energy” refers to the conversion of stored energy into a desired form for practical use.</p> <p>Understand that energy and fuels that humans use are derived from natural resources, and their use affects the environment in multiple ways.</p> <p>Understand that some resources are renewable over time and others are not.</p>	<p>Research and communicate how energy and fuels are derived from natural resources and their uses affect the environment.</p> <ul style="list-style-type: none"> ● Renewable resources can include wind energy, water behind dams, and sunlight ● Nonrenewable resources can include fossil fuels ● Environmental effects can include loss of habitat due to dams, surface mining,

	and air pollution from burning of fossil fuels. ELA RST1-2,7 WH1-2,7-8
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Fourth Grade

Physical Science

Waves and Information

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
Understand that waves, which are regular patterns of motion, can be made in water by disturbing the surface. Waves can make objects move.	Make observations on the patterns of motion made in water by disturbing the surface.
Understand waves of the same type can differ in the height of the wave (<u>amplitude</u>) and the spacing between wave peaks (<u>wavelength</u>).	Develop a model of waves to describe patterns in terms of amplitude and wavelength. <ul style="list-style-type: none"> ● Examples of models could be in the form of diagrams, analogies, and physical models ● Examples of models could include bendable wire to create or mold a wave ● Slinkies or jump ropes can emulate a wave ● Create waves in water and measure the height and wavelength as waves dissipate
Recognize light and sound travel as waves. Understand that an object can be seen when light reflected from its surface enters the eye.	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. <ul style="list-style-type: none"> ● Examples of models could include creating shadows or using a kaleidoscope Communicate observations of how reflected light makes objects visible.
Understand that people use light and sound devices to communicate (send and receive information) over long distances.	Make observations of light or sound devices to solve the problem of communicating over a distance. <ul style="list-style-type: none"> ● Pattern of drum beats ● Mirror as a light source to send signals
	Explain that digitized information can be

	<p>transmitted over long distances without significant degradation.</p> <ul style="list-style-type: none"> • Examples of digitized information could include: Morse code, satellite correspondence, cellphones
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Fourth Grade

Life Science

Structure, Function, and Information Processing

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that plants and animals have both internal and external structures that serve various functions in growth, survival, behavior and reproduction.</p>	<p>Defend a claim with evidence that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.</p> <ul style="list-style-type: none"> • Examples of structures include thorns, stems, roots in plants or heart, stomach, and lungs in animals • Compare and contrast animal structures which support survival <p>ELA RI 3-5,10 W1,4-6,7-9 SL1-2,4-6</p>
<p>Understand the role of human body systems that support life: Circulatory, Respiratory, Skeletal, Digestive, and Nervous (not the function of various parts of the system).</p> <p><i>** human body systems covered in depth in grade 7.</i></p>	<p>Research and communicate how a particular body system supports life.</p> <p>ELA RI2,4,6,10 W2,4-6,7-9 SL1-2,4-6</p>

Fourth Grade

Earth Space Science

Earth's Systems: Processes that Shape the Earth

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand patterns of <u>rock formations</u> reveal changes over time due to earth forces, such as earthquakes.</p>	<p>Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.</p>

<p>Understand the presence and location of certain <u>fossil</u> types indicate the order in which rock layers were formed.</p> <p>Recognize and classify the three types of rock (<u>sedimentary</u>, <u>igneous</u>, and <u>metamorphic</u>).</p> <p><i>** not including the rock cycle</i></p>	<ul style="list-style-type: none"> • Examples of evidence from patterns could include: rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; or a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cuts through the rock.
<p>Recognize water, ice, wind, living organisms, and <u>gravity</u> break rocks, soils, and sediments into smaller particles and displace them.</p> <p>Recognize the effects of <u>weathering</u> or the rate of <u>erosion</u> by water, ice, wind, or vegetation.</p>	<p>Make observations and/or take measurements to provide evidence of the effects of <u>weathering</u> or the rate of <u>erosion</u> by water, ice, wind, or vegetation.</p> <ul style="list-style-type: none"> • Examples of variables to test could include angle of slope in the downhill movement of water • Rain (<u>precipitation</u>) and wind helps to shape the land
<p>Understand the locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.</p> <p>Recognize that most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.</p> <ul style="list-style-type: none"> • Major mountain chains form inside continents or near their edges. 	<p>Analyze and interpret data from maps to describe patterns of Earth’s features and what influenced their formation.</p> <ul style="list-style-type: none"> • Example of maps should include topographical images of Earth’s land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.
<p>Understand natural disasters may impact humans.</p> <p>Recognize humans cannot eliminate the natural disaster but can take steps to reduce their impacts.</p>	<p>Research or design a solution to reduce the impact of natural disaster on humans.</p> <ul style="list-style-type: none"> • Research and communicate how engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands • Design an earthquake resistant building or a device to improve monitoring of volcanic activity <p>ELA RI2,4,6,10 W2,4-6,7-9 SL1-2,4-6</p>

Fifth Grade

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

The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas.

In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.

Fifth Grade

Physical Matter

Structure and Properties of Matter

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize all <u>matter</u> may be subdivided into particles too small to be seen, but the matter still exists and can be detected by other means.</p>	<p>Develop a physical or illustrated model showing that gases are made from matter particles too small to be seen and are moving freely around in space.</p> <ul style="list-style-type: none"> Examples of models could include the inflation and shape of a balloon and the effects of air on larger particles or objects <p>ELA RI.4,10 W2, 4-6, 7-9 SL1-2, 4-6</p>
<p>Understand that the amount (<u>weight</u>) of matter is conserved when it changes states: <u>solid</u>, <u>liquid</u>, and <u>gas</u>.</p> <p>Recognize that during a <u>chemical reaction</u>, matter is conserved.</p> <ul style="list-style-type: none"> There is the same amount of matter at the beginning of the reaction and at the end. 	<p>Measure and graph quantities to provide evidence that regardless of the type of change physical or chemical, that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.</p> <ul style="list-style-type: none"> Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water Measure weight of sugar and water individually then weigh sugar and water combined and graph results <p>ELA RI3,4,5 W2, 4-6 SL1</p>
<p>Understand that properties can be used to identify materials (e.g. color, hardness, reflectivity, electrical conductivity, response to magnetic forces, solubility).</p>	<p>Make observations to identify materials based on their properties.</p> <ul style="list-style-type: none"> Materials could include: baking soda and other powders, metals, minerals, and liquids <p>ELA RI4,10 W2, 4-6 SL1</p>
<p>Understand that when two or more different substances are mixed, a new substance with different properties may be formed.</p>	<p>Plan and conduct an investigation that uses <u>independent</u> and <u>dependent</u> variables. Draw a scientific conclusion based on evidence from the investigation.</p> <ul style="list-style-type: none"> Determine whether the mixing of two or more substances results in new substances. Identify independent variables (controlled) and which are dependent variables (not controlled) Demonstration ideas: make caramel using heat energy, burn substance to create ash particles, make ice cream, making slime <p>ELA RI3,6,7,10 SL1</p>

Matter and Energy in Organisms and Ecosystems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize <u>photosynthesis</u> is the chemical process of plants capturing energy from the sun to create food.</p> <p>Recognize that energy in animals' food was once energy from the sun (<u>respiration</u>).</p> <p>Recognize food provides animals with the energy they need for body repair, growth, warmth, and motion.</p>	<p>Use models to describe the energy cycle in animals' food was once energy from the sun.</p> <ul style="list-style-type: none"> • Examples of models include diagrams and flowcharts <p>ELA RI4 W2, 4-6, 7-9 SL1-2, 4-6</p>
<p>Understand that plants acquire their material for growth primarily from air and water.</p>	<p>Communicate how plants get the materials they need for growth chiefly from air and water.</p> <p>ELA RI2,4 W2, 4-6, 7-9 SL 4-6</p>
<p>Recognize an <u>ecosystem</u> has multiple <u>species</u> that are each able to meet their needs in a web of life.</p> <p>Understand organisms can survive only in environments in which their particular needs are met.</p> <ul style="list-style-type: none"> • Animal's food can be traced back to plants and the sun (<u>food web</u>) • <u>Decomposers</u>, such as fungi and bacteria, break down dead organisms (plants or animals) which restores (recycles) some materials back to the soil <p>Recognize newly introduced species can damage the balance of an ecosystem.</p>	<p>Develop a model or presentation to describe the movement of matter among plants, animals, decomposers, and the environment.</p> <ul style="list-style-type: none"> • Examples of presentations include: interactive, multimedia, visual, and diorama <p>ELA SL1-2, 4-6</p>
<p>Understand that matter cycles between the air, soil, and living things.</p> <ul style="list-style-type: none"> • Organisms obtain gases and water from the environment, and release waste matter (gas, liquid, or solid) back into the environment 	<p>Conduct an investigation for water cycle emphasizing the change in states in matter.</p> <p>ELA RI2,4 W2, 4-6, 7-9 SL1-2, 4-6</p>

Earth Systems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize Earth’s major systems are the <u>geosphere</u> (solid and molten rock, soil, and sediments), the <u>hydrosphere</u> (water and ice), the <u>atmosphere</u> (air), and the <u>biosphere</u> (living things, including humans).</p> <ul style="list-style-type: none"> • These systems interact in multiple ways to affect Earth’s surface materials and processes <p>Understand the ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate.</p> <p>Understand winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.</p>	<p>Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p> <p>Interactions may include (limit to two systems at a time):</p> <ul style="list-style-type: none"> • The influence of the ocean on ecosystems, landform shape, and climate • The influence of the atmosphere on landforms and ecosystems through weather and climate • The influence of mountain ranges on winds and clouds in the atmosphere <p>ELA RI4 W2, 4-6, 7-9 SL1-2, 4-6</p>
<p>Recognize nearly all of Earth’s available water is in the ocean.</p> <ul style="list-style-type: none"> • Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere 	<p>Describe and graph the amounts and percentages of water and differentiate between freshwater and saltwater.</p> <p>ELA RI2,4,6 W2, 4-6, 7-9 SL1-2, 4-6</p>
<p>Understand how human activities in agriculture, industry, and everyday life have had a major effect on the land, vegetation, streams, ocean, air, and even outer space.</p>	<p>Research and communicate information about ways individual communities use science, technology, and engineering to protect the Earth’s resources and environment.</p> <ul style="list-style-type: none"> • Present a simple design solution that is used to address protection of the Earth’ resources. The design includes specified criteria for success and constraints on materials, time, or cost. • Evaluate effectiveness of the solution, in relation to the criteria and constraints of the problem. <p>ELA RI2,4,6,10 W2, 4-6, 7-9 SL1-2,4-6</p>

Space Systems: Stars and the Solar System

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand the <u>gravitational force</u> of Earth, acting on an object near Earth’s surface pulls that object toward the planet’s center.</p>	<p>Support an argument that the gravitational force exerted by Earth on objects is directed down.</p> <p>ELA RI3,4,5,10 W1,4-6,7-9 SL1-2 4-6</p>
<p>Recognize the sun is a star that appears larger and brighter than other stars because it is closer.</p> <ul style="list-style-type: none"> ● Stars range greatly in their distance from Earth. ● Our sun is the star in our solar system. 	<p>Support a claim that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.</p> <p>ELA RI3,4,5,10 W2,4-6,7-9 SL1-2,4-6</p>
<p>Identify the planets of our solar system and recognize their placement in relationship to the sun.</p> <p>Recognize some planets have moons in their individual orbit.</p> <p><i>** will be addressed in-depth in 6th grade</i></p>	<p>Communicate an understanding of the organization of our Solar System.</p>
<p>Recognize the <u>orbits</u> of Earth around the sun, moon around Earth, Earth on an axis between its North and South poles have observable patterns and have a cause and effect relationship (<i>**not including the cause of the seasons</i>).</p> <ul style="list-style-type: none"> ● These patterns include: day and night, daily changes in the length and direction of shadows, and different positions of the sun, moon, and stars at different times of the day, month, and year 	<p>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.</p> <ul style="list-style-type: none"> ● Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular month ● Examples of graphical displays include bar graphs, pictographs, and pie charts <p>ELA W10 SL4-6</p>

Middle School (Sixth, Seventh, Eighth Grades)

<u>Physical Science</u>	<u>Life Science</u>	<u>Earth and Space Sciences</u>
<p>Students in middle school continue to develop understanding of four core ideas in the physical sciences. The performance expectations in the Physical Sciences build on the K – 5 ideas and capabilities to allow learners to explain phenomena central to the physical sciences but also to the life sciences and earth and space science. These expectations blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences. Performance expectations at the middle school level focus on students developing understanding of several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including design and evaluation.</p>	<p>Students in middle school develop understanding of key concepts to help them make sense of life science. The ideas build upon students’ science understanding from earlier grades and from the disciplinary core ideas, science and engineering practices, and crosscutting concepts of other experiences with physical and earth sciences. There are four life science disciplinary core ideas in middle school: 1) From Molecules to Organisms: Structures and Processes, 2) Ecosystems: Interactions, Energy, and Dynamics, 3) Heredity: Inheritance and Variation of Traits, 4) Biological Evolution: Unity and Diversity. The performance expectations in middle school blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge across the science disciplines. While the performance expectations in middle school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many science and engineering practices integrated in the performance expectations.</p>	<p>Students in middle school develop understanding of a wide range of topics in Earth and space science (ESS) that build upon science concepts from elementary school through more advanced content, practice, and crosscutting themes. There are six ESS standard topics in middle school: Space Systems, History of Earth, Earth’s Interior Systems, Earth’s Surface Systems, Weather and Climate, and Human Impacts. The content of the performance expectations are based on current community-based geoscience literacy efforts such as the Earth Science Literacy Principles (Wysesession et al., 2012), and is presented with a greater emphasis on an Earth Systems Science approach. The performance expectations strongly reflect the many societally relevant aspects of ESS (resources, hazards, environmental impacts) as well as related connections to engineering and technology. While the performance expectations shown in middle school ESS couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices that lead to the performance expectations.</p>

Sixth Grade

Earth and Space Sciences

Students in middle school develop understanding of a wide range of topics in Earth and space science (ESS) that build upon science concepts from elementary school through more advanced content, practice, and crosscutting themes. There are six ESS standard topics in middle school: Space Systems, History of Earth, Earth's Interior Systems, Earth's Surface Systems, Weather and Climate, and Human Impacts. The content of the performance expectations are based on current community-based geoscience literacy efforts such as the Earth Science Literacy Principles (Wyssession et al., 2012), and is presented with a greater emphasis on an Earth Systems Science approach. The performance expectations strongly reflect the many societally relevant aspects of ESS (resources, hazards, environmental impacts) as well as related connections to engineering and technology. While the performance expectations shown in middle school ESS couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many practices that lead to the performance expectations.

Space Systems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.</p> <p>Explain <u>eclipses</u> of the sun and the moon.</p> <p>Explain the <u>seasons</u> are a result of the tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.</p>	<p>Develop and use a model to describe the cyclic patterns of eclipses of the sun and moon, and seasons (model can be physical, graphical, or conceptual).</p> <p>Use the model to identify cause and effect relationships.</p> <p>ELA RS1-2, 7</p>
<p>Recognize Earth and its <u>solar system</u> are part of the Milky Way <u>galaxy</u>, which is one of many galaxies in the universe.</p> <p>Understand the solar system consists of the sun and a collection of objects, including <u>planets</u>, their <u>moons</u>, and <u>asteroids</u> that are held in orbit around the sun by its gravitational pull on them.</p> <p>Understand the solar system appears to have formed from a disk of dust and gas, drawn together by gravity.</p>	<p>Analyze and interpret data to determine scale properties of objects in the solar system.</p> <ul style="list-style-type: none"> ● Emphasize the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. ● Example of scale properties include orbital radius. ● Examples of data include statistical information, drawings and photographs, and models. <p>ELA RS2</p> <p>Develop and use a model to describe the role of gravity; as it secures placement of objects, within galaxies and the solar system.</p> <ul style="list-style-type: none"> ● Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Models should include a representation of the role of gravity. <p>ELA RS1-2, 7</p>

Sixth Grade

Earth Space Sciences

Earth Systems

<i>Students need to:</i>	<i>Students who demonstrate understanding can</i>
<p>Understand the roles of water in Earth’s Surface processes.</p> <ul style="list-style-type: none"> Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity. 	<p>Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity.</p> <ul style="list-style-type: none"> Emphasize ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical. <p>ELA RS1-2, 7</p>
<p>Understand the basic property of <u>density</u>.</p> <p>Recognize the variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.</p>	<p>Plan and conduct an investigation that uses independent and dependent variables. Draw a scientific conclusion based on evidence from the investigation.</p> <ul style="list-style-type: none"> Example of investigations include simple density. Predict that the weight of a sample of water will be nearly the same before and after it is frozen or melted. Explain why the weight will be almost the same. <p>ELA RST1-3, 8-9 WHS1-2, 4-6, 7,8,9</p>

Sixth Grade

Earth & Space Science

Weather and Climate

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand the complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, ocean temperatures and currents, are major determinants of local <u>weather patterns</u> and regional <u>climates</u>.</p>	<p>Describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine local or regional climates.</p> <ul style="list-style-type: none"> Emphasize is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasize of atmospheric circulation is on the sunlight-driven latitudinal banding. <p>ELA RS1-2, 7</p>

<p>Understand that <u>weather</u> and <u>climate</u> are:</p> <ul style="list-style-type: none"> ● Influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. ● Influenced by the interaction of <u>air masses</u> due to change in <u>air pressure</u>. Because these patterns are so complex, weather can only be predicted probabilistically. ● Affected by the ocean as it exerts a major influence by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. 	<p>Analyze data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</p> <ul style="list-style-type: none"> ● Emphasize is on how air masses flow from regions of high pressure to low pressure, causing weather at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. ● Emphasize is on how weather can be determined within predicted range. <p>ELA RS1-3, 8-9</p>
<p>Recognize the moral issues regarding science and technology are facing society today. These issues require a response in a manner consistent with the teachings of the Catholic Church.</p> <p>Understand human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming).</p> <p>Understand reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.</p>	<p>Conduct a research project to answer the question: How are human activities affecting the rising global temperatures? Utilize several sources for evidence.</p> <ul style="list-style-type: none"> ● Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). ● Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. ● Emphasis is on the major role that human activities play in causing the rise in global temperatures. <p>ELA RS1-3, 8-9 WHS1-2, 4-6, 7,8,9</p>

History of the Earth

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand <u>geoscientific</u> processes interact from local to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.</p> <ul style="list-style-type: none"> • Understand <u>Tectonic processes</u> continually generate mountains, new ocean sea floor at ridges and destroy old sea floor at trenches. 	<p>Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.</p> <ul style="list-style-type: none"> • Emphasize how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. • Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. • Emphasize geoscience processes that shape local geographic features, where appropriate. <p>ELA RS1-2,6,8,9 WHS 1-2,4-6, 8-9</p>
<p>Understand the <u>rock cycle</u> describes the formation of <u>igneous rock</u>, <u>sedimentary rock</u>, and <u>metamorphic rock</u>.</p> <p>Recognize sedimentary rock provides evidence that determines the age of Earth's changing surface and can be used to estimate the age of fossils found in the rocks.</p>	<p>Identify samples of igneous, sedimentary, and metamorphic rocks from their properties and describe how properties provide evidence of how they were formed.</p>
<p>Understand the <u>geologic time scale</u> interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the <u>fossil record</u> provide only <u>relative dates</u>, not an <u>absolute scale</u>.</p>	<p>Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.</p> <ul style="list-style-type: none"> • Emphasize how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. • Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of Homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life).

	<ul style="list-style-type: none"> • Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions. <p>ELA RS1-2,6,8,9 WHS 1-2,4-6, 8-10</p>
<p>Understand maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth’s plates have moved great distances, collided, and spread apart.</p>	<p>Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.</p> <ul style="list-style-type: none"> • Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).
<p>Understand the cause and effect relationship of water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations.</p>	<p>Plan and conduct an investigation that uses independent and dependent variables. Draw a scientific conclusion based on evidence from the investigation.</p> <ul style="list-style-type: none"> • Examples of investigation include weathering or erosion. <p>Research and communicate solutions addressing a specific weathering or erosion problem supported by multiple sources of evidence.</p> <p>ELA RST1-2,6,8,9 WHST 1-2,4-6, 8-10</p>

Seventh Grade

Life Science

Students in middle school develop understanding of key concepts to help them make sense of life science. The ideas build upon students' science understanding from earlier grades and from the disciplinary core ideas, science and engineering practices, and crosscutting concepts of other experiences with physical and earth sciences. There are four life science disciplinary core ideas in middle school: 1) From Molecules to Organisms: Structures and Processes, 2) Ecosystems: Interactions, Energy, and Dynamics, 3) Heredity: Inheritance and Variation of Traits, 4) Biological Evolution: Unity and Diversity. The performance expectations in middle school blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge across the science disciplines. While the performance expectations in middle school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many science and engineering practices integrated in the performance expectations.

Structure, Function, and Information Processing

<i>Students need to:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that all living things are made up of <u>cells</u>.</p> <p>Understand there are two types of cells, <u>prokaryotic</u> and <u>eukaryotic</u>.</p> <ul style="list-style-type: none"> • Differentiate between plant and animal cells. <p>Recognize an organism may be <u>unicellular</u> or <u>multicellular</u>.</p>	<p>Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</p> <ul style="list-style-type: none"> • Collect and share evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells. <p>ELA RST1-2,6,8,9 WHS 1-2,4-6, 8-10</p>
<p>Understand that within cells <u>organelles</u> are responsible for particular functions.</p> <p>Understand the role each of the following organelles play in the cell: <u>nucleus</u>, <u>chloroplasts</u>, <u>mitochondria</u>, <u>ribosomes</u>, and <u>golgi apparatus</u>,</p> <p>Recognize the <u>cell membrane</u> and in certain cells the <u>cell wall</u> form the boundary that controls what enters and leaves the cell.</p>	<p>Develop and use a model to describe the function of a cell as a whole and how portions of cells contribute to the function.</p> <ul style="list-style-type: none"> • Emphasize the cell functioning as a whole system and the primary role of identified parts of the cell. <p>ELA RS1-2, 7</p>
<p>Recognize most cells divide by a process called <u>mitosis</u>.</p>	<p>Design a model of mitosis.</p>
<p>Understand that in multicellular organisms, the body is a system of multiple interacting subsystems. Understand that cells form <u>tissues</u>, tissues form <u>organs</u>, organs form systems, specialized for particular body functions.</p>	<p>Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.</p> <p>ELA RS1-2 WHS2, 4-6, 8-9</p>
<p>Understand the role, function, and parts of each <u>body system</u>. (e.g. circulatory, excretory, digestive, respiratory, reproductive, and nervous system).</p> <p>Recognize lifestyle choices and living environments can damage structures at any level of organization of the human body and can significantly harm the whole organism.</p>	<p>Explore body systems through:</p> <ul style="list-style-type: none"> • dissection • virtual dissection • build model • design an organ replica <p>Share how lifestyle choices and environments affect parts of the human body and the organism as a whole in specific organ systems (e.g. tobacco, drug, alcohol use, amount of exercise, quality of air, and kinds of food).</p> <p>ELA RS1-2, 7</p>

Matter and Energy in Organisms and Ecosystems

<i>Students need to:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize energy transfers through an <u>ecosystem</u>.</p> <p>Understand plants, <u>algae</u> (including <u>phytoplankton</u>), and many microorganisms use <u>photosynthesis</u> to cycle matter which moves energy into and out of an organism.</p>	<p>Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.</p> <ul style="list-style-type: none"> ● Emphasize tracing movement of matter and flow of energy. ● Emphasize describing that molecules are broken apart and put back together and that in this process, energy is released. <p>ELA RST1-2 WHS 2,4,5,8,9</p>
<p>Recognize <u>cell respiration</u> plays a role in the cycling of matter and flow of energy through an organism.</p>	<p>Construct a scientific explanation based on evidence for the role of cell respiration in the cycling of matter and flow of energy through an organism.</p> <ul style="list-style-type: none"> ● Emphasize tracing movement of matter and flow of energy. <p>ELA RS1-2 WHS 2,4,5,8,9</p>
<p>Recognize organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.</p> <ul style="list-style-type: none"> ● Organisms may compete with each other for limited resources. ● Growth of organisms and population increases are limited by access to resources. 	<p>Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.</p> <ul style="list-style-type: none"> ● Emphasize cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources. <p>Make inferences, based upon patterns in data, about changes in populations and evaluate evidence supporting arguments about changes to ecosystems.</p> <p>ELA RS1-2 WHS2, 4-6, 8-9</p>
<p>Understand food webs within an ecosystem.</p> <p>Understand transfers of matter into and out of the physical environment occur at every level.</p>	<p>Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</p>

Recognize the matter that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem (<u>conservation of matter</u>).	ELA RS1-2, 7
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Seventh Grade

Life Science

Interdependent Relationships in Ecosystems

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand patterns of interactions of organisms with their environments, both living and nonliving.</p> <ul style="list-style-type: none"> • Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. • Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. 	<p>Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.</p> <p>ELA RS1-2 WHS 2,4,5,8,9</p>
<p>Understand the integrity of an ecosystem’s <u>biodiversity</u> is often used as a measure of its health.</p>	<p>Research and communicate a solution for maintaining biodiversity.</p> <p>ELA RS1-3, 7 WH1-2, 4-6, 7-9</p>

Seventh Grade

Life Science

Growth, Development, and Reproduction of Organisms

<i>Students need to:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.</p> <p>Recognize animals engage in characteristic behaviors that increase the odds of reproduction.</p> <p>Recognize plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.</p>	<p>Use argument based on evidence and scientific reasoning to explain how the animal behaviors and plant structures affect the probability of successful reproduction.</p> <ul style="list-style-type: none"> • Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. • Examples of animal behaviors that affect the probability of plant reproduction could

	<p>include transferring pollen or seeds, and creating conditions for seed germination and growth.</p> <ul style="list-style-type: none"> • Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury. <p>ELA RS1-2, 7 WH1-2,7</p>
<p>Understand <u>DNA</u> structure and function.</p> <p>Understand <u>genes</u> are located in the <u>chromosomes</u> of cells, with each chromosome pair containing variants of a distinct gene.</p> <p>Recognize each distinct gene controls the production of a specific <u>protein</u>, which in turn affects the traits of the individual.</p> <p>Recognize <u>mutations</u> to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. Some changes are beneficial, others harmful, and some neutral to the organism.</p>	<p>Research and communicate information on changes in DNA structure which can result in mutations.</p> <p>ELA RS1-2, 7 WH1-2,7-8</p>
<p>Recognize asexual reproduction results in offspring with identical genetic information.</p> <p>Recognize in sexually reproducing organisms, each parent contributes half of the genes acquired by the offspring.</p> <p>Understand individuals have two of each chromosome and two <u>alleles</u> of each gene, one acquired from each parent. These alleles may be identical or may differ from each other.</p> <p>Use a Punnett square to predict the outcome of a genetic cross.</p>	<p>Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.</p> <ul style="list-style-type: none"> • Examples of models include Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation. <p>ELA RS1-2, 7</p>
<p><u>Artificial selection</u> has the capacity to influence certain characteristics of organisms. One can choose desired traits determined by genes, which are then passed onto offspring.</p> <p>Moral issues regarding science and technology are</p>	<p>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms (e.g. genetically modified foods).</p>

facing society today. These issues require a response in a manner consistent with the teachings of the Catholic Church.	ELA RS1-2, 7 WH1-2,7
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Seventh Grade

Life Science

Natural Selection and Adaptations

<i>Students need to:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize the moral issues regarding science and technology are facing society today. These issues require a response in a manner consistent with the teachings of the Catholic Church.</p> <p>Recognize the evidence for evolution:</p> <ul style="list-style-type: none"> • The <u>fossil record</u> • Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. • Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. 	<p>Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth.</p> <ul style="list-style-type: none"> • Emphasize finding patterns of changes of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers. <p>ELA RS1-2, 7 WH1-2,7</p> <p>Construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.</p> <ul style="list-style-type: none"> • Emphasize explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures. <p>ELA RS 1-2, 9 WHS 2,8</p> <p>Analyze pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.</p> <ul style="list-style-type: none"> • Emphasize inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.
<p>Recognize natural selection leads to the predominance of certain traits in a population, and the suppression of others.</p>	<p>Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a</p>

Understand adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions.

- Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population change.

specific environment.

ELA RS 1-2, 9 WHS 2,8

Eighth Grade

Physical Science

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

Structure and Properties of Matter

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Substances are made from different types of <u>atoms</u>, which combine with one another in various ways.</p> <ul style="list-style-type: none"> • Atoms are composed of <u>protons</u>, <u>neutrons</u>, and <u>electrons</u>. • Atoms form <u>molecules</u>. 	<p>Develop models to describe the atomic composition of simple molecules and extended structures.</p> <ul style="list-style-type: none"> • Emphasize developing models of molecules that vary in complexity. • Examples of simple molecules could include ammonia and methanol. • Examples of extended structures could include sodium chloride or diamonds. • Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms. <p>ELA RS1-2, 7</p>
<p>Understand the changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter.</p>	
<p>Recognize atoms of the same element have the same number of protons.</p> <p>Recognize when elements are listed in order according to the number of protons, repeating patterns of physical and chemical properties identify families of elements with similar properties.</p> <ul style="list-style-type: none"> • The <u>Periodic Table</u> is a consequence of the repeating pattern of outermost electrons. 	<p>Analyze and interpret data that emphasizes patterns found in the organization of the periodic table.</p> <p>ELA RS1-2, 7 WH1-2,7</p>
<p>Understand structure of <u>matter</u>:</p> <ul style="list-style-type: none"> • Each pure substance has characteristic physical and chemical properties that can be used to identify it. • In a <u>liquid</u>, the molecules are constantly in contact with others. • In a <u>gas</u>, they are widely spaced except when they happen to collide. • In a <u>solid</u>, atoms are closely spaced, may vibrate in position but do not change relative locations, and may be extended structures with repeating subunits (e.g., crystals). 	<p>Make formal observations on a demonstration or conduct an investigation to determine differences in states of matter and/or properties of matter.</p> <p>ELA RS1-2, 7 WH1-2,7</p>

<p>Understand substances react chemically in characteristic ways.</p> <ul style="list-style-type: none"> In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. 	<p>Make formal observations on a demonstration or conduct an investigation to determine how substances react chemically.</p> <p>ELA RS1-2, 7 WH1-2,7</p>
<p>Understand <u>heat</u> refers to the energy transferred due to the temperature difference between two objects.</p> <ul style="list-style-type: none"> <u>Conduction</u>, <u>convection</u>, and <u>radiation</u> are means of heat transfer. <p>Understand <u>temperature</u> relates to particle motion, adding or removing thermal energy which changes the state of matter.</p>	<p>Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.</p> <ul style="list-style-type: none"> Emphasize models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium. <p>ELA RS1-2, 7</p>

Eighth Grade

Physical Science

Chemical Reactions

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand that each pure substance has characteristic physical and chemical properties that can be used to identify it.</p> <ul style="list-style-type: none"> Physical properties include color, texture, hardness, density, odor, <u>melting point</u>, <u>boiling point</u>, and solubility. Chemical properties include <u>flammability</u>. 	<p>Plan and conduct an investigation that uses independent and dependent variables. Draw a scientific conclusion based on evidence from the investigation.</p> <p>ELA RS1-3, 7 WH1-2, 4-6, 7-9</p>
<p>Understand substances react chemically in characteristic ways.</p> <ul style="list-style-type: none"> In a chemical process, the atoms that make up the original substances are 	<p>Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</p> <ul style="list-style-type: none"> Examples of reactions could include

<p>regrouped into different molecules, and these new substances have different properties from those of the reactants.</p> <ul style="list-style-type: none"> • The total number of each type of atom is conserved, and thus the mass does not change. • Some chemical reactions release energy, others store energy. • Some chemical reactions either release or absorb thermal energy (e.g. <u>endothermic</u> and <u>exothermic</u>). • The transfer of energy can be tracked as energy flows through a designed or natural system. 	<p>teacher demonstration of burning sugar, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.</p> <p>ELA RS1-2, 7 WH1-2,7</p> <p>Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.</p> <ul style="list-style-type: none"> • Emphasize law of conservation of matter and physical models or drawings, including digital forms that represent atoms. <p>ELA RS1-2, 7</p> <p>Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.</p> <ul style="list-style-type: none"> • Emphasize the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. • Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride. <p>ELA RS1-3, 7 WH1-2, 4-6, 7-9</p>
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Eighth Grade

Physical Science

Forces and Interactions

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Recognize <u>Newton’s First Law</u> that states an object at rest tends to stay at rest and an object in motion tends to stay in motion unless acted upon by an <u>unbalanced force</u>.</p> <p>Recognize <u>Newton’s Second Law</u> that states <u>acceleration</u> of an object is produced when a force acts on a mass. A change in force or mass will result in a change in acceleration.</p>	<p>Plan and conduct an investigation that uses independent and dependent variables. Draw a scientific conclusion based on evidence from the investigation. The investigation should provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.</p> <ul style="list-style-type: none"> • Emphasize balanced (Newton’s First Law) and unbalanced forces in a system,

<p>Recognize for any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (<u>Newton's Third Law</u>).</p> <ul style="list-style-type: none"> • The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. • The greater the mass of the object, the greater the force needed to achieve the same change in motion. • <u>Friction</u> is a force that can help objects start moving, stop moving, slow down, or change direction. 	<p>qualitative and quantitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.</p> <p>ELA RS1-3, 7 WH1-2, 4-6, 7-9</p> <p>Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.</p> <ul style="list-style-type: none"> • Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle. <p>ELA RS 1-2, 4 WHS 1-2</p>
<p>Recognize electric and magnetic (<u>electromagnetic forces</u>) can be attractive or repulsive.</p> <ul style="list-style-type: none"> • Sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. <p>Recognize energy from a variety of sources can be transformed into electrical energy, and then to almost any other form of energy.</p>	<p>Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.</p> <ul style="list-style-type: none"> • Conduct an investigation exploring magnetic or electric force. • Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. • Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor. <p>ELA WHS 7</p> <p>Research and communicate information about methods for generating electrical energy.</p> <ul style="list-style-type: none"> • Examples could include solar, water power, wind, and biochemical energy. <p>ELA RS1-2, 7 WH1-2,7-8</p>

Energy

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand motion energy is called <u>kinetic energy</u>; it is proportional to the mass of the moving object and grows with the square of its speed.</p> <ul style="list-style-type: none"> • Average speed is defined as a distance traveled in a given period of time. <p>Understand objects or systems of objects may contain stored <u>potential energy</u>, depending on their relative positions.</p> <p>Recognize <u>temperature</u> is a measure of the average kinetic energy of particles of matter.</p> <p>Recognize the relationship between the temperature, the amount of kinetic energy, and the state of matter.</p>	<p>Graph data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.</p> <ul style="list-style-type: none"> • Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. • Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a whiffle ball versus a tennis ball. <p>ELA RS 7</p> <p>Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.</p> <ul style="list-style-type: none"> • Emphasis is on relative amounts of potential energy, not on calculations of potential energy. • Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate’s hair. • Examples of models could include representations, diagrams, pictures, and written descriptions of systems. <p>ELA RS 7</p>
<p>Recognize the amount of energy transfer needed to change the temperature of matter by a given amount depends on the nature of the matter, the size of the sample, and the environment.</p> <p>Recognize energy is spontaneously transferred out of hotter regions or objects and into colder ones.</p>	<p>Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.</p> <ul style="list-style-type: none"> • Examples of devices could include an insulated box, a solar cooker, and a styrofoam cup. • The device needs to be tested, and then

	<p>modified on the basis of the test results in order to improve it.</p> <p>Plan and conduct an investigation that uses independent and dependent variables. Draw a scientific conclusion based on evidence from the investigation. The investigation should determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.</p> <ul style="list-style-type: none"> • Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added. <p>ELA RS1-3, 7 WHS1-2, 4-6, 7-9</p>
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Eighth Grade

Physical Science

Waves and Electromagnetic Radiation

<i>Students will:</i>	<i>Students who demonstrate understanding can</i>
<p>Understand a simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.</p> <p>Understand a sound wave needs a medium through which it is transmitted.</p> <p>Recognize that waves can be used for communication purposes (e.g. radio waves, Wi-Fi, fiber optics).</p>	<p>Use mathematical representations to describe a simple model for waves that includes how the wavelength, frequency, and amplitude.</p> <ul style="list-style-type: none"> • Emphasis is on describing waves with both qualitative and quantitative thinking. <p>ELA RS 1-2 WHS 2,4</p>
<p>Understand when light shines on an object, it is reflected, absorbed, or transmitted through the object.</p> <p>Understand the path that light travels can be traced</p>	<p>Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.</p> <ul style="list-style-type: none"> • Emphasis is on both light and mechanical

<p>as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.</p>	<p>waves.</p> <ul style="list-style-type: none"> • Examples of models could include drawings, simulations, and written descriptions. <p>ELA RS 7</p>
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Eighth Grade

Earth Space Sciences

Culmination Unit - Human Impact

<i>Students will:</i>	<i>Students who demonstrate understanding can:</i>
<p>Understand all Earth processes are the result of energy flowing and matter cycling within and among the planet's systems.</p> <ul style="list-style-type: none"> • This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. 	<p>Develop a model and describe the cycling of Earth's materials and the flow of energy that drives this process.</p> <ul style="list-style-type: none"> • Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials. <p>ELA RS1-2,7</p>
<p>Understand humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources.</p> <ul style="list-style-type: none"> • Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. 	<p>Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.</p> <ul style="list-style-type: none"> • Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. • Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock). <p>ELA RS1-2,6-8 WHS 1-2,4-6,8-10</p>
<p>Recognize the historical natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the</p>	<p>Analyze and interpret data to identify patterns on natural hazards and forecast future catastrophic events. (e.g. graphs, charts, images).</p>

<p>locations and likelihoods of future events.</p>	<ul style="list-style-type: none"> ● Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. ● Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). ● Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. <p>Research technology to mitigate their effects.</p> <ul style="list-style-type: none"> ● Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts) <p>ELA RS1-2,6,8-9 WHS 1-2,4-6,8-10</p>
<p>Understand human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. Changes to Earth’s environments can have different impacts (negative and positive) for different living things.</p>	<p>Apply scientific principles to design a method or evaluate a current solution for monitoring and minimizing a human impact on the environment.</p> <ul style="list-style-type: none"> ● Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as the air, water, or land).
<p>Recognize that typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.</p>	<p>Construct an oral and written argument supported by evidence, to support or refute a claim for how increases in human population and per-capita consumption of natural resources impact Earth’s systems.</p> <ul style="list-style-type: none"> ● Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy).

	<ul style="list-style-type: none"> • Examples of impacts can include changes to the appearance, composition, and structure of Earth’s systems as well as the rates at which they change. <p>ELA RS1-2 WHS2,4-6,8-9 SL1-2,4-6</p>
<p>All human activity draws on natural resources and has both short and long term consequences, positive as well as negative, for the health of people and the natural environment.</p>	<p>Reflect on the human impact on the environment through Catholic Social Teaching and Science and explain methods for mitigating the negative effects of human activity.</p>