Grade Seven Earth Science

Theme ***Order and Organization***

This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures, and relationships that may be described by simple principles. These principles are related to the properties or interactions within and between systems.

Strand Connection

Systems can exchange energy and/or matter when interactions occur within systems and between systems. Systems cycle matter and energy in observable and predictable patterns.

Science Inquiry and Applications:

During the years of grades 5-8, all students must use the following scientific processes, with appropriate laboratory safety techniques, to construct their knowledge and understanding in all science content areas:

- Identify questions that can be answered through scientific investigations
- Design and conduct a scientific investigation
- Use appropriate mathematics, tools, and techniques to gather data and information
- Analyze and interpret data
- Develop descriptions, models, explanations, and predictions
- Think critically and logically to connect evidence and explanations
- Recognize and analyze alternative explanations and predications
- Communicate scientific procedures and explanations

Reading in Science

Key Ideas and Details:

1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure:

4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Writing in Science

Text Types and Purposes:

1. Write arguments focused on discipline-specific content.
   a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
   b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
   c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
   d. Establish and maintain a formal style.
   e. Provide a concluding statement or section that follows from and supports the argument presented.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Integration of Knowledge and Ideas:

7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
9. Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic.

Range of Reading and Level of Text Complexity:

10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

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

3. Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.

Production and Distribution of Writing:

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

Research to Build and Present Knowledge:

7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of

	each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. 9. Draw evidence from informational texts to support analysis, reflection, and research. ***Range of Writing:*** 10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Grade Seven Earth Science

Topic ***Cycles and Patterns of Earth and the Moon***	**Pacing**
This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun, and moon.	

Content Statement	**Content Elaborations**
1. The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere, and atmosphere. Thermal energy is transferred as water changes state throughout the cycle. The cycling of water in the atmosphere is an important part of weather patterns on Earth. The rate at which water flows through soil and rock is dependent upon the porosity and permeability of the soil or rock. Note: Contamination can occur within any step of the hydrologic cycle. Ground water is easily contaminated as pollution present in the soil or spilled on the ground surface moves into the ground water and impacts numerous water sources. **Learning Targets:** • I can identify the key parts (condensation, evaporation, precipitation, run-off, and percolation) of the hydrologic cycle. • I can explain the process of the hydrologic cycle including its relationship to energy flow and weather. • I can explain the movement of water and contaminates through the spheres (water quality). • I can evaluate the porosity and permeability of a rock to determine how water flows through it. • I can analyze how geographic landforms are involved in the cycling of water by investigating drainage patterns in watersheds. **Advanced Learning Targets (select two of the following):** • I can assess possible disruptions to the hydrologic cycle (i.e., volcanic eruptions, cloud seeding, etc.). • I can compare the water quality of multiple bodies of water from various locations.	***Prior Concepts Related to Hydrologic Cycle*** PreK-2: Water is observed through weather. Water is in the atmosphere. Water can be a solid, a gas, and a liquid. Grades 3-5: Water is present in soil. Water is a nonliving resource. Properties of the different states of water, how water can change the surface of Earth, and how water is a factor in some weather-related events (e.g., flooding, droughts) are discussed. Grade 6: The changes in the state of water are related to motion of atoms (changes in energy). Water flows through rock and soil (porosity and permeability). ***Grade 7 Concepts*** The different pieces of the hydrologic cycle (e.g., properties of water, changes of state, relationships of water to weather, effects of water on Earth's surface) from the elementary grades are formally combined in grade 7 and applied to the components of the hydrologic cycle. The movement of water through the spheres of Earth is known as the hydrologic cycle. As water changes state and energy is transferred, it cycles from one sphere into another (e.g., water transfers from the hydrosphere to the atmosphere when evaporation occurs). Ground water and surface water quality are important components of the hydrologic cycle. The porosity and permeability of the rock and/or soil (grade 6) can affect the rate at which the water flows. The pattern of the cycling illustrates the relationship between water, energy, and weather. The movement of water in the cycle also can move contamination through each of the spheres. Relating water flow to geographic and topographic

• I can construct a model watershed (i.e., ecocolumn).	landforms and/or features leads to an understanding of where water flows and how it moves through the different spheres. Topographic and aerial maps (can be virtual) can be used to identify drainage patterns and watersheds that contribute to the cycling of water. Lab investigations or technology can be used to simulate different segments of the hydrologic cycle. ***Future Application of Concepts*** Grades 8: The relationship between the hydrosphere, atmosphere, and lithosphere are studied as they relate to weathering and erosion. High School: The hydrologic cycle is a component of biology as it relates to ecosystems and the diversity of life.
Content Vocabulary • hydrologic • sources of contamination • topography • water flow rate • water quality • watershed	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • exclude • explain • generalize • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship • simulate • support • test

Formative Assessments • Common Formative Assessments via Portal, Science Journals, Labs	**Summative Assessments** • Project, Tests, and Quizzes reflecting standards, Science Journals, Labs
Resources • Gizmos (explorelearning.com)	**Enrichment Strategies** • Gizmos (explorelearning.com) Activity C is often an extension for those that need a challenge.
Integrations • **ELA**: • **Math**: • **Social Studies**:	**Intervention Strategies** •

Grade Seven Earth Science

Topic *Cycles and Patterns of Earth and the Moon* This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun, and moon.	**Pacing**
Content Statement ***2. Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.*** The sun is the major source of energy for wind, air, and ocean currents and the hydrologic cycle. As thermal energy transfers occur in the atmosphere and ocean, currents form. Large bodies of water can influence weather and climate. The jet stream is an example of an atmospheric current and the Gulf Stream is an example of an oceanic current. Ocean currents are influenced by factors other than thermal energy, such as water density, mineral content (such as salinity), ocean floor topography, and Earth's rotation. All of these factors delineate global climate patterns on Earth. Note: This content statement is related to LS grade 7 (biomes). Regional temperature and precipitation contribute to the identification of climatic zones. **Learning Targets:** • I can explain wind and water currents and their causes. • I can investigate the factors that affect currents (density, thermal energy, pressure, composition of substances, and topography/geography). • I can predict the path of air and water currents based on real time data from atmospheric and oceanic maps. **Advanced Learning Targets:** • I can evaluate wind and water currents effects on local ecosystems.	**Content Elaborations** ***Prior Concepts Related to Energy Transfers, Atmosphere, and Hydrosphere*** PreK-2: Water is observed through weather. Water is in the atmosphere. Water can be a solid, a gas, and a liquid. Grades 3-5: Water is present in soil. Water is a nonliving resource. Properties of the different states of water, how water can change the surface of Earth, and how water is a factor in some weather-related events (e.g., flooding, droughts) are discussed. Grade 6: The changes in the state of water are related to motion of atoms. Atoms take up space and have mass. Changes of state occur due to the amount of motion of atoms and molecules and density. ***Grade 7 Concepts*** The earlier concepts of weather and the physical properties of air and water and their changes are expanded in grade 7 to the relationship of atmospheric and oceanic currents and climate. Current and climate patterns on a global level should be studied using a variety of maps, models, and technology (e.g., remote sensing, satellite images, LANDSAT). The causes of moving currents in the atmosphere and ocean must be connected to thermal energy, density, pressure, composition, and topographic/geographic influences (e.g., continental mountains, ocean ridges). Studies also should include specific current patterns in both the atmosphere and the ocean that are mapped and documented through data. Contemporary studies regarding global climate must be based on facts and evidence. This content statement is connected to the LS grade 7 content pertaining to biomes and the climatic zones of Earth.

	Future Application of Concepts Grades 8: In grade 8, global climate is expanded through the investigation of climate change that occurred throughout Earth's history (as evidenced through the rock record and more recently through ice cores). High School: Gravity, density, gases, and properties of air and water are found in Physical Sciences. In the 11/12 grade Physical Geology and Environmental Science courses, climate change is explored in greater depth.
Content Vocabulary • climate • current (oceanic and atmospheric) • Gulf Stream • jet stream	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • exclude • explain • generalize • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship • simulate • support • test
Formative Assessments	**Summative Assessments**

Resources	Enrichment Strategies
Integrations • **ELA**: • **Math**: • **Social Studies**:	**Intervention Strategies**

Grade Seven Earth Science

Topic ***Cycles and Patterns of Earth and the Moon*** This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun, and moon.	**Pacing**
Content Statement ***3. The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere, and atmosphere.*** The atmosphere is held to the Earth by the force of gravity. There are defined layers of the atmosphere that have specific properties, such as temperature, chemical composition, and physical characteristics. Gases in the atmosphere include nitrogen, oxygen, water vapor, carbon dioxide, and other trace gases. Biogeochemical cycles illustrate the movement of specific elements or molecules (such as carbon or nitrogen) through the lithosphere, biosphere, hydrosphere, and atmosphere. Note: The emphasis is on why the atmosphere has defined layers, not on naming the layers. **Learning Targets:** • I can discriminate the layers of the atmosphere and their composition and properties. • I can identify examples of how natural events and human activity can change the composition of the atmosphere (greenhouse gases, ozone, etc.). • I can investigate how the changes in composition can alter the properties of the atmosphere including air quality. • I can provide examples of contemporary issues and technological advances. **Advanced Learning Targets:** • I can formulate a plan to change the atmospheric composition for a planet and use data to support the plan.	**Content Elaborations** ***Prior Concepts Related to Atmosphere*** PreK-2: Wind is felt as moving air, wind speed and direction can be measured, sunlight warms air, the atmosphere is air, air has properties, transfer of energy causes air movement, and water is present in air. Grades 3-5: Air is a nonliving resource that can be used for energy, air can be contaminated, wind can change the surface of Earth, and Earth is a planet that has an atmosphere. Grade 6: Atoms take up space, have mass, and are in constant motion. Elements, molecules, and compounds (and their properties) are discussed. Changes of state occur due to the amount of motion of atoms and molecules. ***Grade 7 Concepts*** The properties and composition of the layers of Earth's atmosphere are studied, as they are essential in understanding atmospheric current, climate, and biogeochemical cycles, which are seventh-grade concepts. Understanding the interactions between Earth's spheres (Earth Systems Science) and how specific elements and/or molecules move between them should be emphasized. This study must include standard greenhouse gases (including water vapor), ozone (in the atmosphere and at Earth's surface), and natural events/human activities that can change the properties of the atmosphere. Contemporary issues and technological advances should be included within this concept. Real-time scientific data pertaining to air quality and properties of air must be incorporated into the study of atmospheric properties and air quality.

	Future Application of Concepts Grades 8: Changes in environmental and climate conditions (including atmospheric changes) as evidenced in the rock record and contemporary studies of ice cores are studied. High School: Gravity, density, gases, and properties of air are found in the Physical Science course. In grade 11/12 Physical Geology and Environmental Science courses, the atmosphere, Clean Air Act, and climate change are explored further.
Content Vocabulary • atmosphere • atmospheric current • biosphere • hydrosphere • lithosphere	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • exclude • explain • generalize • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship • simulate • support • test
Formative Assessments	**Summative Assessments**

Resources	Enrichment Strategies
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Grade Seven Earth Science

Topic *Cycles and Patterns of Earth and the Moon* This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun, and moon.	**Pacing**
Content Statement ***4. The relative patterns of motion and positions of the Earth, moon, and sun cause solar and lunar eclipses, tides, and phases of the moon.*** The moon's orbit and its change of position relative to the Earth and sun result in different parts of the moon being visible from Earth (phases of the moon) A solar eclipse is when Earth moves into the shadow of the moon (during a new moon). A lunar eclipse is when the moon moves into the shadow of Earth (during a full moon). Gravitational force between the Earth and the moon causes daily oceanic tides. When the gravitational forces from the sun and moon align (at new and full moons) spring tides occur. When the gravitational forces of the sun and moon are perpendicular (at first and last quarter moons), neap tides occur. **Learning Targets:** • I can describe the motion of the Earth and moon in relation to each other and the sun. • I can describe why we see different amounts of the illuminated side of the Moon. • I can describe the position of the earth, moon, and sun during a lunar and solar eclipse. • I can describe that spherical objects cast a shadow in space. • I can use a model or simulation to identify tides, eclipses, and moon phases. • I can describe gravity's role in the tides of the earth. **Advanced Learning Targets (select one of the following):** • I can analyze various media portrayals of the cyclic patterns of the	**Content Elaborations** ***Prior Concepts Related to Moon, Earth, and Sun*** PreK-2: The moon, sun, and stars can be observed at different times of the day or night. The observable shape of the moon changes throughout the month. The sun's position in the sky changes in a single day and from day to day. The sun is the principal source of energy. Grades 3-5: Earth's atmosphere, introduction to gravitational forces, orbits of planets and moons within the solar system, predictable cycles and patterns of motion between the Earth and sun, and the fact that Earth's axis is tilted are explored. Grade 6: Objects and substances in motion have kinetic energy. Objects and substances can store energy as a result of its position (gravitational potential energy). ***Grade 7 Concepts*** The role of gravitational forces and tides is introduced in relationship to the position of the Earth, moon, and sun. Models and simulations (can be 3-D or virtual) must be used to demonstrate the changing positions of the moon and Earth (as they orbit the sun) and lunar/solar eclipses, daily tides, neap and spring tides, and the phases of the moon. The emphasis should not be on naming the phases of the moon or tides but in understanding why the phases of the moon or tides are cyclical and predictable. Advances in science knowledge regarding patterns and movement in the solar system are included in this content statement. ***Future Application of Concepts*** Grades 8: Gravitational forces, frame of reference, forces have magnitude and direction, and gravitational potential energy are explored.

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<td>moon and sun (i.e., use of children's books).
• I can interpret how changes to Sun-Earth-Moon system will impact the system (i.e., tides, eclipses, orbits, periods, etc.).</td>
<td>High School: Patterns of motion within the solar system are expanded to the universe. Forces and motion are investigated at depth.</td>
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<td>Content Vocabulary
• cyclical
• daily tides
• lunar eclipse
• neap tides
• orbit
• phases of the moon
• revolution
• rotation
• solar eclipse
• spring tides</td>
<td>Academic Vocabulary
• account for
• alter
• analyze
• anticipate
• apply
• claim
• classify
• compare
• conclude
• construct
• contemporary issues
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• describe
• design
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• **Math**: • **Social Studies**:	

Grade Seven Life Science

Topic ***Cycles of Matter and Flow of Energy*** This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.	**Pacing**
Content Statement ***1. Matter is transferred continuously between one organism to another and between organisms and their physical environments.*** Plants use the energy in light to make sugars out of carbon dioxide and water (photosynthesis). These materials can be used and immediately stored for later use. Organisms that eat plants break down plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms. Energy can transform from one form to another in living things. Animals get energy from oxidizing food, releasing some of its energy as heat. The total amount of matter and energy remains constant, even though its form and location change. Note 1: Chemical reactions are presented as the rearrangement of atoms in molecules. Note 2: Chemical reactions in terms of subatomic structures of atoms are not appropriate. **Learning Targets:** • I can illustrate the transfer of energy from the sun to animals. • I can describe and compare the processes of photosynthesis and cellular respiration. • I can apply the Law of Conservation of Matter using the equations for photosynthesis and cellular respiration. • I can construct a diagram showing the flow of energy through an ecosystem. ◦ (Plants and Snails Gizmo) • I can investigate biomass as a fuel source compared to other alternative fuels. **Advanced Learning Targets (select one of the following):**	**Content Elaborations** ***Prior Concepts Related to Cycles of Matter and Flow of Energy*** Grades 3-5: Populations of organisms can be categorized by how they acquire energy. Food webs can be used to identify the relationships among organisms. Energy entering ecosystems as sunlight is transferred and transformed by producers into energy that organisms use through the process of photosynthesis. That energy then passes from organism to organism as illustrated in food webs. Grade 6: Atomic Molecular Theory, Cell Theory, and the function of cell organelles, including mitochondria and chloroplast, are studied. ***Grade 7 Concepts*** The basic concepts for matter and energy flow were introduced in grades 3-5. The grades 3-5 concepts are expanded to include a comparison of photosynthesis and cellular respiration. The use of light energy to make food is called photosynthesis. The breakdown of food to release the stored energy is called respiration. General formulas are appropriate at this grade level, because atoms and molecules are taught in grade 6. Details of both processes are not grade appropriate. In grade 6, cellular organelles are introduced. It is appropriate to reinforce that the chloroplast (the plant cell organelle that contains chlorophyll) captures the sun's energy to begin the process of converting the energy from the sun into sugars and sugar polymers, such as starch. As matter is cycled within the environment, it promotes sustainability. The emphasis is not on food webs but on the transfer of matter and energy between organisms. The total amount of matter and energy remains constant in an ecosystem, even though the form and location undergo continual change. The concept of conservation of matter (introduced in PS grade 4) and conservation of energy are applied to ecosystems. An energy pyramid graphic

• I can justify crop production for biomass or human crop fuels. • I can manipulate factors that can impact photosynthesis and cellular respiration.	can illustrate the flow of energy. At each stage in the transfer of energy within an ecosystem, some energy is stored in newly synthesized molecules and some energy is lost into the environment as heat produced by the chemical processes in cells. The elements that make up the molecules of living things are continuously recycled. Energy rich molecules that are passed from organism to organism are eventually recycled by decomposers back into mineral nutrients usable by plants. New discoveries, technology, and research must be used to connect the concept of energy transfer and transformation within the ecosystem and between ecosystems. For example, the use of biomass as an alternative energy source for the local area can focus on different types of biomass, competition between human food crops and biomass crops, and biomass vs. other types of alternatives to fossil-fuels energy. ***Future Application of Concepts*** High School: The chemical flow of energy during reactions will be explored as the molecular structure of molecules is studied.
Content Vocabulary • chlorophyll • chloroplast • conservation of energy • conservation of matter • consumers • decomposers • energy pyramid • glucose • mitochondria • molecules • oxidizing • photosynthesis • producers • sugar polymers • sustain	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove

	• distinguish • estimate • evaluate • examine • exclude • explain • generalize • purpose • rare • reflect • relationship • simulate • support • test
Formative Assessments	**Summative Assessments**
Resources	**Enrichment Strategies**
Integrations • **ELA**: • **Math**: • **Social Studies**:	**Intervention Strategies**

Grade Seven Life Science

Topic ***Cycles of Matter and Flow of Energy***	**Pacing**
This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.	

Content Statement

2. In any particular biome, the number, growth, and survival of organisms and populations depend on biotic and abiotic factors.

Biomes are regional ecosystems characterized by distinct types of organisms that have developed under specific soil and climatic conditions,

The variety of physical (abiotic) conditions that exists on Earth gives rise to diverse environments (biomes) and allows for the existence of a wide variety of organisms (biodiversity).

Ecosystems are dynamic in nature; the number and types of species fluctuate over time. Disruptions, deliberate or inadvertent, to the physical (abiotic) or biological (biotic) components of an ecosystem impact the composition of an ecosystem.

Note: Predator-prey and producer-consumer relations are addressed in grade 5.

Learning Targets:

- I can compare each biome based on biotic (plants and animals) and abiotic factors (topography, soil types, precipitation, solar radiation, and temperature).
- I can evaluate how limiting factors affect the size of a population (food chain gizmo; limiting factors on a rabbit population gizmo).
- I can compare the two types of succession.
- I can predict the next stage of succession in the event of a natural disaster.

Advanced Learning Targets (select one of the following):

- I can assess the effects of a real world disaster on an ecosystem (i.e., tsunami, earthquake, fire, volcanic eruption).
- I can investigate the effects of limiting factors on various populations in a closed system (i.e., Isle Royale, Galápagos, lab setting).

Content Elaborations

Prior Concepts Related to Forces, Movement, and Igneous Environments

PreK-2: Plants and animals have traits that improve their chances of living in different environments. Living things have basic needs, which are met by obtaining materials from the physical environment.

Grades 3-5: Populations of organisms can be categorized by how they acquire energy. Food webs can be used to identify the relationships among organisms. Energy entering ecosystems as sunlight is transferred and transformed by producers into energy that organisms use through the process of photosynthesis. That energy then passes from organism to organism as illustrated in food webs.

Grade 7 Concepts

Biomes are defined by abiotic components of the environment – topography, soil types, precipitation, solar radiation, and temperature. Comparing the different biomes found on Earth is the focus of this content statement. Examples of the Earth's biomes include aquatic (freshwater, brackish water, and marine water), forest (tropical and temperate), desert (cold and hot), grassland, taiga, and tundra. Biomes must be linked to climate zones on a global level by using a variety of maps, models, and technology (e.g., remote sensing, satellite images, LANDSAT). This content statement is connected to the ESS middle school content pertaining to global climate patterns.

An ecosystem is composed of linked and fluctuating interactions between biotic and abiotic factors. Given adequate resources and an absence of disease or predators, populations of organisms in ecosystems increase at rapid rates. Finite resources and other factors limit population growth. As one population proliferates, it is held in check by one or more environmental factors (e.g., depletion of food or nesting sites, increased loss to predators, invasion by parasites). If a natural disaster such as a flood or fire occurs, the damaged ecosystem is likely to recover in a succession of stages that eventually results

	in a system similar to the original one. ***Future Application of Concepts*** High School: The evolutionary mechanisms that build unity and diversity are studied.
Content Vocabulary • abiotic • biomes • biotic • brackish water • dynamic interactions • ecology • ecosystem • fluctuating interactions • limiting factors • proliferates • radiation • solar radiation • succession	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • exclude • explain • generalize • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship • simulate • support • test
Formative Assessments	**Summative Assessments**
Resources	**Enrichment Strategies**

Integrations	Intervention Strategies
• **ELA**: • **Math**: • **Social Studies**:	

Grade Seven Physical Science

Topic ***Conservation of Mass and Energy***	**Pacing**
This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, and transformation and transfer of energy.	
Content Statement	**Content Elaborations**
1. The properties of matter are determined by the arrangement of atoms. Elements can be organized into families with similar properties, such as highly reactive metals, less-reactive metals, highly reactive nonmetals, and some gases that are almost completely nonreactive. Substances are classified according to their properties, such as metals and acids. When substances interact to form new substances, the properties of the new substances may be very different from those of the old, but the amount of mass does not change. Note 1: This is the conceptual introduction of the Periodic Table of Elements. Note 2: Acids and bases are included in this topic; further detail will be provided in the Model Curriculum. Note 3: It is important to emphasize that most changes in the properties of matter have some combination of chemical and physical change (at different levels). **Learning Targets:** • I can determine the properties of an element based on its location in the periodic table. • I can test a variety of natural substances to determine if they are acidic, basic, or neutral. • I can account for all matter during a chemical reaction to show that mass stays constant (open and closed systems). **Advanced Learning Targets:** • I can evaluate how the arrangement of atoms contributes to physical	***Prior Concepts Related to Properties of Matter*** PreK-2: Properties can be used to sort objects. Changes, including phase changes, are explored. Grades 3-5: Objects are composed of matter which has mass* and volume. Properties of solids, liquids, and gases are explored. Phase changes are reversible and do not change the identity of the material. The total amount of matter and mass remains the same when something changes. Grade 6: All matter is made up of atoms that are in constant random motion. Elements, compounds, and molecules are introduced. The properties of solids, liquids, and gases and changes of phase are explained by the motion and spacing of the particles. ***Grade 7 Concepts*** Mixtures are materials composed of two or more substances that retain their separate atomic compositions, even when mixed (e.g., water and sugar can be mixed together thoroughly at the molecular level, but the water particles and sugar particles remain separate). Elements are organized into groups based on their properties (including melting and/or boiling points) and position on the periodic table. These groups include metals, nonmetals, and gases that are almost completely nonreactive. The nonreactive gases exist primarily as elements and do not react to form many compounds. Most metals are malleable, have high melting points, are usually solid at room temperature, and are good conductors of heat and electricity. Nonmetals are poor conductors of heat and electricity, are usually gases at room temperature, and, as solids, tend to be dull and brittle. The pH scale has a range of 0-14 and is used to measure the acidity or alkalinity of a compound. At the seventh-grade level, pH tests must be conducted on a

properties (i.e., crystals). • I can investigate how chemical properties improve the effectiveness of a product (i.e., space shuttle heat shield).	variety of substances. The properties of the compounds that are acidic (below 7 on the pH scale), neutral (7 on the pH scale), or basic (above 7 on the pH scale) must be compared and evaluated. Acidity and alkalinity values must be related and connected to the natural world as pH values are used to measure water, soil, and air quality (e.g., sulfuric acid in the atmosphere can form acidic precipitation which can impact the acidity of a stream and the living organisms in the stream). The discussion of hydroxide and hydrogen ions as they relate to the pH scale is reserved for high school and will not be assessed at grade 7. Chemical and physical changes occur on a continuum and no distinct lines separate the two. In many cases when objects, substances, or materials undergo change, there may be a combination of chemical and physical changes occurring. Under these standards, classifying specific changes as chemical or physical is not appropriate. For any change in a closed system, the number and type of atoms stays the same, even if the atoms are rearranged. Therefore, the mass remains constant. Note 1: Appropriate background knowledge, such as graphics representing the atomic composition of the substances involved or descriptions of how the matter can be formed, decomposed, or separated, should accompany questions asking to classify matter as an element, compound, or mixture. The nature of chemical bonding is not appropriate at this grade. Note 2: H+ and OH- ions as they relate to pH are found at the high school level. Note 3: While mass is always conserved, this is not the case for volume. Mixing alcohol with water results in a volume that is less than the sum of the volumes. Boiling liquid results in a significant increase in volume. Note 4: The idea of reversibility of changes is not a criterion for classifying changes as chemical or physical. Some changes cannot be reversed, like tearing paper. As students progress farther in chemistry, they will learn about equilibrium, which involves many chemical changes that are reversible. Dissolving an ionic substance is an example of a process that is not clearly chemical or physical since bonds are broken (Science: College Board Standards

	for College Success, 2009, page 125). ***Future Application of Concepts*** High School: Metalloids and pH calculations are introduced. Mixtures are classified as homogenous or heterogeneous. Trends in the properties and atomic structure of elements are related to the periodic table. The role of valence electrons in reactivity is explored, balanced chemical equations are written, and stoichiometric problems are solved. *While mass is the scientifically correct term to use in this context, the NAEP 2009 Science Framework (page 27) recommends using the more familiar term "weight" in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.
Content Vocabulary • acidity • alkalinity • atoms • basic • chemical reaction • compound • element • malleable • mass • mixture • neutral • periodic table • weight	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship

	• exclude • explain • generalize • simulate • support • test
Formative Assessments	**Summative Assessments**
Resources	**Enrichment Strategies**
Integrations • **ELA**: • **Math**: • **Social Studies**:	**Intervention Strategies**

Grade Seven Physical Science

Topic ***Conservation of Mass and Energy***	**Pacing**
This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, and transformation and transfer of energy.	

Content Statement	**Content Elaborations**
2. Energy can be transformed or transferred but is never lost. When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. When energy is transformed from one form to another, the total amount of energy remains the same. Note: Further discussion of energy transformation is addressed at the high school level. **Learning Targets:** • I can differentiate between an open and closed system. • I can justify energy conservation within an open and closed system. • I can describe how energy can be dissipated out of an open and closed system. **Advanced Learning Targets:** • I can design an experiment to confirm the law of conservation of energy. Evaluate inefficiencies in that design.	***Prior Concepts Related to Energy Transfer*** PreK-2: Sound is produced by vibrating objects. The sun is the principal source of energy and affects the warming or cooling of Earth (ESS). Weather changes occur due to changes in energy (ESS). Plants get energy from sunlight and animals get energy from plants and other animals (LS). Grades 3-5: Objects with energy have the ability to cause change. Energy can transfer from one location or object to another and can be transformed from one form to another (e.g., light, sound, heat, electrical energy, magnetic energy). Earth's resources can be used for energy (ESS). Sunlight is transformed by producers into energy that organisms can use and pass from organism to organism (LS). Grade 6: There are two forms of energy: kinetic and potential. Energy can transform from one form to another. Thermal energy is due to random motion of the particles of a substance. ***Grade 7 Concepts*** A system is separated from its surroundings by either a physical or mental boundary. A closed system is one that does not interact with its surroundings. Matter and energy cannot get into or out of a closed system. Most systems on Earth are open systems. Matter and energy can be transferred into or out of an open system. If energy appears to be gained or lost, it has just transformed or transferred into a different system. Examples of systems include ecosystems, the atmosphere, the hydrosphere, the solar system, and the human body. When energy transfers to a large system, it may be difficult to measure the effects of the added energy. Dissipated energy (energy that is transformed into thermal energy and released into the surroundings) is difficult or impossible to recapture. Some systems dissipate less energy than others,

	leaving more energy to use. Investigation, testing, and experimentation must be used to explore energy transfers and transformations. Observing the quantifiable energy changes in a virtual environment is recommended at this introductory level, as these can be difficult to measure accurately. Note 1: This content statement does not deal with radiation, convection, and conduction. That is addressed in the seventh-grade Physical Science content statement. Note 2: ESS grade 7 is connected to this content statement regarding thermal energy. Thermal energy is transformed as water changes state throughout the water cycle. Thermal energy transferred in the ocean and atmosphere contributes to the formation of currents, which influence global climate patterns (ESS grade 7). Middle school LS also is connected to this statement as it relates to the transfer and transformation of energy within ecosystems. ***Future Application of Concepts*** Grade 8: Gravitational, chemical, and elastic potential energy are explored. High School: Waves are further explored as a method of transferring energy. Basic formulas are used to perform calculations with energy. Work is a method of and power is a rate of energy transfer.
Content Vocabulary • closed system • conservation of energy • dissipated • open system	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model

	• describe • design • determine • differentiate • discriminate • distinguish • estimate • evaluate • examine • exclude • explain • generalize • modify • order • pattern • predict • prove • purpose • rare • reflect • relationship • simulate • support • test
Formative Assessments	**Summative Assessments**
Resources	**Enrichment Strategies**
Integrations • **ELA**: • **Math**: • **Social Studies**:	**Intervention Strategies**

Grade Seven Physical Science

Topic ***Conservation of Mass and Energy***	**Pacing**
This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, and transformation and transfer of energy.	

Content Statement	**Content Elaborations**
3. Energy can be transferred through a variety of ways. Mechanical energy can be transferred when objects push or pull on each other over a distance. Electromagnetic waves transfer energy when they interact with matter. Thermal energy can be transferred through radiation, convection, and conduction. Electrical energy transfers when an electrical source is connected in a complete electrical circuit to an electrical device. Note 1: Energy transfers should be experimental and observable. This builds upon PS grade 4 and is directly connected to ESS grade 7 (thermal energy transfers in the hydrologic cycle). Note 2: Electricity can be measured through current, voltage, and resistance. In addition, renewable energy systems should be included (such as wind, geothermal, water, or solar). Note 3: The types of waves used within this topic include seismic, oceanic, sound, and light. Seismic waves also are found in ESS grade 8. **Learning Targets:** • I can list the ways in which energy can be transferred (mechanical, electromagnetic, thermal, and electrical). • I can demonstrate the various properties of longitudinal and transverse waves using a slinky (amplitude, frequency, wavelength, speed). • I can evaluate an electrical circuit in terms of type, voltage, current, resistance, and the transfer of energy to other forms (measure the current using an ammeter). • I can design a system that shows the transfer of mechanical energy	***Prior Concepts Related to Energy Transfer*** PreK-2: Temperature changes are observed. The sun is the principal source of energy. It affects the temperature of Earth (ESS) and supplies life's energy (LS). Grades 3-5: Objects with energy have the ability to cause damage. Electrical, heat, light, and sound energy are explored. Earth's resources can be used for energy (ESS). Energy is transferred and transformed by organisms in ecosystems (LS). Grade 6: Energy is identified as kinetic or potential and can transform from one form to another (gravitational, potential, kinetic, electrical, magnetic, heat, light, sound). Density depends on the mass and volume of a substance. Thermal energy is related to the motion of particles. ***Grade 7 Concepts*** Mechanical energy is transferred when a force acts between objects that move one of the objects some distance with or against the force. The amount of energy transferred increases as the strength of the force and/or the distance covered by object increases. This energy transfer (work) stops when the objects no longer exert forces on each other. Vibrations cause wave-like disturbances that transfer energy from one place to another. Mechanical waves require a material (medium) in which to travel. The medium moves temporarily as the energy passes through it but returns to its original undisturbed position. Mechanical waves are classified as transverse or longitudinal (compression) depending on the direction of movement of the medium. Waves can be described by their speed, wavelength, amplitude, and frequency. The energy of a mechanical wave depends upon the material,

depends on the force exerted. • I can compare the transfer of energy between a transverse and compressional wave. • I can design, create, and compare a series and parallel circuit. • I can compare an open and closed electrical circuit. • I can demonstrate an increase or decrease in a resistance in a circuit. • I can create a closed circuit that includes a parallel circuit and resistance and that shows changes in current and voltage. • I can demonstrate how density can be used to create convection currents as a transfer of thermal energy. • I can explain how energy transferred through waves can be transformed into thermal energy (radiation). • I can interpret data representing the transfer of thermal energy on the surface or interior of the Earth. • I can explain the cycle of radiation, conduction, and convection. • I can distinguish between types of electromagnetic waves based upon their frequency and wavelength. • I can apply the concept of energy transfer and waves to real life situations. **Advanced Learning Targets:** • I can develop an investigation to calculate the speed of sound (taking into account the density of the medium). • I can evaluate the energy used by an appliance (e.g., monthly cost to operate, home energy audit). Possible purchase of Kill-A-Watt.	decreases with increasing wavelength, and increases with amplitude. The pitch of a sound wave increases with the frequency and the loudness increases with amplitude. While light and other electromagnetic waves do not require a medium and can travel through a vacuum, they can travel through some media, such as clear glass. A wave travels at a constant speed through a particular material as long as it is uniform (e.g., for water waves, having the same depth). The speed of the wave depends on the nature of the material (e.g., waves travel faster through solids than gases). For a particular uniform medium, as the frequency (f) of the wave is increased, the wavelength (λ) of the wave is decreased. The mathematical representation is vwave= λf. For grade 7, investigation and experiments (3-D and virtual) must be used to connect energy transfer and waves to the natural world. Real data must be used, such as oceanic or seismic wave data or light and sound wave data. Heat is thermal energy transferred between objects and travels from a warm object to a cooler one unless additional energy is used. Thermal energy can be transferred when moving atoms collide. This is called conduction. Thermal energy also can be transferred by means of thermal currents in air, water, or other fluids. As fluids are heated, they expand, decreasing the density. Warmer material with less density rises, while cooler material with a greater density sinks, causing currents that transfer energy in a process called convection. Thermal energy also can be transformed into waves that radiate outward. This energy transferred by the waves can be transformed back into thermal energy when it strikes another material through a process called radiation. Technology (e.g., virtual simulations, satellite imagery, remote sensing, accessing real-time temperature data) can be used to demonstrate the transfer of thermal energy on the surface or interior of Earth and within the solar system. An electric circuit exists when an energy source (e.g., battery, generator, solar cell) is connected to an electrical device (e.g., light bulb, motor) in a closed circuit. The energy source transfers energy to charges in the circuit. Charges flow through the circuit. Electric potential is a measure of the potential electrical energy of each charge. Differences in voltages can be measured with a voltmeter. The energy source does not create the charges; they were already present in the circuit. When the charges reach an electrical device, energy can be transformed into other forms of energy (light , sound, thermal,

	or mechanical). The voltage drops after this energy transfer, but the charges continue to move through the circuit. In an open circuit, the charges stop flowing and energy is not transferred. Current is the rate of charge flow through conductors and can be measured with an ammeter. The degree to which current is opposed in a circuit is called resistance. Generally for a particular energy source, the greater the resistance, the lower the current. The resistance through a wire depends upon the type of metal, the length of the wire, and the diameter of the wire. Electrical devices can be connected in a series or as a parallel circuit. As the number of devices in a series loop increases, the current in the loop decreases. In a parallel circuit, the currents in each loop are the same as they would be if each loop were the only loop in the circuit. Testing and experimenting (3-D or virtually) with electrical circuits to evaluate the energy transfers, resistance, current, and changes in voltage are required. Note: The electromagnetic nature of electromagnetic radiation is not appropriate at this grade level nor are mathematical calculations of work or electricity. ***Future Application of Concepts*** Grade 8: Gravitational, chemical, and elastic potential energy and seismic waves (ESS) are explored. High School: Energy and work are explored mathematically.
Content Vocabulary • ammeter • amplitude • circuit • closed circuit • conduction • convection • current • depth • electrical circuit • electrical potential • electromagnetic • frequency • generator	**Academic Vocabulary** • account for • alter • analyze • anticipate • apply • claim • classify • compare • conclude • construct • contemporary issues • critique • demonstrate • hypothesize • identify • illumination • illustrate • include • influence • interpret • investigate • judge • justify • locate • manipulate • model

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