7th Grade Science Curriculum Map				
Time	**Strands**	**Standards**	**Student Learning Targets "I Can" Statements**	**Assessments**
2 Weeks	**Life Science (LS) Cycles of Matter and Flow of Energy**	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	"I Can"… Describe the process of photosynthesis. Describe the events that occur during respiration. Describe the relationship between photosynthesis and respiration.	Be able to: Answer critical questions Observational data based on class participation Tests/Quizzes/ Homework

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		reactions are presented as the rearrangement of atoms in molecules. **Note 2:** Chemical reactions in terms of subatomic structures of atoms are not appropriate.		

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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 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.

4-5 Weeks	**Life Science (LS) Cycles of Matter and Flow of Energy**	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	"I Can"… Name the six major biomes found on Earth. Name and describe the factors that determine the type of biome found in an area. Describe methods for determining the size of a population.	Be able to: Answer critical questions Observational data based on class participation Tests/Quizzes/ Homework

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		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.	Explain the causes of changes in the population size. Identify factors that limit population growth. Identify the needs that must be met by an organism's surroundings. Identify biotic and abiotic parts of a habitat. Describe the levels of organization within an ecosystem. Explain how an organism's adaptations help it to survive. Describe the major kinds of interactions among organisms in an ecosystem. Identify the three types of symbiotic relationships. Describe the difference between primary and secondary succession.	

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

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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.

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	Earth and Space Science (ESS) Cycles and Patterns of Earth and the Moon	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.	"I Can"… Describe how water moves to and from the atmosphere during the water cycle. Explain how clouds form. Name the three main types of clouds. Identify the common types of precipitation. Describe how precipitation is measured. Name and describe the processes involved in the water cycle. Explain how carbon and oxygen are recycled in ecosystems. Define and describe the nitrogen cycle.	Be able to: Answer critical questions Observational data based on class participation Tests/Quizzes/ Homework

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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 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.

	Earth and Space Science (ESS) Cycles and Patterns of Earth and the Moon	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	"I Can"… State how scientists describe and explain winds. Distinguish between local and global winds. Identify where the major global wind belts are located.	Be able to: Answer critical questions Observational data based on class participation Tests/Quizzes/ Homework

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		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.		

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.

2 Weeks	**Earth and Space Science (ESS) Cycles and Patterns of Earth and the Moon**	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	"I Can"… Describe the composition of Earth's atmosphere. State how the atmosphere is important to living things. Identify the four main layers of the atmosphere. Describe the characteristics of each layer.	Be able to: Answer critical questions Observational data based on class participation Tests/Quizzes Homework

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		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.		

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.

	Earth and Space Science (ESS) Cycles and	The relative patterns of motion and positions of the	"I Can"… Explain what causes the phases of the moon.	Be able to: Answer critical questions

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	Patterns of Earth and the Moon	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.	Describe solar and lunar eclipses. Identify what causes the tides.	Observational data based on class participation Test/Quizzes Homework

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The role of gravitational forces and tides are 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. Earth and its solar system are part of the Milky Way galaxy, which are part of the universe.
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.

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4 Weeks	**Physical Science (PS) Conservation of Mass and Energy**	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.	"I Can"… Explain how atoms are the particles that make up all matter. Describe Dalton's and other scientist's theory of atoms and how the theory developed and changed. Describe the modern theory of the atom. Define elements and explain how they are related to compounds. Describe the properties of a mixture. Explain how Mendeleev discovered the pattern that led to the periodic table. Tell what information is found in the periodic table.	Be able to: Answer critical questions Observational data based on class participation Test/Quizzes Homework Creating a three-dimensional model of the atom Lab activity Atom marshmallows Lab activity Atom models for students Lab activity Elements, Compound, and Mixtures in the Bag Lab activity Classification of Matter

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		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).		

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, non-metals 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 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 the 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

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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).

4-5 Weeks	**Physical Science (PS) Conservation of Mass and Energy**	Energy can be transformed or transferred but is never lost.	"I Can"… Describe the characteristics of a solid, liquid, and a gas. Identify the properties used to describe matter. Differentiate between weight and mass. Identify the units used to express the amount of space occupied by matter. Describe how the density of a material is determined. Describe what a physical and chemical change is. Distinguish between physical and chemical changes in matter. Explain how changes in matter are related to changes in energy. Describe how chemical	Be able to: Answer critical questions Observational data based on class participation Test/Quizzes Homework Lab activities 3 and 4…Properties of solids and liquids Lab activity Finding: mass, volume, and density Lab activity Density: solids in liquids

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			energy is related to chemical change. Identify forms of energy that are related to changes in matter.	

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.

	Physical Science (PS) Matter and Motion	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,	"I Can"…	Be able to: Answer critical questions Observational data based on class participation Test/Quizzes Homework Lab activities

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		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 experiential 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.		

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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, 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 $v_{wave}=\lambda f$.

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.

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