

**7th Grade (Life Science)/8th Grade (Physical Science)/Earth Science (H.S.)
Essential Standards
Science**

Based on State Key Content Standards compiled by the Pulliam Group

Strand	Standard 7 th Grade (Life)	Standard 8 th Grade (Physical)	Standard Earth Science (H.S.)
	<p>1. Cell Biology- All living organisms are composed of cells. Students should know that:</p> <ul style="list-style-type: none"> a. cells function similarly in all living organisms. b. the characteristics that distinguish plant cells from animal cells, including chloroplasts and cell walls. c. the nucleus is the repository for genetic information in plant and animal cells. e. cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes. <p>2. Genetics- Cells contain genetic instructions that specify its traits. Students should know that:</p> <ul style="list-style-type: none"> b. sexual reproduction produces offspring that inherit half their genes from each parent. c. an inherited trait can be determined by one or more genes. d. plant and animal cells contain many thousands of different genes and typical have two copies of every gene. The copies, or alleles, of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive. e. DNA is the genetic material of living organisms and is located in the chromosomes of each cell. <p>3. Evolution- Evolution accounts for diversity of species. Students should know that:</p> <ul style="list-style-type: none"> a. that genetic variation and environmental factors cause evolution and diversity of organisms. c. how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution. <p>Earth Science-</p> <p>4. Evidence from rocks allows us to understand evolution. Students should know that:</p> <ul style="list-style-type: none"> a. that Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time. b. that the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impacts of asteroids. c. that fossils provide evidence of how life and environmental conditions have changed. <p>5. Structure and functions in living systems. Structure and function are complementary in animals and plants. Students should know:</p> <ul style="list-style-type: none"> a. that plants and animals have levels of organization for structure and function, including cells, tissues, organs, 	<p>Physical Science-</p> <p>1. Motion- Velocity is the rate of change of position. Students should know:</p> <ul style="list-style-type: none"> a. position is defined in relation to a standard reference point and a set of directions. b. average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary. c. how to solve problems involving distance, time, and average speed. d. the velocity of an object must be described by specifying, both the direction and the speed of the object. <p>2. Forces- Unbalanced forces cause changes in velocity. Students should know that:</p> <ul style="list-style-type: none"> a. a force has both direction and magnitude. c. when the forces on an object are balanced, the motion of the object does not change. e. when the forces on an object are unbalanced, the object will change its velocity. f. the greater the mass of an object, the more force is needed to achieve the same rate of change in motion. <p>3. Structure of Matter- Each element has distinctive properties and an atomic number. Students should know:</p> <ul style="list-style-type: none"> a. the structure of the atom and know it is composed of protons, neutrons, and electrons. b. that compounds are formed by combining two or more different elements and that compounds have properties that are different from their constituent elements. d. the states of matter (solid, liquid, gas) depend on molecular motion. f. how to use the periodic table to identify elements in simple compounds. <p>4. Earth in the Solar System- Structure and composition of the universe. Students should know that:</p> <ul style="list-style-type: none"> a. galaxies are clusters of billions of stars and may be different shapes. b. the Sun is one of many stars in the Milky Way galaxy and that stars may differ in size temperature, and color. d. stars are the source of light for all bright objects in outer space and that the Moon and planets shine by reflected sunlight, not by their own light. <p>5. Reactions- Chemical reactions are atoms arranged into different combination. Students should know:</p> <ul style="list-style-type: none"> a. that reactant atoms and molecules interact to form 	<p>Earth's Place in the Universe- 27%</p> <p>1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. Students should know:</p> <ul style="list-style-type: none"> a. how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system. b. that evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago. c. that the evidence from geological studies of Earth and other planets suggests that the early Earth was very different from Earth today. d. the evidence indicating that the planets are much closer to Earth than the stars are. e. that the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium. f. the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth. <p>2. Astronomy reveals changes in the universe over time. To understand these concepts, students should know:</p> <ul style="list-style-type: none"> a. that the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years. b. that galaxies are made of billions of stars and comprise most of the visible mass of the universe. c. the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars. c. the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars. d. that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences. <p>Dynamic Earth Processes- 12%</p> <p>3. Plate tectonics- Students should know:</p> <ul style="list-style-type: none"> a. that features of the ocean floor provide evidence of plate tectonics. b. the principle structures that form at the three different kinds of plate boundaries. c. how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.

	<p>organ systems, and the whole organism.</p> <p>b. that organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.</p> <p>c. how bones and muscles work together to provide a structural framework for movement.</p> <p>g. how to relate the structures of the eye and ear to their functions.</p> <p>Physical Science-</p> <p>6. Physical principles underlie biological systems. Students should know that:</p> <p>b. that for an object to be seen, light emitted by or scattered from it must be detected by the eye.</p> <p>d. how simple lenses are used in a magnifying glass, the eye, a camera, a telescope, and a microscope.</p> <p>f. light can be reflected, refracted, transmitted, and absorbed by matter.</p>	<p>products with different chemical properties.</p> <p>b. that the idea of atoms explains the conservation of matter: in chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.</p> <p>6. Chemistry of Living Systems- Chemistry is the basis of biological systems. Students should know:</p> <p>a. that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.</p> <p>b. that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.</p> <p>7. Periodic Table- students should know that:</p> <p>a. how to identify regions corresponding to metals, nonmetals, and inert gases.</p> <p>b. each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different by specific number of neutrons in the nucleus.</p> <p>8. Density/Buoyancy- objects are buoyant immersed in fluid. Students should know:</p> <p>a. that density is mass per unit volume.</p> <p>b. how to calculate the density of substances (regular and irregular solids and liquids) from measurements of mass and volume.</p>	<p>d. why and how earthquakes occur and the scales used to measure intensity and magnitude.</p> <p>e. that there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.</p> <p>Energy in the Earth System- 20%</p> <p>4. Energy enters the earth as solar radiation and escapes as heat. To understand these concepts, students should know:</p> <p>a. the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.</p> <p>b. the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.</p> <p>c. the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.</p> <p>5. Heating of the earth's surface produces winds and currents. To understand these concepts, students should know:</p> <p>a. how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.</p> <p>b. the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.</p> <p>c. the origin and effects of temperature inversions.</p> <p>d. that properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.</p> <p>e. that rain forests and deserts on Earth are distributed in bands at specific latitudes.</p> <p>6. Climate is the long-term average of a region's weather and depends on many factors. To understand these concepts, students should know:</p> <p>a. that weather and climate involve the transfer of energy into and out of the atmosphere.</p> <p>b. the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.</p> <p>c. how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.</p> <p>Biogeochemical cycles- 10%</p> <p>7. Students should know:</p> <p>a. the carbon cycle of photosynthesis and respiration and the nitrogen cycle.</p> <p>b. the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.</p>
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Investigations and Experimentation	<p>7. Students will develop questions and perform investigations.</p> <p>a. Select and use appropriate tools and technology to perform tests, collect and display data.</p> <p>c. Communicate the logical connection among hypotheses, science concepts, test conducted, data collected, and conclusions drawn from scientific evidence.</p> <p>d. Construct models, and appropriately labeled diagrams to communicate scientific knowledge (e.g., cell structure).</p> <p>e. Communicate the steps and results from an investigation in written reports and oral presentations.</p>	<p>9. Students will develop questions and perform investigations.</p> <p>a. Plan and conduct a scientific investigation to test hypotheses.</p> <p>c. Distinguish between variable and controlled parameters in a test.</p> <p>e. Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.</p> <p>f. Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including $\text{speed} = \text{distance}/\text{time}$, $\text{density} = \text{mass}/\text{volume}$, $\text{force} = \text{pressure} \times \text{area}$, $\text{volume} = \text{area} \times \text{height}$).</p>	<p>Scientific progress is made by asking meaningful questions and conducting careful investigations- 15%</p> <p>To understand this students should be able to:</p> <p>a. select and use appropriate tools and technology to perform test, collect data, analyze relationships and display data.</p> <p>b. identify and communicate sources of unavoidable experimental error.</p> <p>c. identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.</p> <p>d. formulate explanations by using logic and evidence.</p> <p>e. solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.</p> <p>f. distinguish between hypothesis and theory as scientific terms.</p> <p>g. recognize the usefulness and limitations of models and theories as scientific representations of reality.</p> <p>h. read and interpret topographic and geologic maps.</p> <p>i. analyze the locations, sequences, or time intervals that are characteristic of natural phenomena such as the relative ages of rocks, locations of planets over time.</p> <p>n. know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent and that the theory is sometimes wrong.</p>