Mississippi Science

High School: Earth and Space Science

Adopted 2018

High School - Earth and Space Science

1. **Earth in the Universe** ESS.1

   1A. Students will develop an understanding of the universe, its development, immense size, and composition. ESS.1A

      1. Describe the Big Bang theory and summarize observations (e.g., cosmic microwave background radiation, Hubble's law, and redshift caused by the Doppler effect) as evidence to support the formation and expansion of the universe. ESS.1A.1
      2. Interpret information from the Hertzsprung -Russell diagram to differentiate types of stars, including our sun, according to size, magnitude, and classification. ESS.1A.2
      3. Organize and interpret data sets for patterns and trends to compare and contrast stellar evolution in order to explain and communicate how a star changes during its life. ESS.1A.3
      4. Research and explain how nuclear fusion in stars and supernova lead to the formation of all other elements. ESS.1A.4

   1B. Students will develop an understanding of Earth, the solar system, and the laws that predict the motion of celestial bodies. ESS.1B

      1. Read and evaluate scientific information for mechanisms/results (e.g., the solar nebular theory) to explain how the solar system was formed. Cite evidence and develop a logical argument. ESS.1B.1
      2. Compare and contrast celestial bodies (e.g., planets, natural satellites, comets, asteroids, and the Oort cloud) and their motion in our solar system (e.g., revolution and rotation). Build an Analemma calendar. ESS.1B.2
      3. Design a model (e.g., a gravity simulation using PVC and a neoprene screen) to demonstrate Kepler's laws and the relationships of the orbits of objects in our solar system. Relate them to Newton's law of universal gravitation and laws of motion. ESS.1B.3

2. Earth Structure and History ESS.2

2A. Students will develop an understanding of the structure and composition of Earth and its materials. ESS.2A

1. Analyze and interpret data to explain and communicate the differentiation of Earth's internal chemical structure (e.g., core, mantle, and crust) using the production of internal heat from the radioactive decay of unstable isotopes and gravitational energy. ESS.2A.1
2. Analyze and interpret data to explain and communicate the differentiation of Earth's physical divisions (e.g., lithosphere and asthenosphere) using data from seismic waves and Earth's magnetic field. ESS.2A.2
3. Investigate the physical and/or chemical characteristics of mineral specimens to identify minerals and mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, and phosphates). Include the relationship between chemical bonds, chemical formulas, mineral use, and mineral properties. ESS.2A.3
4. Investigate the physical and/or chemical characteristics of rock specimens to identify and categorize igneous, sedimentary, and metamorphic rocks. Include the processes that generate the transformation of rocks. ESS.2A.4

2B. Students will develop an understanding of the history and evolution of the earth. ESS.2B

1. Research, analyze, and evaluate the contributions of William Smith, James Hutton, Nicolaus Steno, Charles Lyell, and others to physical geology. ESS.2B.1
2. Apply different techniques (e.g., superposition, original horizontality, cross-cutting relationships, lateral continuity, principle of inclusions, fossil succession, and unconformities) to analyze and interpret the relative age of actual sequences, models, or photographs. ESS.2B.2
3. Use mathematical concepts to calculate the absolute age of earth materials using actual or simulated isotope ratios. ESS.2B.3
4. Research, analyze, and explain the origin of geologic features and processes that result from plate tectonics, including sea floor spreading, earthquake activity, volcanic activity, mountain building, and location of natural resources. ESS.2B.4
5. Use mathematical representations to interpret seismic graphs to triangulate the location of an earthquake's epicenter and magnitude and to correlate the frequency and magnitude of an earthquake. ESS.2B.5
6. Plan and conduct a scientific investigation to determine how factors (e.g., wind velocity, water velocity, ice, and temperature) may affect the rate of weathering. ESS.2B.6
7. Enrichment: Use an engineering design process to design a model to simulate the formation of caves and karst topography by groundwater. ESS.2B.7

3. **Earth's Systems and Cycles** ESS.3

3A. Students will develop an understanding of Earth's systems and cycles. ESS.3A

1. Use mathematical representations (e.g., latitude, longitude, and maps) to calculate the angle of noon solar incidence and relate the value to day length, distribution of sunlight, and seasonal change. ESS.3A.1
2. Enrichment: Use an engineering design process to explore the concepts of passive solar architecture to design a structure that best utilizes solar incidence. ESS.3A.2
3. Explain how temperature and density of ocean water influence circulation. ESS.3A.3
4. Research and communicate information to explain the importance of the transfer of thermal energy among the hydrosphere, geosphere, and atmosphere. Include the unique physical and chemical properties of water, the water cycle, and energy transfer within the rock cycle. ESS.3A.4
5. Analyze and interpret weather data using maps and global weather systems to explain and communicate the relationships among air masses, pressure systems, and frontal boundaries. ESS.3A.5
6. Construct an explanation from data sets to obtain and evaluate scientific information to construct scientific arguments on changes in climate caused by various natural factors (e.g., plate tectonics and continent location and Milankovitch cycles) versus anthropogenic factors (e.g., fossil fuel use and agricultural factors). ESS.3A.6
7. Cite evidence and develop logical arguments to identify the cause and effect relationships of the evolutionary milestones (e.g., photosynthesis and the atmosphere, the evolution of multicellular animals, the development of shells, and the colonization of terrestrial environments by plants and animals) that most profoundly shaped Earth's systems. ESS.3A.7
8. Analyze and interpret the record of shared ancestry, evolution, and extinction as related to natural selection using fossils. ESS.3A.8

4. **Earth's Resources and Human Activity** ESS.4

   4A. Students will develop an understanding of Earth's resources and the impact of human activities. ESS.4A

      1. Research, evaluate, and communicate about how human life on Earth shapes Earth's systems and responds to the interaction of Earth's systems (e.g., geosphere, hydrosphere, atmosphere, and biosphere). Examine how geochemical and ecological processes interact through time to cycle matter and energy and how human activity alters the rates of these processes. ESS.4A.1

      2. Research, assess, and communicate how Earth's systems influence the distribution of life, including how various natural hazards and geologic events (e.g., volcanic eruptions, earthquakes, landslides, tornadoes, and hurricanes) have shaped the course of human history. ESS.4A.2

      3. Analyze earthquake and volcanic data to determine patterns that can lead to predicting such hazards and mitigating impact to humans. ESS.4A.3

      4. Enrichment: Use an engineering design process to research, develop, and test models to aid in the responsible management of natural resources (e.g., recycling, composting, and energy usage). ESS.4A.4

      5. Enrichment: Research and communicate regarding geoscience career options (e.g., geologist, petroleum engineer, meteorologist, paleontologist, astronomer, and oceanographer. ESS.4A.5