

Howard County Public School System

Essential Curriculum for Middle School Science

(Adapted from the Maryland Voluntary State Curriculum for Science 6-8)

GRADE 6

Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.

Unit I: Investigating Weather

Goal 1. Cite evidence to explain the relationship between the hydrosphere and atmosphere.

- a. Describe the composition of the atmosphere and hydrosphere.
 - Define and describe the hydrosphere.
 - Recognize and describe the function of the layers of Earth’s atmosphere.
 - Describe the relationship between the composition of the troposphere and Earth’s weather.
- b. Recognize and describe the water cycle as the distribution and circulation of Earth’s water through precipitation, glaciers, surface water, groundwater, oceans, and atmosphere.
 - Identify the various stages and paths of the water cycle (such as rain, snow, glaciers, rivers, and groundwater).
 - Describe the state of matter based on observable properties.
 - Name and describe state changes (melting, freezing, evaporating, condensing).
 - Describe cloud formation using the stages of the water cycle (condensation, evaporation, precipitation).
 - Identify and compare the physical properties of fresh water and salt water.
 - Compare the relative densities associated with fresh water, salt water, and ice. [G/T]
 - Analyze the impact of an imbalance in the water cycle on the local environment (salinity, drought, flood, farming). [G/T]
- c. Identify and describe how the temperature and precipitation in a geographic area are affected by surface features and changes in atmospheric and ocean content.
 - Relative location of mountains
 - Volcanic eruptions
 - Proximity to large bodies of water
 - Heat energy of ocean currents

Goal 2. Identify and describe the atmospheric and hydrospheric conditions related to weather systems.

- a. Identify the observable or measurable elements of weather: air temperature, air pressure, atmospheric pressure, relative humidity, wind direction, wind speed, cloud type, and cloud cover.
- b. Measure temperature accurately using a Celsius thermometer.

- c. Explain the relationship between cloud type and cloud cover and weather conditions.
- d. Identify and describe weather patterns associated with high and low pressure systems and frontal systems.
 - Based on observable phenomena, describe conduction and convection.
 - Based on observable phenomena, describe that radiation does not require matter to transfer heat energy.
 - Apply the concept of heat transfer to everyday situations related to weather.
 - Explain how relative differences in convection affect air pressure. [G/T]
 - Interpret weather symbols and graphic images. [G/T]
- e. Identify and describe the atmospheric and hydrospheric conditions associated with the formation and development of hurricanes, tornadoes, and thunderstorms.
- f. Identify and describe how various tools (barometer, thermometer, anemometer, psychrometer) are used to collect weather data and forecast weather conditions.
 - Recognize and explain that forecast models or simulations vary in their reliability.
 - Use various sources of authentic weather data (such as satellite images, weather stations, web-based sources and newspapers) to identify the stages in the development of weather phenomenon such as hurricanes and nor'easters.
 - Analyze, summarize, and explain, given a set of real-life data, the data essential to predicting local weather events and large-scale phenomena. [G/T]

Unit II: Investigating Geologic Processes

Goal 1. Recognize and describe the internal and external structure of the Earth.

- a. Recognize and describe that the Earth's mantle:
 - Lies between the core and the crust.
 - Is very hot.
 - Has properties of both solids and liquid.
- b. Recognize and describe that the Earth's core:
 - Is at the center of the Earth.
 - Is very hot.
 - Is dense and metallic.
- c. Identify and describe the Earth's crust:
 - The solid crust consists of separate plates.
 - The plates constantly move at a slow pace in different directions.
 - The plates interact with one another as a result of plate motion
 - Plate interaction creates land features such as volcanoes, mountains, rift valleys, etc.
- d. Relate the movement of magma to movement to temperature and density differences.
- e. Illustrate how convection currents in the mantle cause crustal movement. [G/T]

Goal 2. Recognize and explain how major geologic events are a result of the movement of Earth's crustal plates.

- a. Recognize and describe the evidence for plate movement.
 - Shape of continents.
 - Continuity of geologic features and fossils on the continents.
 - Ocean rifts, seafloor spreading.
 - Global patterns of earthquakes and volcanoes.
- b. Recognize and explain that major geologic events (earthquakes, volcanic activity, sea floor

spreading) occur along crustal plate boundaries.

Goal 3. Differentiate among sedimentary, igneous, and metamorphic rocks based upon the processes by which they are formed.

- a. Identify and describe the processes that form sedimentary rock.
 - Deposition
 - Compaction
 - Cementation
- b. Identify and describe the processes that form igneous rocks.
 - Volcanic eruptions
 - Igneous intrusions
- c. Identify and describe the processes that form metamorphic rocks.
 - High temperature
 - Pressure
- d. Cite features that can be used as evidence to distinguish among the three types of rocks and relate these features to the processes that form each rock type.
 - Classify examples of the three rock types.
- e. Describe the processes that change one form of rock into another (rock cycle).

Goal 4. Explain how sedimentary rock is formed periodically, embedding plant and animal remains and leaving a record of the sequence in which the plants and animals appeared and disappeared.

- a. Explain how sedimentary rock buried deep enough may be reformed by pressure and heat and these re-formed rock layers may be forced up again to become land surface and even mountains.
- b. Cite evidence to confirm that thousands of layers of sedimentary rock reveal the long history of the changing surface of the Earth.
 - Use the Law of Superposition and the placement of a fossil in a layer of sedimentary rock to determine the relative age of the rock layer.
 - Analyze a cross section of rock layers that has undergone significant change to determine the relative age of fossils in the rock layers.
- c. Explain why some fossils found in the top layers of sedimentary rock are older than those found beneath in lower layers.
 - Folding
 - Breaking
 - Uplift
 - Faulting
 - Tilting

Goal 5. Recognize and explain that fossils found in layers of sedimentary rock provide evidence of changing life forms.

- a. Recognize how different types of fossils are formed, such as petrified remains, imprints, molds, and casts.
- b. Recognize and explain that the fossil record of plants and animals describes changes in life forms over time.

Unit III: Investigating Earth Systems

- Goal 1. Cite evidence to demonstrate and explain that physical weathering and chemical weathering cause changes to Earth materials.**
- a. Identify examples of physical weathering, such as the effect of wind, ice, etc. and describe the changes caused in each.
 - b. Describe the changes in materials caused by each of the chemical weathering processes listed:
 - Rusting/tarnishing
 - Dissolving by acid rain
 - Oxidation.
 - c. Compare physical and chemical weathering and provide examples of changes caused in Earth materials or features by each of these processes.
 - Describe weathering and erosion as destructive processes that slowly change landforms.
 - Describe landslides, earthquakes, volcanoes, and tsunamis as destructive processes that rapidly change landscapes.
 - Describe rock formation, volcanic eruptions, and deposition of sediments as constructive processes that change landforms.
 - Investigate how glaciers, moving water, and wind can be agents of weathering, erosion, and deposition.
 - Predict how a combination of slow and rapid processes might cause changes in landforms over time.
 - Interpret the effects of geologic processes on human activity. (i. e., Assateague Island, Bethany Beach, Chesapeake Bay) [G/T]
- Goal 2. Recognize and describe the various factors that affect climate.**
- a. Identify and describe how the temperature and precipitation of an area are affected by surface and ocean features.
 - Relative location of mountains
 - Proximity to large bodies of water
 - Warm and cold ocean currents
 - b. Explain the effects of ocean temperatures on climate and the atmosphere.
 - c. Explain how topography (such as mountains, glaciers, and lakes) affects Earth's climate.
 - d. Explain the effect of latitude on climate.
 - e. Recognize and describe how the tilt of Earth's axis affects the climate in Maryland.
 - f. Recognize and describe the global effects of volcanic eruptions, greenhouse gases, and El Nino.
 - g. Recognize and explain how human activities can accelerate or magnify many naturally occurring changes in climates now and in the future.
 - h. Compare the water cycle in different regions of the world (i. e., Saharan Africa, rainforest, Chesapeake Bay).
- Goal 3. Recognize and describe that environmental changes can have local, regional, and global consequences.**
- a. Identify and describe local, regional, or global environmental issues.
 - b. Identify and describe that different individuals or groups are affected by an issue in different ways.

- Goal 4. Recognize and explain how human activities can accelerate or magnify many naturally occurring changes.**
- a. Based on data from research identify and describe how natural processes change the environment.
 - Sedimentation in watersheds
 - Cyclic climate change
 - b. Identify and describe how human activities produce changes in natural processes.
 - Climate change
 - Cycling of matter
- Goal 5. Recognize and compare how different parts of the world have varying amounts and types of natural resources and how the use of those resources impacts environmental quality.**
- a. Identify and describe natural resources as:
 - Land
 - Water
 - Wind
 - Fossil fuels
 - Minerals.
 - b. Identify and describe the distribution of natural resources around the Earth.
 - c. Identify and describe how the natural change processes may be affected by human activities.
 - Agriculture
 - Beach preservation
 - Mining
 - Development/construction
 - Stream/river alteration
 - d. Identify and describe problems associated with obtaining, using, and distributing natural resources.
 - e. Identify possible solutions to problems associated with obtaining, using, and distributing natural resources.
- Goal 6. Recognize and explain the impact of a changing human population on the use of natural resources and on environmental quality.**
- a. Differentiate between renewable and nonrenewable resources.
 - b. Identify the environmental problems associated with the use of resources, specifically soil erosion, water pollution, and deforestation.
 - c. Based on data identify and describe the positive and negative impacts of an increasing human population on the use of natural resources.
 - d. Recognize and describe the decreasing dependence on local resources due to the impact of available transportation.
- Goal 7. Recognize and explain that human-caused changes have consequences for Maryland's environment as well as for other places and future times.**
- a. Identify and describe a range of local issues that have an impact on people in other places.
 - Air pollution
 - Water pollution
 - Trash

- b. Recognize and describe how environmental change in one part of the world can have consequences for other parts of the world.
- c. Identify and describe that ecosystems can be impacted by human activities.
 - Protection of the Chesapeake Bay watershed
 - Resource acquisition and use
 - Land use decisions (agriculture, mining, and development)
 - Recycling
 - Use and disposal of toxic substances

Unit IV: Investigating the Solar System

Goal 1. Recognize that objects of our solar system are interrelated.

- a. Recognize that Earth and its closest star, the sun, are part of a disk-shape galaxy of stars and that our galaxy is one of billions of galaxies.
- b. Describe the characteristics of our Sun.
- c. Construct models with accurate scales that represent the position of the Earth relative to the Sun and to other planets.
- d. Measure a distance accurately using a meter stick.
- e. Identify and describe the general pattern of movement of all objects in our solar system.
- f. Recognize that the pull of gravity causes the pattern of motion of celestial objects such as planets, moons, comets, asteroids, and meteors.

Goal 2. Identify and describe the components of the universe.

- a. Recognize that a galaxy contains billions of stars that cannot be distinguished by the unaided eye because of their great distance from Earth, and that there are billions of galaxies.
- b. Identify that our solar system is a component of the Milky Way Galaxy.
- c. Identify and describe the various types of galaxies.
- d. Identify and describe the type, size, and scale, of the Milky Way Galaxy.

Goal 3. Identify and explain celestial phenomena using the regular and predictable motion of objects in the solar system.

- a. Identify and describe the relationships among the period of revolution of a planet, the length of its solar year, and its distance from the sun.
- b. Identify and explain the relationship between the rotation of a planet or moon on its axis and the length of the solar day for that celestial object.
- c. Identify and explain the cause of the phases of the moon.
- d. Describe how lunar and solar eclipses occur.
- e. Demonstrate the arrangement of the Sun, Moon, and Earth during solar and lunar eclipses.
- f. Identify and describe how the shape and location of the orbits of asteroids and comets affect their periods of revolution.
- g. Compare the movements of the planets of the Solar System and explain the environmental differences that results from them (length of day and year, seasons, tidal forces).

Goal 4. Recognize and explain how the force of gravity causes the tides.

- a. Identify and describe the cause of high and low tides.

- b. Relate the pattern of daily high and low tides to the relative positions of Earth, Moon, and Sun.

Goal 5. Recognize and explain the effects of the tilt of Earth's axis.

- a. Recognize and describe that Earth's axis is tilted about 23° from vertical with respect to the plane of its orbit and points in the same direction during the year.
- b. Recognize and describe that the tilt of Earth's axis causes.
 - Changes in the angle of the sun in the sky during the year
 - Seasonal differences in the northern and southern latitudes
 - Changes in the length of daylight
- c. Define solstices and equinoxes.
- d. Investigate the effects of Earth's tilt on the amount of sunlight received. [G/T]