

Middle School Curriculum Standards: Earth Science

Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

Key Idea 1:

The Earth and celestial phenomena can be described by principles of relative motion and perspective.

The universe is comprised of a wide array of objects, a few of which can be seen by the unaided eye. Others can only be observed with scientific instruments. These celestial objects, distinct from Earth, are in motion relative to Earth and each other. Measurements of these motions vary with the perspective of the observer. Cyclical changes on Earth are caused by interactions among objects in the universe.

PERFORMANCE INDICATOR 1.1

Explain daily, monthly, and seasonal changes on Earth.

Major Understandings:

1.1a Earth's Sun is an average-sized star. The Sun is more than a million times greater in volume than Earth.

1.1b Other stars are like the Sun but are so far away that they look like points of light. Distances between stars are vast compared to distances within our solar system.

1.1c The Sun and the planets that revolve around it are the major bodies in the solar system. Other members include comets, moons, and asteroids. Earth's orbit is nearly circular.

1.1d Gravity is the force that keeps planets in orbit around the Sun and the Moon in orbit around the Earth.

1.1e Most objects in the solar system have a regular and predictable motion. These motions explain such phenomena as a day, a year, phases of the Moon, eclipses, tides, meteor showers, and comets.

1.1f The latitude/longitude coordinate system and our system of time are based on celestial observations.

1.1g Moons are seen by reflected light. Our Moon orbits Earth, while Earth orbits the Sun. The Moon's phases as observed from Earth are the result of seeing different portions of the lighted area of the Moon's surface. The phases repeat in a cyclic pattern in about one month.

1.1h The apparent motions of the Sun, Moon, planets, and stars across the sky can be explained by Earth's rotation and revolution. Earth's rotation causes the length of one day to be approximately 24 hours. This rotation also causes the Sun and Moon to appear to rise along the eastern horizon and to set along the western horizon. Earth's revolution around the Sun defines the length of the year as $365 \frac{1}{4}$ days.

1.1i The tilt of Earth's axis of rotation and the revolution of Earth around the Sun cause seasons on Earth. The length of daylight varies depending on latitude and season.

1.1j The shape of Earth, the other planets, and stars is nearly spherical.

Key Idea 2:

Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

Students should develop an understanding of Earth as a set of closely coupled systems. The concept of systems provides a framework in which students can investigate three major interacting components: lithosphere, hydrosphere, and atmosphere. Processes act within and among the three components on a wide range of time scales to bring about continuous change in Earth's crust, oceans, and atmosphere.

PERFORMANCE INDICATOR 2.1 Explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact, evolve, and change.

Major Understandings:

2.1a Nearly all the atmosphere is confined to a thin shell surrounding Earth. The atmosphere is a mixture of gases, including nitrogen and oxygen with small amounts of water vapor, carbon dioxide, and other trace gases. The atmosphere is stratified into layers, each having distinct properties. Nearly all weather occurs in the lowest layer of the atmosphere.

2.1b As altitude increases, air pressure decreases.

2.1c The rock at Earth's surface forms a nearly continuous shell around Earth called the lithosphere.

2.1d The majority of the lithosphere is covered by a relatively thin layer of water called the hydrosphere.

2.1e Rocks are composed of minerals. Only a few rock-forming minerals make up most of the rocks of Earth. Minerals are identified on the basis of physical properties such as streak, hardness, and reaction to acid.

2.1f Fossils are usually found in sedimentary rocks. Fossils can be used to study past climates and environments.

2.1g The dynamic processes that wear away Earth's surface include weathering and erosion.

2.1h The process of weathering breaks down rocks to form sediment. Soil consists of sediment, organic material, water, and air.

2.1i Erosion is the transport of sediment. Gravity is the driving force behind erosion. Gravity can act directly or through agents such as moving water, wind, and glaciers.

2.1j Water circulates through the atmosphere, lithosphere, and hydrosphere in what is known as the water cycle.

PERFORMANCE INDICATOR 2.2

Describe volcano and earthquake patterns, the rock cycle, and weather and climate changes.

Major Understandings:

- 2.2a The interior of Earth is hot. Heat flow and movement of material within Earth cause sections of Earth's crust to move. This may result in earthquakes, volcanic eruption, and the creation of mountains and ocean basins.
- 2.2b Analysis of earthquake wave data (vibrational disturbances) leads to the conclusion that there are layers within Earth. These layers—the crust, mantle, outer core, and inner core—have distinct properties.
- 2.2c Folded, tilted, faulted, and displaced rock layers suggest past crustal movement.
- 2.2d Continents fitting together like puzzle parts and fossil correlations provided initial evidence that continents were once together.
- 2.2e The Theory of Plate Tectonics explains how the “solid” lithosphere consists of a series of plates that “float” on the partially molten section of the mantle. Convection cells within the mantle may be the driving force for the movement of the plates.
- 2.2f Plates may collide, move apart, or slide past one another. Most volcanic activity and mountain building occur at the boundaries of these plates, often resulting in earthquakes.
- 2.2g Rocks are classified according to their method of formation. The three classes of rocks are sedimentary, metamorphic, and igneous. Most rocks show characteristics that give clues to their formation conditions.
- 2.2h The rock cycle model shows how types of rock or rock material may be transformed from one type of rock to another.
- 2.2i Weather describes the conditions of the atmosphere at a given location for a short period of time.
- 2.2j Climate is the characteristic weather that prevails from season to season and year to year.
- 2.2k The uneven heating of Earth's surface is the cause of weather.
- 2.2l Air masses form when air remains nearly stationary over a large section of Earth's surface and takes on the conditions of temperature and humidity from that location. Weather conditions at a location are determined primarily by temperature, humidity, and pressure of air masses over that location.
- 2.2m Most local weather condition changes are caused by movement of air masses.
- 2.2n The movement of air masses is determined by prevailing winds and upper air currents.
- 2.2o Fronts are boundaries between air masses. Precipitation is likely to occur at these boundaries.
- 2.2p High-pressure systems generally bring fair weather. Low-pressure systems usually bring cloudy, unstable conditions. The general movement of highs and lows is from west to east across the United States.

**PERFORMANCE
INDICATOR 2.2**

continued

2.2q Hazardous weather conditions include thunderstorms, tornadoes, hurricanes, ice storms, and blizzards. Humans can prepare for and respond to these conditions if given sufficient warning.

2.2r Substances enter the atmosphere naturally and from human activity. Some of these substances include dust from volcanic eruptions and greenhouse gases such as carbon dioxide, methane, and water vapor. These substances can affect weather, climate, and living things.

Key Idea 3:

Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Objects in the universe are composed of matter. Matter is anything that takes up space and has mass. Matter is classified as a substance or a mixture of substances. Knowledge of the structure of matter is essential to students' understanding of the living and physical environments. Matter is composed of elements which are made of small particles called atoms. All living and nonliving material is composed of these elements or combinations of these elements.

**PERFORMANCE
INDICATOR 3.1**

Observe and describe properties of materials, such as density, conductivity, and solubility.

Major Understandings:

3.1a Substances have characteristic properties. Some of these properties include color, odor, phase at room temperature, density, solubility, heat and electrical conductivity, hardness, and boiling and freezing points.

3.1b Solubility can be affected by the nature of the solute and solvent, temperature, and pressure. The rate of solution can be affected by the size of the particles, stirring, temperature, and the amount of solute already dissolved.

3.1c The motion of particles helps to explain the phases (states) of matter as well as changes from one phase to another. The phase in which matter exists depends on the attractive forces among its particles.

3.1d Gases have neither a determined shape nor a definite volume. Gases assume the shape and volume of a closed container.

3.1e A liquid has definite volume, but takes the shape of a container.

3.1f A solid has definite shape and volume. Particles resist a change in position.

3.1g Characteristic properties can be used to identify different materials, and separate a mixture of substances into its components. For example, iron can be removed from a mixture by means of a magnet. An insoluble substance can be separated from a soluble substance by such processes as filtration, settling, and evaporation.

3.1h Density can be described as the amount of matter that is in a given amount of space. If two objects have equal volume, but one has more mass, the one with more mass is denser.

3.1i Buoyancy is determined by comparative densities.