



## Science

The science standards at the middle school build upon the foundation for students to work as scientists by asking testable questions, collecting and analyzing different types of evidence, and by providing rationale for their interpretations through reasoning and/or argumentation. Mastery of these standards will result in students deepening their understanding of science through an application and development of scientific knowledge to the solution of practical problems. Students will experience all three “strands” of the science standards during their secondary years: physical science, life science, and earth science. The evidence outcomes in middle school blend the core ideas they learn the course with scientific and engineering practices and crosscutting concepts to support students in developing usable knowledge across three science disciplines. Students will address the following over the course of their Middle School science experience:

- **Physical Science:** Grade level expectations in middle school physical science are focused in four areas: (1) Matter and its interactions, (2) Motion and Stability: Forces and Interactions, (3) Energy, (4) Waves and Their Applications in Technologies for Information Transfer.
- **Life Science:** Grade level expectations in middle school life science are focused in four areas: 1) From Molecules to Organisms: Structures and Processes, 2) Ecosystems: Interactions, Energy, and Dynamics, 3) Heredity: Inheritance and Variation of Traits, 4) Biological Evolution: Unity and Diversity.
- **Earth and Space Science:** Grade level expectations in middle school Earth and Space Science are focused in three areas: (1) Earth’s Place in the Universe, (2) Earth’s Systems, (3) Earth and Human Activity.

### Expectations for Students in Physical Science:

- Recognize that matter is composed of atoms and molecules, and that an understanding of the properties of atoms can be used to explain the properties of substances and diversity of materials we engage with on a daily basis.
- Understand how reacting substances rearrange to form new substances, and that through the process matter is

### When Studying Physical Science You May Find Students:

- Developing models to describe the atomic composition of simple molecules and extended structures like water, table salt, and other common substances.
- Analyzing and interpreting data from various sources,

conserved. Recognize that some reactions release energy and others absorb energy.

- Explain how motion is described and how the mass and force influence motion, as part of this analyze interactions and energy transfer between two objects in motion.
- Understand that forces, like gravity, that act a distance can be explained by force fields that extend through space and that their impact on objects can be analyzed.
- Recognize that kinetic energy, the energy of motion, can be distinguished from the various forms of potential (stored) energy, and explain how changes in energy forms can be tracked through physical or chemical interactions. Explore the relationship between the temperature and the total energy of a system.
- Explore the properties of waves, and understand how waves transmit energy, and gather information about technology that transmit information as wave pulses. This model can explain many phenomena which include light and sound.

### **Expectations for Students in Life Science:**

- Recognize that all living things are made of cells, and that sustaining life requires substantial energy and matter inputs. Describe how sense receptors respond to different stimuli, and how they transmit signals to the brain.
- Understand that organisms reproduce and transfer their genetic information to their offspring, and that there are processes by which characteristics or traits are passed from one generation to another.
- Recognize that ecosystems are dynamic in nature, and are sustained by a continuous flow of energy that originates primarily from the sun. Analyze how organisms and populations of plants and animals in ecosystems are dependent on environmental interactions with living and nonliving things, and that variations in populations of

including hands on labs, to determine if a chemical reaction has occurred.

- Developing models that demonstrate understanding of the relationship between temperature and particle motion or wave transmission through various materials.
- Planning investigations to provide evidence about the impact of force and mass on an object's motion; constructing and testing a device that can keep an object hot or cold for extended periods of time.
- Constructing and presenting arguments using evidence to support claims around the interaction between mass and gravitational force.

### **When Studying Life Science You May Find Students:**

- Gathering information and conducting investigations to support explanations about the structure and function relationship of cells, the role of cells in body systems, and to understand how these systems work to support life.
- Constructing an explanation and reasoning mathematically to determine how environmental and genetic factors affect the growth of organisms. They can connect this to understand the role animal behavior (e.g., nest building), specialized plant structures (e.g., bright colors in flowers to attract bees) and adaptation play in reproduction.
- Constructing explanations based on evidence (e.g., fossil records, complexity of anatomical traits, etc.) to support fundamental understandings of natural selection and evolution. Students will use ideas of genetic variation in a

organisms is beneficial for their survival and reproduction in an environment.

- Describe how fossils and fossil records can be used to understand the changes that have occurred over time.

population to make sense of organisms surviving and reproducing, hence passing on the traits of the species.

- Applying multiple practices to gain a deeper understanding of natural resources and the cycling of matter and the flow of energy in ecosystems. Studying patterns of the interactions among organisms within an ecosystem and examining the impact that shifts in biotic and abiotic factors have on the populations of organisms.
- Evaluating competing design solutions for maintaining biodiversity and ecosystem services like water purification, recycling, or prevention of erosion.

### **Expectations for Students in Earth and Space Science: When Studying Earth and Space Science You May**

- Understand that we can use models of our solar system to predict eclipses, lunar phases, and seasons. Analyze how gravity plays a role in how objects in our solar system interact with each other.
- Examine how we can use rock strata and the fossil record to organize the relative order of historical events in Earth's history.
- Recognize that plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history.
- Understand energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Study the water cycle, and how changes the properties of water and movement of water impact Earth's systems.
- Describe the complex interactions that determine local weather patterns and influence climate, including the role of the ocean.
- Describe how humans depend on the Earth for different resources, and analyze how human activities have impacted Earth's biosphere and climate. Map the history of natural hazards in a region and understand related

### **Find Students:**

- Developing models to examine the Earth's place in relation to the solar system, the Milky Way galaxy, and universe. Using models of the solar system to explain astronomical and other observations of the cyclic patterns of eclipses, tides, and seasons.
- Developing models to describe the cycling of water through Earth's systems and to describe the processes that determine regional climates.
- Constructing explanations based on evidence for how geoscience processes (e.g., earthquakes, volcanoes, etc.) have changed Earth's surface.
- Analyzing and interpreting data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Constructing an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems, and applying scientific principles to design a method for minimizing human impact on the environment.

- geological forces.
- Evaluate ways to reduce the impact of global warming.