Arizona Science Standards - 6th Grade

Three Dimensions of Science

Sensemaking in science occurs with the integration of three essential dimensions.

Science and Engineering Practices

- ask questions and define problems
- develop and use models
- plan and carry out investigations
- analyze and interpret data
- use mathematics and computational thinking
- construct explanations and design solutions
- engage in argument from evidence
- obtain, evaluate, and communicate information

Crosscutting Concepts

- patterns
- cause and effect
- structure and function
- systems and system models
- stability and change
- scale, proportion, and quantity
- energy and matter

Core Ideas

Core Ideas for Knowing Science

Physical Science

P1: All matter in the Universe is made of very small particles.
P2: Objects can affect other objects at a distance.
P3: Changing the movement of an object requires a net force to be acting on it.
P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

Earth and Space Science

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.
E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

Life Science

L1: Organisms are organized on a cellular basis and have a finite life span.
L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
L3: Genetic information is passed down from one generation of organisms to another.
L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

Core Ideas for Using Science

U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

Life Science Standards

Students develop an understanding of the flow of energy in a system beginning with the Sun to and among organisms They also understand that plants and animals (including humans) have specialized internal and external structures and can respond to stimuli to increase survival.

6.L2U3.11	Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.
6.L2U3.12	Engage in argument from evidence to support a claim about the factors that cause species to change and how humans can impact those factors.
6.L2U1.13	Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.
6.L2U1.14	Construct a model that shows the cycling of matter and flow of energy in ecosystems.

Key Crosscutting Concepts in 6th Grade
Patterns; *Cause and Effect;* ***Scale, Proportion and Quantity***; ***Systems and System Models; Energy and Matter***; *Structure and Function; Stability and Change*

Phenomena are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions).

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Released 11/03/2022

ARIZONA Department of Education

Physical Science Standards

Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.

6.P1U1.1	Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).
6.P1U1.2	Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter.
6.P1U1.3	Develop and use models to represent that matter is made up of smaller particles called atoms.
6.P2U1.4	Develop and use a model to predict how forces act on objects at a distance.
6.P4U2.5	Analyze how humans use technology to store (potential) and/or use (kinetic) energy.

Earth and Space Science Standards

Students develop an understanding of how the Sun provides light and energy for Earth systems.

6.E1U1.6	Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.
6.E2U1.7	Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system.
6.E2U1.8	Develop and use models to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.
6.E2U1.9	Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.
6.E2U1.10	Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.

Arizona Science Standards - 6th Grade

Core Ideas for Knowing Science: Elements for Physical, Earth & Space, and Life Science Standards

Elements of Physical Science Standards

6.P1U1.1 Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).

- The particles are not static but move in random directions. The speed at which they move is experienced as the temperature of the material.
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with each other; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and vibrate in position but do not change relative locations.

6.P1U1.2 Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter.

- The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter.

Boundary: Predictions here are qualitative, not quantitative.

6.P1U1.3 Develop and use models to represent that matter is made up of smaller particles called atoms.

- All materials, anywhere in the universe, living and nonliving, are made of a very large numbers of basic "building blocks" called atoms, of which there are about 100 different kinds.
- The behavior and arrangement of the atoms explains the properties of different materials.

6.P2U1.4 Develop and use a model to predict how forces act on objects at a distance.

- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass.
- Forces that act at a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). (7.P2U1.2)

Note: Gravitational force is a suggested focus for 6th grade; It is suggested that all 3 forces be focused on in 7th grade.

6.P4U2.5 Analyze how humans use technology to store (potential) and/or use (kinetic) energy.

- Objects can have stored energy (that is, the ability to make things change) either because of their chemical composition, their movement, their temperature, their position in a gravitational or other field.
- Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
- A system of objects may also contain stored (potential) energy, depending on their relative positions.

Elements of Earth and Space Science Standards

6.E1U1.6 Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.

- The radiation from the Sun absorbed by the Earth warms the surface which then emits radiation of longer wavelength (infrared) that does not pass through the atmosphere but is absorbed by it, keeping the Earth warm.
- Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating Earth's average surface temperature and keeping it habitable.

6.E2U1.7 Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system.

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

Note: Utilize the Crosscutting Concept Scale, Proportion, and Quantity 6-8 elements when teaching this standard.

6.E2U1.8 Develop and use models to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.

- Patterns of the apparent motion of the Sun, the Moon, and stars in the sky can be observed, described, and explained with models. (6.E2U1.9) (6.E2U1.10)

6.E2U1.9 Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.

- Patterns of the apparent motion of the Sun, the Moon, and stars in the sky can be observed, described, and explained with models. (6.E2U1.8) (6.E2U1.10)
- A model of the solar system can explain tides and eclipses of the sun and the moon.

6.E2U1.10 Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.

- Patterns of the apparent motion of the Sun, the Moon, and stars in the sky can be observed, described, and explained with models. (6.E2U1.8) (6.E2U1.9)
- Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

The elements are not to be used as a check-off list, but rather a useful tool to help educators identify the specific pieces of knowledge and skill that make up the practice, crosscutting concept, or core idea at that grade-band.

Elements of Life Science Standards

6.L2U3.11 Use evidence to construct an argument regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.

- Human activity which controls the growth of certain plants and animal changes an ecosystem.
- In any given ecosystem there is competition among species for the energy resources and the materials they need to live. The persistence of an ecosystem depends on the continued availability in the environment of these energy resources and materials.
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. (6.L2U3.12) Note: Supports the 8th grade standard, 8.E1U3.8.
- Changes to Earth's environments can have different impacts (negative and positive) for different living things. *Note: Supports the 8th grade standard, 8.E1U3.8.*

6.L2U3.12 Engage in argument from evidence to support a claim about the factors that cause species to change and how humans can impact those factors.

- Ecosystems are dynamic in nature, their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. (6.L2U3.11) *Note: Supports the 8th grade standard, 8.E1U3.8.*

6.L2U1.13 Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.

- Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

6.L2U1.14 Construct a model that shows the cycling of matter and flow of energy in ecosystems.

- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment.
- Energy resources pass through the ecosystem. When food is used by organisms for life processes some energy is dissipated as heat but is replaced in the ecosystem by radiation from the Sun being used to produce plant food.
- Food webs are models that demonstrate how matter and energy are transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycles repeatedly between the living and nonliving parts of the ecosystem

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Released 11/03/2022