



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.

Physical Science Standards

Students develop an understanding of how Earth's resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.

4.P4U1.1	Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.
4.P4U1.2	Develop and use a model that explains how energy is moved from place to place through electric currents.
4.P2U1.3	Develop and use a model to demonstrate magnetic forces.
4.P4U3.4	Engage in argument from evidence on the use and impact of renewable and nonrenewable resources to generate electricity.

Life Science Standards

Students develop an understanding of the diversity of past and present organisms, factors impacting organism diversity, and evidence of change of organisms over time.

4.L4U1.11	Analyze and interpret environmental data to demonstrate that species either adapt and survive or go extinct over time.
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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).

Earth and Space Science Standards

Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.

4.E1U1.5	Use models to explain seismic waves and their effect on the Earth.
4.E1U1.6	Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.
4.E1U1.7	Develop and/or revise a model using various rock types, fossil location, and landforms to show evidence that Earth's surface has changed over time.
4.E1U1.8	Collect, analyze, and interpret data to explain weather and climate patterns.
4.E1U3.9	Construct and support an evidence-based argument about the availability of water and its impact on life.
4.E1U2.10	Define problem(s) and design solution(s) to minimize the effects of natural hazards.

Key Crosscutting Concepts in 4th Grade

*Patterns; Cause and Effect; Scale, Proportion and Quantity; **Systems and System Models; Energy and Matter; Structure and Function; Stability and Change***



Arizona Science Standards - 4th Grade



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

Elements of Physical Science Standards

4.P4U1.1 Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.

- Energy is transferred from one object, which is an energy source or resource, to another.
- Energy is present whenever there are moving objects, sound, light, or heat. (4.P4U1.2)

4.P4U1.2 Develop and use a model that explains how energy is moved from place to place through electric currents.

- Energy is present whenever there are moving objects, sound, light, or heat. (4.P4U1.1)
- Energy can be moved from place to place by moving objects or through sound or light, or electric currents.
- Boundary: At this grade level, no attempt is made to give a precise or complete definition of energy.*
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- Light also transfers energy from place to place through electric currents.

4.P2U1.3 Develop and use a model to demonstrate magnetic forces.

- Magnetic forces between a pair of objects do not require that the objects be in contact. The size of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

4.P4U3.4 Engage in argument from evidence on the use and impact of renewable and nonrenewable resources to generate electricity.

- The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

Elements of Life Science Standards

4.L4U1.11 Analyze and interpret environmental data to demonstrate that species either adapt and survive or go extinct over time.

- When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.
- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

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 Earth and Space Science Standards

4.E1U1.5 Use models to explain seismic waves and their effect on the Earth.

- Earthquakes cause seismic waves, which are waves of motion in Earth’s crust.
- Energy originates from the sun and from Earth’s interior. Transfers of energy and the movements of matter can cause physical changes among Earth’s materials and living organisms.
- Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. (4.E1U1.7)

4.E1U1.6 Plan and carry out an investigation to explore and explain the interactions between Earth’s major systems and the impact on Earth’s surface materials and processes.

- Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.
- Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.E1U1.7)

4.E1U1.7 Develop and/or revise a model using various rock types, fossil location, and landforms to show evidence that Earth’s surface has changed over time.

- Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4.E1U1.5)
- Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.E1U1.6)
- Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help infer the history of the current landscape.

4.E1U1.8 Collect, analyze, and interpret data to explain weather and climate patterns.

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
- Climate describes the ranges of an area’s typical weather conditions and the extent to which those conditions vary over years.

4.E1U3.9 Construct and support an evidence-based argument about the availability of water and its impact on life.

- Nearly all of Earth’s available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.
- About two-thirds of the surface of the Earth is covered by liquid water, which is essential to life.

4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.

- A variety of hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

