

National Science Education Content Standards

Levels K-4

UNIFYING CONCEPTS AND PROCESSES - LEVELS K-12

Systems, Order, and Organization

- A system is an organized group of related objects or components (organisms, machines, fundamental particles, galaxies, ideas, numbers, transportation, and education).
- Students should analyze in terms of systems (mass, energy, objects, organisms and events).
- Systems have structure and function.
- Feedback and equilibrium are associated with systems.
- Systems can be open or closed.
- The assumption of order establishes the basis for cause-effect relationships and predictability.
- Prediction can be used to explain change. Math can be used to do this through probability.
- Systems have levels of organization (periodic table & classification of organisms).
- Living systems have levels of organization (cells, tissues, organs, organisms, populations and communities).
- Interactions occur in systems.

Evidence, Models, and Explanation

- Evidence should be used in explanations.
- Models can be used in explanations.
- Terms such as hypothesis, model, law, principle, theory, and paradigm are used to explain scientific explanations.

Constancy, Change, and Measurement

- Interactions result in change.
- Changes vary in rate, scale, and pattern, including trends and cycles.
- Math measures change.
- Scientists use the metric system.
- Scale includes understanding that parts of a system might change as its size changes.
- Rate compares one measured quantity with another.

Evolution and Equilibrium

- Evolution is a series of changes. This includes changes in the universe.
- The present is a result of the past.
- Equilibrium is a physical state in which forces and changes occur in opposite

and offsetting directions.

- Steady state, balance, and homeostasis describe equilibrium states.

Form and Function

- Form follows function.
- Students should explain function in terms of form and form in terms of function.

SCIENCE AS INQUIRY

Abilities Necessary to do Scientific Inquiry

- Students answering questions using scientific resources combined with observations.
- Plan and conduct a simple systematic observation or investigation.
- Use simple instruments such as ruler, thermometer, watch, balance, magnifier, microscope, computer, or calculator to gather data and extend the senses.
- Use knowledge and evidence (data) to formulate explanation.
- Communicate or analyze investigations and explanations that might be drawn or spoken as well as written.

Understanding about Scientific Inquiry

- Recognizing that all of the above are things scientists do.

PHYSICAL SCIENCE

Properties of Objects and Materials

- Objects have measurable and observable properties which use tools.
- Objects can be described by their properties and classified accordingly.
- Materials can exist in different states (solid, liquid, gas).

Position and Motion of Objects

- Position of an object can be described relative to other objects.
- Object's motion can be described by observing its position over time.
- Position or motion of object can be changed by pushing or pulling.
- Sound is produced by vibration of objects and pitch can be varied.

Light, Heat, Electricity, and Magnetism

- Light travels in a straight line and can be reflected, refracted, and absorbed by objects.
- Electricity in circuits can produce light, heat, sound, and magnetic effects.
- Magnets attract and repel.

LIFE SCIENCE

Characteristics of Organisms

- All organisms have different needs.
- The environment must supply the needs of organisms.
- Each organism has different structures for different functions.

- Behavior is influenced by internal cues (hunger) and external cues (change in environment).

Life Cycles of Organisms

- Plants and animals have life cycles.
- A life cycle includes: birth, development, adulthood, reproduction, and death.
- Offspring resemble parents.
- Some characteristics of organisms are inherited while others result from interactions.

Organisms and Their Environments

- Plants are the base of an ecosystem.
- All animals depend on plants.
- Organism's patterns of behavior relate directly to the environment (kinds and numbers of other organisms, the availability of food and resources, and physical characteristics of the environment).
- Organisms can cause changes.
- Humans depend on environments.

EARTH AND SPACE SCIENCE

Properties of Earth Materials

- Earth materials have different physical and chemical properties.
- Soils have different properties and abilities to support plants.
- Fossils provide evidence about the environment, plants, and animals of the past.

Objects in the Sky

- The sun, moon, stars, birds, clouds, airplanes, all have characteristics that can be observed and described.
- The sun provides light and heat necessary to maintain Earth's temperature.

Changes in the Earth and Sky

- The surface of the Earth changes.
- Weather changes from day to day and over the seasons.
- Objects in the sky have patterns of movement.

SCIENCE & TECHNOLOGY

Abilities of Technological Design

- Identify a simple problem.
- Propose a solution.
- Implement a proposed solutions.
- Evaluate a product of design.
- Communicate a problem, design, and solution.

Understanding About Science and Technology

- Science is one way of answering and explaining the natural world.

- Trying to determine the effects of solutions helps people avoid some new problems.
- Scientists and engineers work in teams.
- Women and men of all ages, backgrounds, and groups engage in a variety of scientific and technological work.
- Tools help scientists make better observations, measurements, and equipment for investigations.

Abilities to Distinguish Between Natural Objects and Objects Made by Humans

- Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life.
- Objects can be categorized into two groups, natural and designed.

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Personal Health

- Safety and security are basic needs of humans.
- Individuals have some responsibility for their own health.
- Nutrition is essential to health.
- Different substances can damage the body and how it functions.

Characteristics and Changes in Populations

- Human populations include groups of individuals living in a particular location. Population density refers to the number of people of a particular population that live in a given amount of space.
- The size of human populations can increase or decrease.

Types of Resources

- Resources are things we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials (air, water, soil).
- Some resources are produced (food, fuel, building materials).
- Some resources are nonmaterial (quiet places, beauty, security, safety).

Changes in Environments

- Environments are the space, conditions, and factors that affect an individual's and a population's ability to survive and their quality of life.
- Changes in environments can be natural or influenced by humans.
- Some environmental changes occur slowly, and others occur rapidly.

Science and Technology in Local Challenges

- People continue inventing new ways of doing things. It is helpful to try to determine in advance how ideas and inventions will affect other people.
- Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits are not available worldwide.

HISTORY AND NATURE OF SCIENCE

Science as a Human Endeavor

- Science has a rich history.
- Many contributions have been made to science and technology.
- Science will never be finished.
- Science can be a life-long career.
- Many people derive great pleasure from doing science.