

**ELEMENTARY SCIENCE MAP**  
**CONTENT STANDARDS**  
**For 1998, 1999, and 2000**

**Scientific Inquiry**

- Words, pictures, numbers, models, and sounds can be used to describe objects and events.
- Graphs, charts, maps, equations, and oral and written reports can be used to share the results of a scientific investigation and facilitate its discussion.
- Most experiments involve changing something and then repeatedly comparing it to something similar that has not been changed.

**Scientific Relevance**

- Technology extends the ability of people to change the way things work.
- Throughout human history, technological innovations have played an important role in improving the quality of life.
- Science is a way to solve problems; everybody can do scientific activities, discover some things about nature, and invent things and ideas.

**Matter and Energy**

- Observable properties are used to identify objects
- Matter has physical properties that can change
- Matter is anything that has mass and volume and is composed of smaller parts.
- Substances can occur either in pure form or as a mixture.
- Sound is a form of energy that results from vibrations in matter. Sound has the qualities of loudness and pitch.
- Objects that give off light may also give off heat.
- Heat causes materials to increase in temperature and feel warmer, or change state (gas, liquid, or solid).

**Force, Motion, and Mechanical Energy**

- An object's position can be described relative to another object (above, below, left of, right of, behind, or in front).
- Force is any push or pull exerted by one object on another.
- Weight is a measurement of the attraction of gravity on a mass. Mass is the amount of matter of an object.
- Forces can be mechanical, gravitational, magnetic, or electrostatic.
- Magnets attract and repel each other and certain kinds of metals.
- The movement of an object depends on the force applied and how much mass it has.
- Simple machines are used to change the direction of an applied force and provide the mechanical advantage needed to move objects.

## Universe

- Earth is not alone in the universe. Enormous distances separate most of the objects in the universe.
- The sun, moon, and stars have recurring patterns.
- Earth is in our solar system and has unique properties to sustain life.
- Earth rotates on a tilted axis and revolves around the sun.
- Objects in the sky move.
- Earth makes a full rotation on its axis every 24 hours that causes the day/night cycle.
- Telescopes and satellite imaging allow scientists to observe features and structures of some objects in the sky.

## Earth Systems

- Water reaches Earth in different forms (snow, hail, rain, fog, etc.)
- The atmosphere has physical properties that are measurable and predictable.
- Rocks change over time by weathering.
- Earth's rotation causes a day and night cycle.
- Seasons and changes in weather affect human and animal activity and plant growth.
- The surface of Earth changes slowly (e.g., erosion, weathering) or quickly (e.g., earthquakes, floods, rock/mud slides, volcanic activity).

## Living Systems

- Observable characteristics of living organisms can be used to sort and group them.
- Organisms differ in structure and function and have characteristics that help them survive and reproduce in different environments.
- Plants and animals are alive and have characteristics that make them different from non-living matter.
- Organisms go through life cycles.
- Most organisms require a variety of materials including food, water, air, and a suitable environment for survival. Animals obtain energy and nutrients from plants or other animals.
- Organisms can be grouped by specific structures.
- All types of living organisms have offspring, and the similarities between parents and their offspring become more apparent as the offspring mature.
- The phases in the life cycle of all living organisms are predictable, but differ from species to species.
- Organisms of the same species can have variations that provide an advantage in survival and reproducing

## Ecology

- All living organisms interact with each other and their environment.
- All organisms depend on one another and their environment to live and grow.
- Organisms interact with each other as producer/consumer, scavenger, predator/prey, parasite/host, decomposer, etc.
- All organisms, including humans, cause changes in their environments that can be either beneficial or harmful to the organisms in the ecosystem.
- Human activities can change the environment in ways that affect the health and survival of all living organisms.

**INTERMEDIATE SCIENCE MAP**  
**CONTENT STANDARDS**  
**For 1998, 1999, and 2000**

**Scientific Inquiry**

- Graphs, charts, maps, equations, and oral and written reports can be used to share the results of a scientific investigation and facilitate its discussion. (grade 3)
- Various statistical procedures are used to determine characteristics of sets of data as well as to determine the validity of experimental results.
- The use of tools allows more sophisticated means of observation and data collection, analyzation, storage, and retrieval.
- Communication and the open sharing of information and knowledge are essential parts of scientific inquiry.
- A valid experiment, or “fair test,” involves the manipulation of only one variable, while all others are held constant. Experiments should be repeated many times before accepting the results as true.
- Critical analysis of procedures, data, evidence, and conclusions developed during an investigation can be used to judge the quality and validity of the work.

**Scientific Relevance**

- When people want to build something or try something new, they should try to figure out ahead of time how this might affect all living things and environments. (grade 3)
- Technological solutions to problems often have drawbacks as well as benefits. (grade 3)
- Technology extends the ability of people to change the way things work. (grade 3)
- The issues related to science, technology, and society are often complex and involve risk/benefit trade-offs.
- Breakthroughs in science often lead to advances in technology and improved technological equipment leads to more accurate data collection.
- Scientific ethics require that scientists must not knowingly subject co-workers, students, human research subjects, the neighborhood, or the community to health or property risks without their knowledge and consent.
- Social, cultural, environmental, and economic factors all influence which science and technology will be undertaken and used. The discoveries of science and products of technology directly influence society and the environment.

## **Matter and Energy**

- Objects that give off light may also give off heat. (grade 3)
- Heat causes materials to increase in temperature and feel warmer, or change state (gas, liquid, or solid). (grade 3)
- Light spreads from a source and travels in straight lines. Light can be transmitted, reflected, refracted, or absorbed by different materials.
- Different types of matter conduct heat at different rates.
- Some physical properties depend on the amount of matter present while other properties do not.
- Solution properties depend on concentration and nature of the substances involved.
- Energy is required to produce changes in matter and do work.
- Heat energy can be transferred by conduction, convection, or radiation.
- The interaction between matter and energy can result in changes in electronic, atomic, and molecular motion.
- Different materials have different electrical resistance. Resistance converts electric energy into heat energy.

## **Force, Motion, and Mechanical Energy**

- The motion of an object can be represented graphically in terms of direction over time, speed over time, or position over time.
- The overall effect of many forces acting on an object at the same time is called net force. The size and direction of this net force determines the change in motion of an object.
- Mechanical energy comes from the motion (kinetic energy) and/or position (potential energy) of an object.
- Simple machines can be used to change the force on an object, its speed, or its direction of movement.

## **Universe**

- Earth is not alone in the universe. Enormous distances separate most of the objects in the universe. (grade 3)
- Recurring predictable movements of the Earth and moon can be used to measure time. (grade 3)
- Constellations are patterns of stars.
- Different constellations can be seen in different seasons.
- The universe is so large that its distances are expressed in special units (i.e., light years, astronomical units).
- Celestial objects possess both similarities and differences.
- The force of gravity determines the orbital patterns of celestial objects.
- Earth is a moving planet that has unique features.
- Moon phases and eclipses result from the angle from which we view the moon.
- Nine planets, their moons, comets, asteroids, and meteorites orbit the sun.
- A variety of technological tools are used to provide information concerning the physical properties and conditions of the solar system.

## Earth Systems

- Water condenses, evaporates, and exists as a gas, liquid, or solid on Earth and in the air.
- The atmosphere is composed of a chemical mixture of gases, water vapor, and minute particles.
- Properties of the atmosphere are observed and measured to predict weather changes.
- Rocks and minerals can be classified by their chemical and physical properties
- Formation of layers of sedimentary rock and their associated fossils confirm the long history of Earth and its changing life-forms.
- There is economic value in Missouri resources, both above and below the ground.
- The surface of Earth has changed as a result of dynamic forces originating within the mantle. The physical evidence (faulting, volcanoes, folding of rock, etc.) of these constructive and destructive forces is associated with plate movement.

## Living Systems

- The phases in the life cycle of all living organisms are predictable, but differ from species to species. (grade 3)
- Organisms are composed of parts that work together and exhibit behaviors that ensure the survival of the whole organism.
- Organisms can be classified into kingdoms or sub-kingdoms based on similarities and differences.
- Each structure in an organism is uniquely adapted to a particular function for enhancing the ability of the organism to survive.
- Cells contain a set of structures called organelles that control the various functions of the cell.
- Energy is needed for living cells to carry out all the processes of life.
- In the process of photosynthesis, green plants convert water and carbon dioxide into energy-rich simple sugars and oxygen.
- A species is an important biological grouping of organisms whose members have similar structures, normally interbred, and produce fertile offspring.
- The combination of genes in sexual reproduction results in a greater variety of possible gene combinations than in asexual reproduction that results in offspring genetically identical to the parent.
- Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to its daughter cells, and from a parent to its offspring.

## Ecology

- All organisms, including humans, are part of and depend on one global food web that begins with organisms at the bottom of the energy pyramid. (grade 3)
- As energy flows through the ecosystem, all organisms must transform the portion of energy available to them into usable forms.
- Matter is recycled in an ecosystem, changing form and location.
- Abstract concepts of global environment can be applied to complex interactions of the biotic and abiotic factors that affect populations and ecosystems.
- The variation of characteristics in a population increases the likelihood that some members will survive the physical or biological changes of that system.
- The equilibrium of a species in an ecosystem changes when environmental conditions change.

**SECONDARY SCIENCE MAP**  
**CONTENT STANDARDS**  
**For 1998, 1999, and 2000**

**Scientific Inquiry**

- The breadth and style of investigations depend on the questions asked. (grade 3)
- A valid experiment, or “fair test,” involves the manipulation of only one variable, while all others are held constant. (grade 7)
- Critical analysis of procedures, data, evidence, and conclusions developed during an investigation can be used to judge the quality and validity of the work. (grade 7)
- Controlling all variables that might influence an experiment is important. Sometimes it is not possible, for practical or ethical reasons, to control some conditions, but a wide range of observations of natural occurrences can reveal patterns.
- Technological tools and techniques extend human capabilities to perform investigations in more detail and with greater accuracy and precision.
- The testing of a hypothesis requires a structured and rigorous investigative process.
- The testing, revising, and occasional discarding of theories lead to increasingly better understanding, but not to absolute truth.

**Scientific Relevance**

- The issues related to science, technology, and society are often complex and involve risk/benefit trade-offs. (grade 7)
- Human beings have a huge impact on other species, their environments, and technology. These impacts include reducing the amount of habitat available, interfering with food sources, changing the temperature and chemical composition of their habitats, introducing foreign species, and altering organisms directly through selective breeding and genetic engineering.
- Scientific theories are developed based on the body of knowledge that exists at any particular time. The driving force to find what is really true motivates scientists to test the validity of these theories and as a result the mysteries of nature are continuously probed and explained as new theories are created and old theories discarded.
- Scientists make mistakes like all people. Deliberate deceit, however, is rare and is likely to be exposed eventually by the scientific enterprise itself.

**Matter and Energy**

- Energy can be converted into different forms. (grade 3)
- Light spreads from a source and travels in straight lines. Light can be transmitted, reflected, refracted, or absorbed by different materials. (grade 3)
- Most processes involve energy transformation with the release of heat. (grade 7)
- The Periodic Table organizes the elements according to their physical properties and chemical reactivity.
- Models can be used to represent elements, compounds, and ions.
- Solution properties depend upon the concentrations, properties, and interactions of the solutes and solvents.
- Energy can be transferred as waves. The relative motion of the source and receiver affects the frequency and wavelengths of the waves.
- Heat flows from a body of a higher temperature to one of a lower one.

## **Force, Motion, and Mechanical Energy**

- Motion can be described in terms of velocity and acceleration and be represented by equations and vectors.
- The acceleration of an object is related to its mass and the force acting on it.
- Newton's Laws of Motion that are used to predict changes in linear and/or rotational motion can explain the action of all forces.
- A force, acting on an object, moving it through a distance, can change its kinetic energy, potential energy, or both.
- The ratio of output work to input energy is the efficiency of a machine or process and is always less than 100%. Power is the rate at which work is done.
- The Law of Conservation of Momentum can be used to predict the outcome of collisions.

## **Universe**

- Recurring predictable movement of the Earth and moon can be used to measure time. (grade 3)
- Our solar system is part of the Milky Way Galaxy, one of many galaxies in the universe. (grade 7)
- Celestial objects possess both similarities and differences. (grade 7)
- The current model of the universe was developed from evidence about its content and theoretical assumptions based upon mathematical and computer-simulated models.
- Stars appear to go through a cycle of birth, development, and death.
- Because of the vast distances between objects in the universe, light may take billions of years to reach Earth.
- Gravitational laws explain planetary motion and tides.

## **Earth Systems**

- The surface of Earth has changed as a result of dynamic forces originating within the mantle. The physical evidence (faulting, volcanoes, folding of rock, etc.) of these constructive and destructive forces is associated with plate movement. (grade 7)
- Incoming solar radiation and the hydrologic cycle create patterns of weather and climate. (grade 7)
- Changes in the atmosphere can be caused by natural or human activities.
- Crustal plate movement affects Earth's topography and provides evidence of a geologic time scale.
- Circulation of air and water around Earth, driven by radiation energy from the sun, causes weather phenomena and regional climate.
- Science technology has enhanced our ability to detect atmospheric changes resulting from interactions of Earth's systems.

## **Living Systems**

- Observable characteristics of living organisms can be used to sort and group them. (grade 3)
- Each structure in an organism is uniquely adapted to a particular function for enhancing the ability of the organism to survive. (grade 7)
- Each cell of a developing organism receives an exact copy of the genetic information contained in the fertilized egg. (grade 7)
- A successful population can adapt to environmental changes through genetic variations.
- Cells have distinct and separate structures that perform and monitor processes essential for the survival of the cell and/or organism, such as chemical synthesis, energy conversion, material transport, and cell replication.
- Optimum conditions are maintained in an organism as a result of special functions performed at the cellular level.

- The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics.
- Embryological development in plants and animals involves a series of orderly changes in cell division and differentiation.
- The process of natural selection provides that some heritable variations that arise from mutation and recombination give individuals within a species some advantage over others for survival.

## **Ecology**

- Organisms interact with each other as producer/consumer, scavenger, predator/prey, parasite/host, decomposer, etc. (grade 3)
- All organisms, including humans, are part of and depend on one global food web that begins with organisms at the bottom of the energy pyramid. (grade 3)
- As energy flows through the ecosystem, all organisms must transform the portion of energy available to them into usable forms. (grade 7)
- No two species occupy the same niche in an ecosystem so that different species can coexist and help maintain the stability of that system.
- Human decisions concerning the use of resources can alter the stability and biodiversity of ecosystems.
- Biological, chemical, and physical processes interconnect ecosystems so that changes in one ecosystem can have local or global consequences.
- Overpopulation in an ecosystem can lead to depletion of resources and elimination of a species.