PROGRAM FOR LICENSING ASSESSMENTS FOR COLORADO EDUCATORS® (PLACE®) OBJECTIVES FIELD 005: SCIENCE

Subareas

Scientific Inquiry and Connections
Physical Science
Life Science
Earth and Space Science

SCIENTIFIC INQUIRY AND CONNECTIONS

Understand the principles and processes of scientific inquiry and conducting scientific investigations.

Includes recognizing questions and hypotheses that can be investigated according to the criteria and methods of science; characteristics of various types of scientific investigations (e.g., controlled experiments, field observations, historical studies); principles and procedures of designing and conducting scientific investigations (e.g., manipulating one variable at a time); the appropriateness of a given investigative design for testing a particular hypothesis; and sources of error or uncertainty in an investigation.

Understand procedures for gathering, recording, organizing, interpreting, analyzing, and communicating scientific data and information.

Includes appropriate methods, tools, technologies, and measurement units for gathering, recording, and processing data; methods and criteria for organizing and communicating data (e.g., tables, graphs, models); analyzing data to construct and revise scientific hypotheses and models; and identifying and evaluating various sources of scientific information (e.g., handbooks, professional journals, popular press, on-line resources).

Understand appropriate safety practices and the selection and proper use of materials, equipment, and technologies in scientific investigations.

Includes evaluating equipment, materials, procedures, and setting for potential safety hazards; selecting appropriate materials, equipment, and technologies for specified purposes; and identifying and locating sources of information about safety, the proper handling of scientific materials, state and federal regulations, legal issues, and guidelines pertaining to scientific materials and specimens.

OBJECTIVES
FIELD 005: SCIENCE

Understand the nature of scientific knowledge and common connections among scientific disciplines.

Includes the purpose of science; the dynamic nature of scientific knowledge, including ways in which scientific knowledge is developed and modified; the importance of empirical standards, verifiable evidence, logical reasoning, rational thought, and openness to new ideas in science; the roles of communication, critique, and consensus in promoting scientific progress; and common scientific themes (e.g., change, systems, models, equilibrium) and how they help to unify scientific theories and facts regarding natural phenomena.

Understand the interrelationships among science, technology, and society.

Includes concepts and methods that are common to science and technology; the different roles of science and technology with respect to society; the interdependence of science and technology; the influence of social and cultural factors on advances in science and technology; the effects of significant scientific and technological advances on humans; ethical issues related to science and technology; benefits, limitations, costs, and consequences associated with given technologies (e.g., biotechnology, space technology); and scientific and technological aspects of contemporary issues (e.g., resource availability, environmental quality, personal health).

PHYSICAL SCIENCE

Understand the structure and properties of matter.

Includes models of atomic structure; classification and characteristics of atoms, elements, molecules, compounds, and mixtures; the use of models to explain observed properties of matter; organization of the periodic table and its relationship to the structure and properties of matter; physical and chemical properties of matter; and the use of chemical symbols and formulas to represent the composition and structure of matter.

Understand principles and concepts related to energy.

Includes forms of energy (e.g., heat, light, mechanical, sound) and their characteristics; the basic principles and concepts of the laws of thermodynamics (e.g., conservation of energy, entropy); quantities used to measure energy in its various forms (e.g., temperature, electrical charge, voltage, amplitude); and qualitative and quantitative relationships associated with energy transfer or transformation (e.g., kinetic energy, potential energy).

Understand interactions of energy and matter.

Includes the relationship between energy and matter and ways in which they interact (e.g., light absorbed or reflected by a substance); the use of conceptual models (e.g., the kinetic molecular model) to describe and explain the behavior of solids, liquids, and gases and the interactions of energy and matter; the interrelationships among temperature, pressure, and volume in a closed system; and characteristics of the electromagnetic spectrum.

OBJECTIVES
FIELD 005: SCIENCE

Understand physical and chemical changes in matter.

Includes types and characteristics of physical and chemical changes; applying the concept of conservation of matter; factors that cause physical and chemical changes in matter; characteristics of the various states of matter and energy changes associated with changes in state; types and characteristics of chemical bonds; the relationship between chemical bonds and the properties of matter; factors that affect rates of chemical reactions (e.g., temperature, concentration); and the use of symbolic equations to represent chemical changes and reactions.

Understand forces and motions.

Includes basic principles of mechanics; types and characteristics of forces (e.g., gravitational, frictional); the effects of forces on particles and objects; qualitative and quantitative descriptions of moving objects and of the physical interactions in a system (e.g., force, velocity, acceleration, power); and types and characteristics of simple machines.

Understand electricity, magnets, and electromagnetism.

Includes characteristics of static electricity and electric fields; characteristics and interpretation of simple electrical circuits; characteristics of magnets and magnetic fields; and principles and applications of electromagnetism.

LIFE SCIENCE

Understand the characteristics of living things and the diversity of life.

Includes characteristics that distinguish organisms from nonliving things; basic requirements of life; principles of cell theory; methods of classifying organisms; and similarities and differences among organisms from various taxonomic groups.

OBJECTIVES
FIELD 005: SCIENCE

Understand matter and energy in living systems.

Includes sources of energy for various types of organisms; forms of energy in living systems; principles related to the transformation and transfer of energy in living systems; the importance to organisms of a constant input of energy and other materials (e.g., water, oxygen, nutrients); the fundamental processes of photosynthesis and cellular respiration; ways in which organisms use energy and matter; and the cycling of matter (e.g., carbon cycle, nitrogen cycle) and the movement of energy through an ecosystem.

Understand the structure, organization, and basic life functions of organisms.

Includes structures and functions of various types of cells and cellular organelles; levels of organization (i.e., cells, tissues, organs, systems) in organisms; basic physiological functions (e.g., excretion, digestion, respiration, reproduction) in various organisms; the relationship between structure and function in organisms; homeostatic and metabolic processes; and structures and functions of human body systems and characteristics of diseases and disorders that may affect these systems.

Understand interactions of organisms with one another and with their environment.

Includes characteristics of populations, communities, ecosystems, and biomes and how they are related; interactions of abiotic and biotic components of ecosystems; interrelationships among organisms in ecosystems (e.g., predator-prey, parasite-host); the ecological concepts of niche and carrying capacity; strategies used by organisms to obtain their basic needs (e.g., food, water, space); features of food chains and food webs; the process of ecological succession; ways in which ecosystems respond to change; and the significance of biodiversity and factors that affect biodiversity.

Understand how organisms change over time in terms of genetics and biological evolution.

Includes the structures and functions of DNA, genes, and chromosomes; basic concepts and principles of inheritance (e.g., dominance, independent assortment); the processes of mitosis and meiosis and their relationship to genetic principles; the transmission of traits from one generation to the next; sources of variation in populations (e.g., mutations, environmental factors); the roles of variation, natural selection, and reproductive isolation in speciation; and evidence for changes in organisms over time and evolutionary relationships among organisms.

OBJECTIVES
FIELD 005: SCIENCE

EARTH AND SPACE SCIENCE

Understand the composition and structure of Earth, its history, and the natural processes that shape Earth.

Includes the composition and structure of Earth's interior; properties of rocks, minerals, and soils and their formation; the rock cycle; theories and evidence about Earth's geologic history; the theory of plate tectonics and supporting evidence; major features of Earth's surface (e.g., mountains, oceans, plateaus, deep-sea trenches) and the processes that create and shape them (e.g., earthquakes, erosion, volcanic activity); and the causes and effects of natural events (e.g., earthquakes, landslides, floods).

Understand the characteristics of the atmosphere and weather processes.

Includes the basic composition, properties, and structure of the atmosphere; the patterns and effects of energy transfer in the atmosphere (e.g., air circulation, cloud formation, precipitation); characteristics of large-scale and local weather systems; factors that influence weather and climate; methods and equipment for observing, measuring, and recording weather conditions; the analysis of weather data to make predictions; and the causes and effects of severe weather events (e.g., tornadoes, blizzards, thunderstorms).

Understand the characteristics of the hydrosphere and the movement of water in the environment.

Includes properties and behaviors of water; the water cycle; major categories of water on Earth (e.g., oceans, glaciers, rivers, ground water); patterns and processes of water circulation through the environment; interactions among the hydrosphere, atmosphere, lithosphere, and biosphere; the composition and physical characteristics of oceans (e.g., salinity, currents, waves); and the interrelationships between the circulation of oceans and weather and climate.

Understand the structure and components of the solar system and universe and the interactions of objects in the universe.

Includes major components of the solar system (e.g., sun, planets, asteroids) and their characteristics; the effects of gravitation on the motions of objects in the solar system and universe; movements and interactions of the sun, Earth, and moon and the effects of these movements and interactions (e.g., seasons, eclipses, tides); characteristics of stars and the life cycle of stars; theories regarding the origin and evolution of the solar system and universe; methods and technology used to explore space; and societal benefits of technological advances associated with space exploration.

OBJECTIVES
FIELD 005: SCIENCE

Understand Earth's natural resources and principles and concepts related to environmental science.

Includes characteristics and sources of Earth's natural resources; the importance and uses of natural resources; costs, benefits, and consequences of various uses of Earth's natural resources; effects of human activities on the environment (e.g., habitat destruction, pollution); interrelationships among humans, the environment, and other organisms; and advantages and disadvantages of various strategies for dealing with environmental problems.