

Arizona Educator Proficiency Assessments® (AEPA®)

FIELD 39: MIDDLE GRADES GENERAL SCIENCE TEST OBJECTIVES

Subarea	Range of Objectives	Approximate Test Proportions*
I. Characteristics of Science	1–4	20%
II. Life Science	5–9	25%
III. Physical Science	10–15	30%
IV. Earth and Space Science	16–20	25%

*May not add to 100% due to rounding.

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**Arizona Educator Proficiency Assessments® (AEPA®)
Subject Knowledge Test**

**Test Objectives
Field 39: Middle Grades General Science**

Subareas:

Characteristics of Science
Life Science
Physical Science
Earth and Space Science

CHARACTERISTICS OF SCIENCE

0001 Understand the history of science and the nature of scientific inquiry.

For example:

- recognizing the nature, purpose, and characteristics of science, including critical evaluation of scientific claims
- analyzing the historical development and impact of major scientific ideas, including the contributions of individuals from different periods and cultures
- recognizing the process by which scientific knowledge changes over time
- demonstrating knowledge of the reliance of scientific investigations on empirical data, verifiable evidence, and logical reasoning
- identifying strategies for avoiding bias in scientific investigations

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0002 Understand the principles and procedures of scientific investigations.

For example:

- demonstrating knowledge of the principles and procedures for designing and conducting scientific investigations
- identifying appropriate resources for use in designing and conducting scientific investigations
- recognizing safe and appropriate procedures for using equipment and materials in scientific investigations
- recognizing the roles of accuracy and precision in the collection of scientific data
- selecting appropriate scientific tools and international system (SI) units to collect and represent data
- demonstrating knowledge of the appropriate use and care of living organisms in scientific investigations
- recognizing appropriate procedures for maintaining a safe and effective learning environment during scientific investigations

0003 Understand processes of analyzing and communicating the results of scientific investigations.

For example:

- demonstrating knowledge of methods (e.g., tables, graphs) for organizing and analyzing data
- applying basic mathematical concepts and computational skills for analyzing experimental data, including the use of simple descriptive statistics
- solving problems involving scientific measurements and experimental data
- demonstrating knowledge of the criteria used to judge the validity and reliability of scientific investigations
- recognizing the procedures and criteria for formally reporting experimental results and data to the scientific community

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0004 Understand the relationship of science to contemporary, historical, technological, and societal issues.

For example:

- demonstrating knowledge of the unifying concepts (e.g., systems, models, change) among the life, physical, and Earth sciences
- analyzing the risks and benefits of developments in science and technology
- demonstrating knowledge of the relationships among science, technology, and society
- analyzing the use of technology in science-related careers
- analyzing solutions to environmental problems associated with human activities
- recognizing the importance of ethical issues in scientific endeavors

LIFE SCIENCE

0005 Understand cell theory and the structure and function of cells.

For example:

- demonstrating knowledge of the principles of cell theory
- relating basic cell structures to their functions
- demonstrating knowledge of the differences in the structure and function of plant and animal cells
- analyzing the function of specialized cells in plants and animals

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0006 Understand the characteristics and life processes of living organisms.

For example:

- demonstrating knowledge of the growth of multicellular organisms by the process of mitosis
- analyzing the life cycles and reproductive strategies of common organisms
- demonstrating knowledge of how organisms obtain and use energy (e.g., photosynthesis, respiration)
- relating the structures of living organisms (e.g., gills, lungs, stomata, xylem) to their functions
- identifying the behaviors and physiological mechanisms that allow organisms to maintain homeostasis
- recognizing levels of biological organization and interactions between the levels (e.g., cells, tissues, organs, systems)
- analyzing the functions of specialized structures (e.g., bark, fur) and systems (e.g., vascular, circulatory, skeletal)

0007 Understand the basic principles of the inheritance of biological traits and the uses of genetic engineering.

For example:

- recognizing how characteristics, including human traits, are passed from generation to generation and the influence of environmental factors on the inheritance of characteristics
- recognizing the structure and functions of genes and chromosomes
- demonstrating knowledge of the role of DNA and RNA in the transmission of genetic information
- applying the basic principles of inheritance and Mendel's laws
- identifying applications (e.g., agriculture, pest control) of genetic engineering technology

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0008 Understand the processes of natural selection and adaptation.

For example:

- identifying behavioral and physiological adaptations that help organisms survive in a variety of environments
- analyzing the roles of variation, natural selection, and adaptation in biological evolution
- recognizing evidence for the evolution of species (e.g., Darwin's finches, fossils, DNA analysis)
- demonstrating knowledge of factors that affect the biological evolution of species (e.g., geographic isolation, genetic mutation)

0009 Understand the interactions among populations, communities, ecosystems, and biomes.

For example:

- analyzing the role of biotic and abiotic factors in a variety of ecosystems and biomes
- demonstrating knowledge of population dynamics
- analyzing the relationships among organisms in an ecological community
- demonstrating knowledge of the flow of matter and energy through an ecosystem
- identifying the roles of producers, consumers, and decomposers in ecosystems
- demonstrating knowledge of how various factors (e.g., natural disasters, human activity, climate change) affect ecosystems

PHYSICAL SCIENCE

0010 Understand the structure and properties of matter.

For example:

- recognizing the characteristics of elements, compounds, mixtures, and solutions
- identifying the component parts of matter (e.g., atoms, ions, molecules)
- distinguishing among the physical, chemical, and nuclear properties of matter (e.g., melting point, reactivity, radioactivity)
- recognizing the patterns of chemical and physical properties underlying the systematic organization of the periodic table
- identifying chemical symbols and interpreting chemical formulas

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0011 Understand physical, chemical, and nuclear changes that occur in matter.

For example:

- applying knowledge of the conservation of matter and energy to the analysis of physical, chemical, and nuclear changes
- recognizing the kinds of evidence that indicate a chemical reaction has occurred (e.g., formation of a precipitate, change in pH)
- identifying properties of solutions (e.g., concentration, pH, salinity)
- analyzing factors that affect the rate of a physical change or a chemical reaction (e.g., temperature, catalyst)

0012 Understand relationships among force, mass, and motion.

For example:

- demonstrating knowledge of Newton's three laws of motion and their application to everyday situations, including solving problems involving force, mass, and acceleration
- recognizing the forces (e.g., normal force, gravity, friction) acting on an object in a given situation
- solving problems involving distance, direction, time, and velocity
- analyzing position-time graphs and velocity-time graphs depicting the motion of an object
- demonstrating knowledge of simple machines and their uses

0013 Understand different forms of energy and energy transformations.

For example:

- identifying types, characteristics, and uses of different forms of energy (e.g., kinetic, potential, nuclear, chemical)
- recognizing how the processes by which energy is transferred (e.g., conduction, convection, radiation) can affect the physical and chemical properties of matter
- demonstrating knowledge of the kinetic theory of matter
- recognizing the laws of thermodynamics and their application in physical systems
- interpreting phase-change diagrams
- analyzing energy changes that occur during chemical reactions

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0014 Understand the characteristics of waves and the behavior of sound and light.

For example:

- demonstrating knowledge of the characteristics of mechanical waves (e.g., wavelength, frequency, amplitude)
- demonstrating knowledge of the relationships between wave characteristics and the properties of sound and light (e.g., loudness, Doppler effect)
- recognizing how wave interactions (e.g., interference, superposition) affect the character and propagation of waves
- identifying the effects of mirrors, lenses, and prisms on the behavior of light (e.g., reflection, refraction, dispersion)
- demonstrating knowledge of the characteristics and applications of the electromagnetic spectrum

0015 Understand the principles of electricity, magnetism, and electromagnetism.

For example:

- recognizing the characteristics of static electricity and electric fields
- demonstrating knowledge of the characteristics of voltage, current, and resistance in their application to series and parallel circuits (e.g., flashlights, holiday lights)
- identifying properties of magnets and the characteristics of magnetic fields
- demonstrating knowledge of electromagnetism and its application in electric motors and generators

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EARTH AND SPACE SCIENCE

0016 Understand the geologic composition, structure, and history of Earth.

For example:

- demonstrating knowledge of the properties and composition of Earth's crust, mantle, and core
- distinguishing igneous, metamorphic, and sedimentary rocks based on their characteristics and formation
- demonstrating knowledge of the strategies used to identify and classify minerals (e.g., hardness, density)
- recognizing theories of Earth's origin and major events in the history of Earth (e.g., mass extinctions, continental glaciations)
- demonstrating knowledge of the conditions under which fossils form and the information fossils provide about ancient environments
- recognizing the evidence supporting the theory of plate tectonics
- demonstrating knowledge of methods for determining the relative and absolute age of Earth (e.g., stratigraphy, radiometric dating)

0017 Understand the geologic processes acting on Earth.

For example:

- demonstrating knowledge of the processes involved in the rock cycle
- demonstrating knowledge of the processes associated with the movement of tectonic plates (e.g., convection, seafloor spreading, subduction)
- analyzing the constructive and destructive processes (e.g., volcanism, meteorite impacts, weathering, erosion, deposition, soil formation) that shape Earth's surface
- relating landforms (e.g., folded mountains, uplifted plateaus, deltas, canyons) to the geologic processes that formed them
- demonstrating knowledge of earthquake measurement

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0018 Understand the characteristics and properties of the hydrosphere.

For example:

- analyzing the characteristics of freshwater and salt water (e.g., density, specific heat, salinity)
- demonstrating knowledge of the characteristics of the major reservoirs of water on Earth (e.g., oceans, groundwater, surface water, glaciers)
- analyzing the movement of water through the water cycle and the physical processes involved in phase changes
- demonstrating knowledge of ocean currents and the structure and composition of the oceans
- demonstrating knowledge of the management and conservation of water resources

0019 Understand Earth's weather, climate, and atmosphere.

For example:

- demonstrating knowledge of the structure, functions, and characteristics of the atmosphere
- recognizing the processes related to cloud formation and precipitation
- analyzing the role of air masses and atmospheric circulation on weather
- analyzing factors that affect climate and weather (e.g., large bodies of water, rain shadows, elevation, ocean currents)
- demonstrating knowledge of the factors that affect Arizona's weather
- identifying evidence of recent and ancient changes in climate (e.g., global warming, ozone depletion, deglaciation, Ice Age)

0020 Understand the relationships between objects in the solar system and the characteristics of the solar system and universe.

For example:

- analyzing theories of the structure, origin, and evolution of the solar system and universe
- recognizing the effects of gravitational force on objects in the solar system and universe (e.g., tides, planetary orbits, black holes)
- recognizing the effects of the relative orientations, positions, and movements of Earth, Moon, Sun, and stars (e.g., seasons, eclipses, phases of the moon, major constellations)
- identifying the characteristics of stars and galaxies (e.g., life cycles of stars, types of galaxies)
- demonstrating knowledge of the methods used to observe and collect data about the solar system and universe