

NEW MEXICO TEACHER ASSESSMENTS™

TEST FRAMEWORK

FIELD 25: MIDDLE LEVEL SCIENCE

Subarea	Range of Competencies	Test Proportion
I. Scientific Inquiry and the History and Nature of Science	0001–0005	24%
II. Life Science	0006–0010	24%
III. Physical Science	0011–0016	28%
IV. Earth and Space Science	0017–0021	24%

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NEW MEXICO TEACHER ASSESSMENTS™

Field 25: Middle Level Science

Scientific Inquiry and the History and Nature of Science
Life Science
Physical Science
Earth and Space Science

SUBAREA I—SCIENTIFIC INQUIRY AND THE HISTORY AND NATURE OF SCIENCE

0001 Understand the nature of science and the processes and principles of scientific inquiry.

For example:

- demonstrate an understanding of the nature, purpose, and distinguishing characteristics of science (e.g., the use of empirical standards, logical argument, skepticism) and limitations to the scope of science
- recognize the importance of verifiable evidence and peer review in science and that scientific hypotheses are subject to experimental and observational confirmation
- demonstrate knowledge of scientific methods and apply principles and procedures for designing and conducting scientific investigations (e.g., identifying constants, manipulated and responding variables; sampling)
- identify the characteristics and uses of various types of scientific investigations (e.g., controlled experiments, field observations) and evaluate the appropriateness of a given investigative design for testing a particular hypothesis
- identify sources of error or uncertainty in an investigation

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0002 Understand procedures for gathering, recording, organizing, interpreting, analyzing, and communicating scientific data and information.

For example:

- use appropriate methods, tools, and technologies for gathering, recording, processing, analyzing, and evaluating data and for communicating the results of scientific investigations
- select appropriate methods and criteria for organizing and displaying data (e.g., tables, graphs, models)
- demonstrate an understanding of the concepts of precision, accuracy, and error with regard to gathering and recording scientific data
- demonstrate knowledge of the measurement units used in scientific investigations
- identify and evaluate various sources of scientific information (e.g., handbooks, professional journals, popular press, the Internet, community-based resources)

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0003 Understand appropriate safety practices, including the selection and proper use of materials, equipment, and technologies in scientific investigations.

For example:

- evaluate equipment, procedures, and settings for potential safety hazards
- maintain safe practices and procedures in all areas related to science instruction
- respond to accidents by applying first-response procedures, including first aid
- identify various sources of information about safety, legal issues, and the proper use, storage, and disposal of scientific materials (e.g., state and federal regulations and guidelines, material safety data sheets)
- demonstrate knowledge of the safe and proper use of science tools, equipment, chemicals, materials, and technology in scientific inquiry (e.g., computers, scientific instrumentation)
- apply various procedures for using and caring for living organisms in an ethical and humane manner according to the standards of the National Association of Biology Teachers

0004 Understand shared concepts, themes, and methods among scientific and other disciplines and the interdependence of science and technology.

For example:

- identify common scientific concepts and themes (e.g., change, systems, models, form and function) that link and unify science fields
- demonstrate knowledge of the general characteristics and properties of systems and how system components and different systems interact (e.g., feedback)
- demonstrate an understanding of how models are used in science and methods for evaluating the strengths and weaknesses of scientific models
- analyze the interrelationships among science and other disciplines (e.g., mathematics, arts, social studies, language arts)
- identify concepts and methods that are common to science and technology and analyze the interdependence of science and technology

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0005 Understand the history of science and the interrelationships of science and society.

For example:

- identify key events in the history of science and the science contributions of people from a variety of social and ethnic backgrounds
- demonstrate an understanding of the influence of social and cultural factors on science and technology
- demonstrate the ability to distinguish between the ethical and unethical uses of science (e.g., the use of proper protocol)
- identify the effects of scientific and technological developments on the environment, human biology, society, and culture
- identify careers in science and evaluate reasons why people choose science as a career

SUBAREA II—LIFE SCIENCE

0006 Understand basic concepts of cell biology.

For example:

- identify characteristics and functions of biologically important compounds (e.g., carbohydrates, lipids, proteins, nucleic acids)
- demonstrate knowledge of the structure and function of the parts of a cell and cellular organelles (e.g., cell membrane, nucleus, mitochondria)
- demonstrate an understanding of the processes by which cells transport materials across cell membranes (e.g., osmosis, diffusion, active transport)
- compare and contrast viruses and bacteria, prokaryotic and eukaryotic cells, and plant and animal cells
- demonstrate an understanding of the cell cycle and the processes of mitosis and meiosis
- demonstrate knowledge of abnormal cell structures and processes and their relation to diseases (e.g., cancer)

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0007 Understand the structure, organization, and basic life functions of organisms.

For example:

- demonstrate knowledge of the levels of organization in organisms (i.e., cells, tissues, organs, and systems) and the relationship of organs and organ systems to each other and to the organism as a whole
- analyze the relationship between structure and function in different systems for various types of organisms (e.g., respiratory, digestive)
- compare and contrast how various organisms carry out basic life processes (e.g., maintaining homeostasis, reproduction, growth)
- compare and contrast sources of energy and matter for different organisms and how various organisms obtain, store, and use energy and matter
- categorize organisms based on methods of reproduction and offspring development
- analyze behavioral responses to external stimuli in a variety of organisms

0008 Understand the basic principles of genetics and evolution.

For example:

- relate the structure and behavior of chromosomes during meiosis to hereditary patterns
- demonstrate knowledge of the principles of inheritance (e.g., dominant, recessive, and sex-linked traits, DNA) and apply probability methods to determine genotype and phenotype frequencies
- identify sources of variation in populations (e.g., mutations, sexual reproduction)
- demonstrate an understanding of the roles of variation, natural selection, and reproductive isolation in adaptation and speciation
- identify evidence for evolutionary change in organisms over time

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0009 Understand human biology, including the interactions of humans with the environment.

For example:

- demonstrate knowledge of human anatomy and physiology and how humans meet their basic needs
- identify responsible health practices, including issues relating to nutrition and exercise
- analyze the global impact humans have on living and nonliving environments, including issues related to overpopulation
- analyze the relationships among renewable and nonrenewable resources and the human population

0010 Understand interactions of organisms with one another and their environments.

For example:

- identify characteristics of populations, communities, ecosystems, and biomes
- demonstrate an understanding of the interactions of living and nonliving components of ecosystems and of limiting factors that regulate productivity, complexity, and population sizes within ecosystems (e.g., temperature, soil fertility, light intensity)
- demonstrate an understanding of the concepts of niche and carrying capacity
- analyze the roles of organisms within an ecosystem and the interrelationships among organisms in ecosystems (e.g., predator-prey, commensalism, parasitism)
- analyze the flow of energy and the features of food chains and food webs in various types of ecosystems

SUBAREA III—PHYSICAL SCIENCE

0011 Understand the properties of matter.

For example:

- demonstrate knowledge of the atomic and subatomic structure of matter
- compare and contrast the characteristics of atoms, elements, molecules, and compounds
- identify the physical and chemical properties of elements and compounds (e.g., density, boiling point, solubility)
- interpret chemical symbols, formulas, and expressions

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0012 Understand physical and chemical changes in matter.

For example:

- identify types and characteristics of physical (e.g., phase changes) and chemical (e.g., oxidation, combustion) changes in matter and factors that cause these changes
- apply the concept of conservation of matter
- identify properties of various states of matter and the energy transfer associated with changes in state
- demonstrate an understanding of the predictable nature of chemical reactions
- analyze how concentration, pressure, temperature, and catalysts affect chemical reactions (e.g., rate of reaction)
- demonstrate an understanding of the use of symbolic equations to represent chemical changes and reactions

0013 Understand concepts related to energy and energy transformation.

For example:

- demonstrate knowledge of the forms of energy (e.g., heat, light, mechanical) and their characteristics
- analyze the relationship between energy and matter and the ways in which they interact
- demonstrate a basic understanding of the laws of thermodynamics (e.g., conservation of energy, entropy changes) and the processes of heat transfer (e.g., conduction, radiation, convection)
- demonstrate an understanding of energy transfer in physical systems (e.g., kinetic energy, potential energy, heat energy)
- apply the kinetic molecular model to explain the behavior of solids, liquids, and gases and to explain what happens during chemical reactions

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0014 Understand electricity, magnets, and electromagnetism and their associated fields.

For example:

- analyze the characteristics of static electricity and electric fields
- demonstrate an understanding of the basic properties of electricity (e.g., current, voltage, resistance)
- interpret diagrams of simple electrical circuits and their characteristics
- demonstrate knowledge of the characteristics of magnets and magnetic fields
- demonstrate an understanding of the principles of electromagnetism
- use the principles of electromagnetism to explain the operation of electric motors, generators, and transformers

0015 Understand forces and motion.

For example:

- compare and contrast types and characteristics of forces (e.g., gravitational, frictional) and how they affect the physical world
- analyze the motion of objects and the effects of forces on objects (e.g., resolving vectors, analyzing free-body diagrams)
- demonstrate an understanding of Newton's laws of motion and apply Newton's laws to a variety of practical problems (e.g., assessing frictional forces, determining forces acting on a pendulum)
- demonstrate an understanding of the relationships of mass, force, motion, time, and position (e.g., inertia, momentum, velocity, acceleration)
- compare and contrast characteristics of force, work, and power, and types and characteristics of simple machines

0016 Understand characteristics and behavior of waves, sound, and light.

For example:

- identify types and characteristics of waves (e.g., amplitude, frequency, wavelength, speed) and their effects on properties of sound and light (e.g., pitch, color, spectrum)
- compare and contrast the behavior of sound and light waves in various media (e.g., speed, transmission)
- analyze the behavior of light under various conditions (e.g., refraction, reflection, absorption, dispersion)
- demonstrate knowledge of phenomena related to sound and light (e.g., echoes, shadows, Doppler effect)

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SUBAREA IV—EARTH AND SPACE SCIENCE

0017 Understand the structure and composition of Earth and the natural processes that shape it.

For example:

- demonstrate knowledge of the composition and structure of Earth's interior
- identify the physical and chemical properties of the lithosphere (e.g., rocks, minerals, soils) and analyze characteristics and processes of the rock cycle
- identify major features of Earth's surface (e.g., mountains, oceans, plains, deep-sea trenches) and analyze processes that produce changes in these features (e.g., weathering, erosion, deposition, plate tectonics)
- demonstrate knowledge of how fossils form and how fossils provide evidence of complexity and diversity over time
- demonstrate knowledge of methods and techniques for locating points and features on Earth's surface (e.g., rectilinear coordinate systems, topographic maps, global positioning systems)

0018 Understand characteristics of the atmosphere, weather, and climate.

For example:

- demonstrate knowledge of the basic composition, structure, and properties of the atmosphere
- demonstrate an understanding of the processes of energy transfer in the atmosphere (e.g., convection, radiation, phase changes of water)
- identify types and characteristics of clouds and the processes of cloud formation and precipitation
- analyze characteristics of large-scale and local weather systems (e.g., air masses, fronts, upper-level wind patterns) and the causes and effects of severe weather events (e.g., tornadoes, thunderstorms, blizzards)
- identify the characteristics and distribution of Earth's major climatic zones and factors that affect local and global weather and climate (e.g., deforestation, rain-shadow effect, chinook winds, maritime effect)
- identify methods, techniques, tools, and technology used in observing, measuring, and recording weather conditions and in making weather predictions

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0019 Understand characteristics of the hydrosphere and the movement of water in the environment.

For example:

- demonstrate an understanding of the properties and behavior of water in various states
- identify major categories, characteristics, and distribution of hydrologic systems on Earth (e.g., oceans, glaciers, groundwater, surface waters, water vapor)
- analyze patterns and processes of water circulation through the environment (e.g., water cycle)
- identify characteristics of watersheds and aquifers and the effects of natural events (e.g., droughts) and human activities (e.g., clear-cutting, pumping of groundwater, building acequias) on watersheds and aquifers
- analyze the composition and physical characteristics of oceans (e.g., salinity, density)
- demonstrate an understanding of the causes and effects of waves and tides, and analyze patterns of ocean circulation (e.g., upwelling, currents) and their effects on weather and climate

0020 Understand interactions among Earth's systems and concepts related to environmental science.

For example:

- analyze interactions among Earth's lithosphere, hydrosphere, atmosphere, and biosphere and how natural events (e.g., floods, volcanic eruptions) affect and are affected by these interactions
- identify types of natural resources (e.g., water, wood, land, fossil fuels, minerals) and the consequences of various uses of Earth's natural resources (e.g., global warming, deforestation)
- analyze various strategies for dealing with environmental problems and resource depletion (e.g., mining, nuclear waste, water allocation, agriculture)

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0021 Understand characteristics of the solar system and universe and the methods of exploring them.

For example:

- identify characteristics (e.g., mass, temperature, density) and interactions (e.g., gravitational effects) of the major components of the solar system (e.g., the Sun, planets, satellites, asteroids, comets)
- analyze the effects of the relative positions, movements, and interactions of the Sun, Earth, and Moon (e.g., seasons, lunar phases, eclipses, tides)
- demonstrate knowledge of the types and characteristics of celestial objects (e.g., stars, galaxies, black holes, nebulae)
- demonstrate an understanding of various scientific theories of the origin of the universe (e.g., Big Bang)
- interpret simple data derived from remote and direct observations of the solar system and universe (e.g., evidence of planets near stars other than the Sun)
- demonstrate knowledge of human space exploration, methods and technology used to gather data about space (e.g., types of telescopes, space probes), and benefits to society of technological advances associated with space exploration