

New Mexico

Teacher Assessments™

Study Guide

New Mexico Content Knowledge Assessments™

15 Science



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An Overview of the Testing Program, How to Prepare for the Assessments, and the Day of the Test: Helpful Hints

The first three sections of the study guide are available in a separate PDF file. Click the link below to view or print these sections.

[An Overview of the Testing Program, How to Prepare for the Assessments, and the Day of the Test:
Helpful Hints](#)



An Introduction to the New Mexico Content Knowledge Assessment of Science

The New Mexico Content Knowledge Assessments are designed to measure the subject matter knowledge and skills that are needed to teach effectively in New Mexico schools. The Science test is intended for individuals seeking a 7–12 teaching license.

The Science test consists of 100 selected-response questions.



Test Framework

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 preconceptions and misconceptions in science) 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 constant, 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

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 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)

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

For example:

- evaluate equipment, materials, procedures, and settings for potential safety hazards
- maintain safe practices and procedures in all areas related to science instruction
- apply first response procedures, including first aid, for responding to accidents
- identify 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 procedures for using and caring for living organisms in an ethical and appropriate manner

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

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 discriminate 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
- analyze the relationships between personal choices and health and model responsible health practices, including issues relating to nutrition and exercise
- 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:

- 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 processes by which cells transport materials across cell membranes (e.g., osmosis, diffusion, active transport)
- compare and contrast viruses and cells, prokaryote and eukaryote cells, and plant and animal cells
- analyze cell specialization (e.g., skin and muscle cells in animals, root and leaf cells in plants) and the relationship between a cell's structure and function
- demonstrate an understanding of the cell cycle and the role of cell division (e.g., meiosis, mitosis), growth, and differentiation in the development of living organisms
- demonstrate knowledge of cellular responses to environmental stimuli (e.g., production of antibodies, color changes)

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

For example:

- recognize differences between living organisms and nonliving things
- demonstrate knowledge of the levels of organization in organisms (i.e., cells, tissues, organs, 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
- compare and contrast how various animals and plants carry out basic life processes (e.g., maintaining homeostasis, reproduction, growth and development)
- analyze behavioral responses to external and internal stimuli in a variety of organisms
- analyze structures and functions of human body systems, characteristics of diseases and disorders that may affect these systems, and strategies for maintaining health

0008 Understand the role of genetics and evolution in producing diversity in living organisms.

For example:

- demonstrate an understanding of the structure and function of DNA, RNA, genes, and chromosomes and the processes of replication, transcription, translation, genetic regulation, and protein synthesis
- demonstrate knowledge of the basic principles of inheritance (e.g., dominant and recessive traits, linkage, monogenic and polygenic inheritance), and apply probability methods to determine genotype and phenotype frequencies
- identify sources of variation in populations (e.g., mutations, sexual recombination)
- demonstrate an understanding of the relationship between natural selection and adaptation, and analyze the roles of variation, natural selection, and reproductive isolation in speciation and evolutionary change
- analyze evidence for evolutionary change in organisms over time, and identify evolutionary relationships among organisms
- demonstrate an understanding of methods of classifying organisms and of using classification systems to understand how organisms are related phylogenetically

0009 Understand the role of matter and energy in living systems.

For example:

- recognize that the Sun is the major source of energy for most Earth ecosystems
- identify chemical elements necessary for life, how these chemicals combine to form biologically important compounds, and the structures and functions of carbohydrates, lipids, proteins, and nucleic acids
- compare and contrast sources of energy and matter for different organisms and how various organisms obtain (e.g., photosynthesis, aerobic and anaerobic respiration), store, and use (e.g., growth, thermoregulation, work) energy and matter
- demonstrate an understanding of the transformation, transfer, and flow of energy in living systems (e.g., trophic levels in ecosystems)
- analyze the cycling of matter through ecosystems (e.g., carbon cycle, nitrogen cycle)

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

For example:

- identify characteristics of different communities, ecosystems, and biomes and their indigenous plants and animals
- demonstrate an understanding of the interactions of abiotic and biotic components of ecosystems and of limiting factors that regulate productivity, complexity, and population sizes within ecosystems (e.g., temperature, soil fertility, light intensity)
- analyze interrelationships among organisms in ecosystems (e.g., predator-prey, commensalism, parasitism) and features of food chains and food webs
- demonstrate knowledge of the ways in which ecosystems change and the concept of ecological succession
- demonstrate an understanding of the concepts of niche and carrying capacity, including factors affecting human population growth
- analyze the significance of biodiversity and factors that affect biodiversity

SUBAREA III—PHYSICAL SCIENCE

0011 Understand the structure and 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, reactivity)
- predict how atoms interact based upon sharing or transference of outer electrons
- demonstrate an understanding of the organization of the periodic table and its relationship to the structure and properties of matter
- compare and contrast mixtures and solutions, and identify types and properties of solutions and factors that affect solubility
- interpret chemical symbols, formulas, and expressions

0012 Understand physical and chemical changes in matter.

For example:

- identify types and characteristics of physical, chemical, and nuclear changes in matter and factors that cause these changes
- apply the concept of conservation of matter
- identify characteristics of various states of matter and the energy changes associated with changes in state
- demonstrate knowledge of the types and characteristics of chemical bonds and the relationship between chemical bonds and the properties of matter
- analyze processes of chemical reactions and the factors that affect reaction rates (e.g., temperature, concentration, pressure, catalysts)
- demonstrate an understanding of the use of symbolic equations to represent chemical changes and reactions

0013 Understand concepts related to energy and the interactions of energy and matter.

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 an understanding of the laws of thermodynamics (e.g., conservation of energy, entropy) and processes of heat transfer (e.g., conduction, radiation, convection)
- demonstrate an understanding of energy transfer and transformation in physical systems (e.g., kinetic energy, potential energy)
- apply the kinetic molecular model to explain the behavior of solids, liquids, and gases and identify the interrelationships among pressure, temperature, and volume
- identify units and procedures for measuring energy in various forms and contexts (e.g., temperature, electrical charge, voltage, amplitude)

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 properties of electricity (e.g., current, resistance, potential difference)
- interpret simple electrical circuits and their characteristics
- analyze the characteristics of magnets and magnetic fields
- demonstrate an understanding of the principles of electromagnetism
- apply principles of electromagnetism to the analysis of the operation of electric meters, motors, generators, and transformers

0015 Understand forces and motion.

For example:

- compare and contrast types and characteristics of forces (e.g., gravitational, frictional) and their applications to the physical world
- analyze the effects of forces on particles and objects (e.g., resolving vectors, analyzing free-body diagrams, predicting motion of an object based on net applied force)
- 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, analyzing nonlinear motion)
- 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 characteristics of the electromagnetic spectrum, including types and characteristics of waves (e.g., amplitude, frequency, wavelength, velocity) and their effects on properties of sound and light (e.g., pitch, color)
- compare and contrast transverse and longitudinal waves and analyze wave interactions (e.g., interference) and their effects on sound and light
- compare and contrast the behavior of sound and light waves in various media and substances (e.g., speed, penetration)
- analyze the behavior of light under various conditions (e.g., refraction, reflection, absorption, dispersion)
- apply wave analysis to understand various optical and auditory phenomena (e.g., mirrors, lenses, microphones)

SUBAREA IV—EARTH AND SPACE SCIENCE

0017 Understand the structure and composition of Earth, its history, and the natural processes that shape Earth.

For example:

- demonstrate knowledge of the composition and structure of Earth's interior, and sources and flow of energy in 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, faulting, volcanism)
- demonstrate an understanding of the theory of plate tectonics, supporting evidence for plate tectonics, and how plate tectonics produces changes in Earth's surface
- demonstrate knowledge of the geologic time scale, methods of absolute and relative dating, how fossils form, and how fossils provide evidence of change in complexity and diversity over time
- demonstrate knowledge of methods and techniques for locating and mapping points and features on the surface of Earth (e.g., topographic maps, rectilinear coordinate systems)

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

For example:

- demonstrate knowledge of the basic composition, properties, structure, and evolution of the atmosphere
- demonstrate an understanding of the patterns 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, hurricanes, blizzards)
- identify the characteristics and distribution of Earth's major climatic zones and the factors that affect local and global weather and climate (e.g., deforestation, global warming, maritime effect, rain shadow effect, chinook winds)
- identify methods, techniques, tools, and technology used in observing, measuring, and recording weather conditions and in making short-term and long-term predictions about weather and climate

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, sources and flow of water through watersheds, and effects of natural events (e.g., droughts) and human activities (e.g., irrigation, pumping of groundwater) on watersheds
- analyze the composition and physical characteristics of oceans (e.g., salinity, density) and the interactions among these characteristics (e.g., relationships of temperature, density, depth and buoyancy; relationship of evaporation rate and salinity)
- 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, human use of natural resources, and the effects of natural events and human activity on Earth's systems.

For example:

- analyze interactions among the Earth's systems and the causes and effects of natural catastrophes and other natural events that affect Earth systems (e.g., floods, landslides, mudslides, forest fires, earthquakes, volcanic eruptions)
- 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 the interrelationships among humans, the environment, and other organisms, and the effects of human activities on the environment (e.g., pollution, habitat destruction/protection)
- identify various strategies for dealing with environmental problems and resource depletion

0021 Understand the structure of the solar system and universe, the types of objects in the universe, and their interactions.

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., Sun, planets, asteroids, icy satellites)
- analyze the effects of the 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), the life cycles of various types of stars, and the source and production of energy in stars, including the Sun
- demonstrate an understanding of various scientific theories of the origin of the solar system and universe (e.g., Big Bang)
- demonstrate knowledge of human space exploration programs, methods and technology used to gather data about space (e.g., different types of telescopes, space probes), and benefits to society of technological advances associated with space exploration



Sample Test Directions

A sample of the general directions for the New Mexico Content Knowledge Assessment of Science is shown in the box below.

You should have in front of you:

- (1) a test booklet for the assessment for which you registered (check the assessment name on the front cover);
- (2) an Answer Sheet A; and
- (3) a No. 2 lead pencil.

IF YOU ARE MISSING ANY OF THESE MATERIALS, NOTIFY YOUR TEST ADMINISTRATOR. REMOVE ALL OTHER MATERIALS FROM YOUR DESK.

TEST DIRECTIONS

Each question in this booklet is a selected-response question with four answer choices. Read each question carefully and choose the ONE best answer. Record your answer on Answer Sheet A in the space that corresponds to the question number. Completely fill in the circle having the same letter as the answer you have chosen. *Use only a No. 2 lead pencil.*

- Sample Question:
1. What is the capital of New Mexico?
 - A. Albuquerque
 - B. Las Cruces
 - C. Santa Fe
 - D. Silver City

The correct answer to this question is C. You would indicate that on Answer Sheet A as follows:

1. A B C D

Try to answer all questions. Even if you are unsure of an answer, it is better to guess than not to answer a question at all. You will NOT be penalized for guessing.

You may use the margins of the test booklet for scratch paper, but all of your answers must be recorded on the answer sheet. Answers that are in the test booklet will not be scored.

The words "End of Test" indicate that you have completed the test. You may go back and review your work, and be sure you have answered all questions before raising your hand for dismissal. Your test materials must be returned to a test administrator when you finish the test.

FOR TEST SECURITY REASONS, YOU MAY NOT TAKE NOTES OR REMOVE ANY OF THE TEST MATERIALS FROM THE ROOM.

This testing session will last four hours. You may work at your own pace. If you have any questions, please ask them now before beginning the test.



DO NOT GO ON UNTIL YOU ARE TOLD TO DO SO.



Sample Selected-Response Questions

This section presents sample selected-response questions for you to review as part of your preparation for the New Mexico Content Knowledge Assessment of Science. To demonstrate how the test competencies may be assessed, each sample question is preceded by the competency that it measures. On an actual test, the competencies will not be given.

The sample selected-response questions are designed to illustrate the nature of the test questions. They should not be used as a diagnostic tool to determine your individual strengths and weaknesses. The selected-response questions require you to demonstrate more than the ability to recall factual information. They ask you to think critically about the information, to analyze it, to consider it carefully, or to apply it to a hypothetical situation.

Work through each question carefully before referring to the answer key, which is located at the end of the section.

Competency 0001

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

1. **Use the information below to answer the question that follows.**

In an experiment designed to test the effects of solutes on temperature, students label four beakers A, B, C, and D and add 50 mL of distilled water at room temperature to each. They then add 5 g of table sugar to beaker B, 10 g to beaker C, and 15 g to beaker D. No sugar is added to beaker A. The students measure the temperature of the contents of each beaker. After heating each beaker for the same amount of time on a hot plate at the same setting, the students measure the temperature again. The change in temperature is recorded.

Beaker A is included in this investigation for which of the following reasons?

- A. to compare the expected and actual average temperatures of beakers B, C, and D
- B. as a trial run to confirm the proper functioning of the apparatus and calibration of the thermometer
- C. to be certain that the specified amount of heating time will not be enough to bring the water to the boiling point
- D. as a control to establish the standard against which temperature changes in the other beakers may be compared

Competency 0003

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

2. When preparing to heat a liquid in a beaker or flask on a hot plate, the first safety precaution that should be taken is to:
 - A. check the glassware for cracks or chips.
 - B. check the thermostat of the hot plate to ensure it is properly calibrated.
 - C. preheat the hot plate to the final operating temperature before placing the container on it.
 - D. add boiling chips to the container.

Competency 0006

Understand basic concepts of cell biology.

3. Use the information in the table below to answer the question that follows.

Cell	Cell Wall	Nucleus	Chlorophyll
1	no	yes	yes
2	yes	no	no
3	no	yes	no
4	yes	no	yes

Based on the list of cell characteristics shown in the table above, which cell is most likely from the kingdom Animalia?

- A. Cell 1
- B. Cell 2
- C. Cell 3
- D. Cell 4

Competency 0009

Understand the role of matter and energy in living systems.

4. In the process of photosynthesis, radiant energy is used to:
- A. convert simple sugars into complex carbohydrates such as cellulose.
 - B. split polysaccharides into three-carbon molecules.
 - C. convert atmospheric carbon dioxide into carbohydrate molecules.
 - D. split oxygen molecules and combine the resulting atoms with hydrogen.

Competency 0010

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

5. Early in their life cycles, amphibians and most invertebrates go through a larval stage in which the body form is distinctly different from the body form of the adult. Which of the following is often a consequence of this phenomenon?
- A. The young and adults of a species occupy different habitats or eat different foods, thereby reducing intraspecific competition.
 - B. Predators are less likely to prey on the young, thereby increasing the young animals' survival rates.
 - C. The life cycles of the animals of a particular species are synchronized, thereby ensuring that all the animals become sexually mature at the same time.
 - D. The young are more sensitive than the adults to selection factors in the environment, thereby increasing the rate at which these species evolve.

Competency 0012

Understand physical and chemical changes in matter.

6. Which of the following properties is most likely to be associated with nonpolar covalent substances?
- A. high freezing point
 - B. easily soluble in water
 - C. high boiling point
 - D. poor electrical conduction

Competency 0013

Understand concepts related to energy and the interactions of energy and matter.

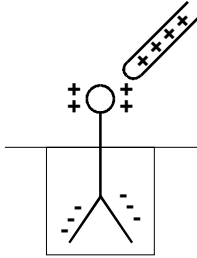
7. According to the kinetic theory of gases, decreasing the volume of an ideal gas, while keeping the mass and the temperature of the gas constant, increases its pressure by increasing the:
- A. average speed of the molecules in the gas.
 - B. average momentum of the molecules in the gas.
 - C. rate of molecular collisions with the walls of the container.
 - D. intermolecular forces between the molecules in the gas.

Competency 0014

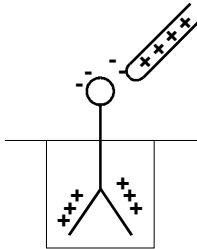
Understand electricity, magnets, and electromagnetism and their associated fields.

8. A positively charged plastic rod is brought near the ball of an electroscope but does not touch it. Which of the following diagrams correctly represents the charge distribution on the electroscope in this situation?

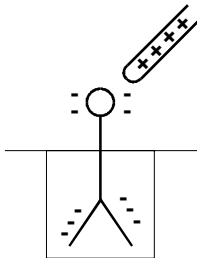
A.



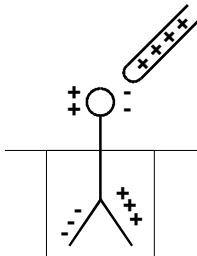
B.



C.



D.



Competency 0017

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

9. A granitic tectonic plate is moving westward. A basaltic tectonic plate is moving eastward toward the granitic plate. Which of the following will occur where these two plates collide?

- A. a coastal mountain range along the western edge of an ocean basin
- B. an island arc off the eastern margin of a continent
- C. a volcanic mountain range along the western margin of a continent
- D. an ocean trench at the western margin of an ocean basin

Competency 0020

Understand interactions among Earth's systems, human use of natural resources, and the effects of natural events and human activity on Earth's systems.

10. **Use the information below to answer the question that follows.**

A coastal region is characterized by steep and rolling hillsides. The area generally has cool winters with heavy rains and warm, dry summers. The human population in the area has been steadily increasing. Homes, businesses, and roads have been built on many steep hillsides in the region. Large areas of natural vegetation have been removed as a result of this development.

Which of the following changes is most likely to occur as a direct result of the changes described in this passage?

- A. a rise in the level of the regional water table
- B. an increase in runoff and surface erosion
- C. an expansion of the saturation zone within the regional aquifer
- D. an increase in the rate of flow of groundwater in all permeable rock layers



Answer Key for the Sample Selected-Response Questions

1. D
2. A
3. C
4. C
5. A
6. D
7. C
8. B
9. C
10. B