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Texas Examinations of Educator Standards

Field 116: Science 4–8
Test Framework

Domain	Range of Competencies
I. Scientific Inquiry and Processes	001–005
II. Physical Science	006–010
III. Life Science	011–015
IV. Earth and Space Science	016–020
V. Science Learning, Instruction, and Assessment	021–023

TEST FRAMEWORK FOR FIELD 116: SCIENCE 4–8

Domain I Scientific Inquiry and Processes (approximately 22% of the test)

Standards Assessed:

Science Standards I, II, III, VI, VII, and XI:

The science teacher manages classroom, field, and laboratory activities to ensure the safety of all students and the ethical care and treatment of organisms and specimens.

The science teacher understands the correct use of tools, materials, equipment, and technologies.

The science teacher understands the process of scientific inquiry and its role in science instruction.

The science teacher understands the history and nature of science.

The science teacher understands how science affects the daily lives of students and how science interacts with and influences personal and societal decisions.

The science teacher knows unifying concepts and processes that are common to all sciences.

Domain II Physical Science (approximately 22% of the test)

Standards Assessed:

Science Standard VIII:

The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in physical science.

Domain III Life Science (approximately 22% of the test)

Standards Assessed:

Science Standard IX:

The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in life science.

Domain IV Earth and Space Science (approximately 22% of the test)

Standards Assessed:

Science Standard X:

The science teacher knows and understands the science content appropriate to teach the statewide curriculum (Texas Essential Knowledge and Skills [TEKS]) in Earth and space science.

Domain V Science Learning, Instruction, and Assessment (approximately 13% of the test)

Standards Assessed:

Science Standards III, IV, and V:

The science teacher understands the process of scientific inquiry and its role in science instruction.

The science teacher has theoretical and practical knowledge about teaching science and about how students learn science.

The science teacher knows the varied and appropriate assessments and assessment practices to monitor science learning.

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DOMAIN I—SCIENTIFIC INQUIRY AND PROCESSES

Competency 001

The teacher understands how to manage learning activities to ensure the safety of all students.

The beginning teacher:

- Understands safety regulations and guidelines for science facilities and science instruction.
- Knows procedures for and sources of information regarding the appropriate handling, use, disposal, care, and maintenance of chemicals, materials, specimens, and equipment.
- Knows procedures for the safe handling and ethical care and treatment of organisms and specimens.

Competency 002

The teacher understands the correct use of tools, materials, equipment, and technologies.

The beginning teacher:

- Selects and safely uses appropriate tools, technologies, materials, and equipment needed for instructional activities.
- Understands concepts of precision, accuracy, and error with regard to reading and recording numerical data from a scientific instrument.
- Understands how to gather, organize, display, and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations).
- Understands the international system of measurement (i.e., metric system) and performs unit conversions within measurement systems.

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Competency 003

The teacher understands the process of scientific inquiry and the history and nature of science.

The beginning teacher:

- Understands the characteristics of various types of scientific investigations (e.g., descriptive studies, controlled experiments, comparative data analysis).
- Understands how to design, conduct, and communicate the results of a variety of scientific investigations.
- Understands the historical development of science and the contributions that diverse cultures and individuals of both genders have made to scientific knowledge.
- Understands the roles that logical reasoning, verifiable evidence, prediction, and peer review play in the process of generating and evaluating scientific knowledge.
- Understands principles of scientific ethics.
- Develops, analyzes, and evaluates different explanations for a given scientific result.
- Demonstrates an understanding of potential sources of error in inquiry-based investigation.
- Demonstrates an understanding of how to communicate and defend the results of an inquiry-based investigation.

Competency 004

The teacher understands how science impacts the daily lives of students and interacts with and influences personal and societal decisions.

The beginning teacher:

- Understands that decisions about the use of science are based on factors such as ethical standards, economics, and personal and societal needs.
- Applies scientific principles and the theory of probability to analyze the advantages of, disadvantages of, or alternatives to a given decision or course of action.
- Applies scientific principles and processes to analyze factors that influence personal choices concerning fitness and health, including physiological and psychological effects and risks associated with the use of substances and substance abuse.
- Understands concepts, characteristics, and issues related to changes in populations and human population growth.
- Understands the types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources.
- Understands the role science can play in helping resolve personal, societal, and global challenges.

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Competency 005

The teacher knows and understands the unifying concepts and processes that are common to all sciences.

The beginning teacher:

- Understands how the following concepts and processes provide a unifying explanatory framework across the science disciplines: systems, order, and organization; evidence, models, and explanation; change, constancy, and measurements; evolution and equilibrium; and form and function.
- Demonstrates an understanding of how patterns in observations and data can be used to make explanations and predictions.
- Analyzes interactions and interrelationships between systems and subsystems.
- Applies unifying concepts to explore similarities in a variety of natural phenomena.
- Understands how properties and patterns of systems can be described in terms of space, time, energy, and matter.
- Understands how change and constancy occur in systems.
- Understands the complementary nature of form and function in a given system.
- Understands how models are used to represent the natural world and how to evaluate the strengths and limitations of a variety of scientific models (e.g., physical, conceptual, mathematical).

DOMAIN II—PHYSICAL SCIENCE

Competency 006

The teacher understands forces and motion and their relationships.

The beginning teacher:

- Demonstrates an understanding of properties of universal forces (e.g., gravitational, electrical, magnetic).
- Understands how to measure, graph, and describe changes in motion using concepts of displacement, velocity, and acceleration.
- Understands the vector nature of force.
- Identifies the forces acting on an object and applies Newton's laws to describe the motion of an object.
- Analyzes the relationship between force and motion in a variety of situations (e.g., simple machines, blood flow, geologic processes).

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Competency 007

The teacher understands physical properties of and changes in matter.

The beginning teacher:

- Describes the physical properties of substances (e.g., density, boiling point, solubility, thermal and electrical conductivity).
- Describes the physical properties and molecular structure of solids, liquids, and gases.
- Describes the relationship between the molecular structure of materials (e.g., metals, crystals, polymers) and their physical properties.
- Relates the physical properties of an element to its placement in the periodic table.
- Distinguishes between physical and chemical changes in matter.
- Applies knowledge of physical properties of and changes in matter to processes and situations that occur in life and earth/space science.

Competency 008

The teacher understands chemical properties of and changes in matter.

The beginning teacher:

- Describes the structure and components of the atom.
- Distinguishes among elements, mixtures, and compounds and describes their properties.
- Relates the chemical properties of an element to its placement in the periodic table.
- Describes chemical bonds and chemical formulas.
- Analyzes chemical reactions and their associated chemical equations.
- Explains the importance of a variety of chemical reactions that occur in daily life (e.g., rusting, burning of fossil fuels, photosynthesis, cell respiration, chemical batteries, digestion of food).
- Understands applications of chemical properties of matter in physical, life, and earth/space science and technology (e.g., materials science, biochemistry, transportation, medicine, telecommunications).

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Competency 009

The teacher understands energy and interactions between matter and energy.

The beginning teacher:

- Describes concepts of work, power, and potential and kinetic energy.
- Understands the concept of heat energy and the difference between heat and temperature.
- Understands the principles of electricity and magnetism and their applications (e.g., electric circuits, motors, audio speakers, nerve impulses, lightning).
- Applies knowledge of properties of light (e.g., reflection, refraction, dispersion) to describe the function of optical systems and phenomena (e.g., camera, microscope, rainbow, eye).
- Demonstrates an understanding of the properties, production, and transmission of sound.
- Applies knowledge of properties and characteristics of waves (e.g., wavelength, frequency, interference) to describe a variety of waves (e.g., water, electromagnetic, sound).

Competency 010

The teacher understands energy transformations and the conservation of matter and energy.

The beginning teacher:

- Describes the processes that generate energy in the sun and other stars.
- Applies the law of conservation of matter to analyze a variety of situations (e.g., the water cycle, food chains, decomposition, balancing chemical equations).
- Describes sources of electrical energy and processes of energy transformation for human uses (e.g., fossil fuels, solar panels, hydroelectric plants).
- Understands exothermic and endothermic chemical reactions and their applications (e.g., hot and cold packs, energy content of food).
- Applies knowledge of the transfer of energy in a variety of situations (e.g., the production of heat, light, sound, and magnetic effects by electrical energy; the process of photosynthesis; weather processes; food webs; food/energy pyramids).
- Applies the law of conservation of energy to analyze a variety of physical phenomena (e.g., specific heat, nuclear reactions, efficiency of simple machines, collisions).
- Understands applications of energy transformations and the conservation of matter and energy in life and earth/space science.

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DOMAIN III—LIFE SCIENCE

Competency 011

The teacher understands the structure and function of living things.

The beginning teacher:

- Describes characteristics of organisms from the major taxonomic groups.
- Analyzes how structure complements function in cells.
- Analyzes how structure complements function in tissues, organs, organ systems, and organisms.
- Identifies human body systems and describes their functions.
- Describes how organisms obtain and use energy and matter.
- Applies chemical principles to describe the structure and function of the basic chemical components (e.g., proteins, carbohydrates, lipids, nucleic acids) of living things.

Competency 012

The teacher understands reproduction and the mechanisms of heredity.

The beginning teacher:

- Compares and contrasts sexual and asexual reproduction.
- Understands the organization of hereditary material (e.g., DNA, genes, chromosomes).
- Describes how an inherited trait can be determined by one or many genes and how more than one trait can be influenced by a single gene.
- Distinguishes between dominant and recessive traits and predicts the probable outcomes of genetic combinations.
- Evaluates the influence of environmental and genetic factors on the traits of an organism.
- Describes current applications of genetic research (e.g., related to cloning, reproduction, health, industry, agriculture).

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Competency 013

The teacher understands adaptations of organisms and the theory of evolution.

The beginning teacher:

- Describes similarities and differences among various types of organisms and methods of classifying organisms.
- Describes traits in a population or species that enhance its survival and reproductive success.
- Describes how populations and species change through time.
- Applies knowledge of the mechanisms and processes of biological evolution (e.g., variation, mutation, environmental factors, natural selection).
- Describes evidence that supports the theory of evolution of life on Earth.

Competency 014

The teacher understands regulatory mechanisms and behavior.

The beginning teacher:

- Describes how organisms respond to internal and external stimuli.
- Applies knowledge of structures and physiological processes that maintain stable internal conditions.
- Demonstrates an understanding of feedback mechanisms that allow organisms to maintain stable internal conditions.
- Understands how evolutionary history affects behavior.

Competency 015

The teacher understands the relationships between organisms and the environment.

The beginning teacher:

- Identifies the abiotic and biotic components of an ecosystem.
- Analyzes the interrelationships among producers, consumers, and decomposers in an ecosystem.
- Identifies factors that influence the size and growth of populations in an ecosystem.
- Analyzes adaptive characteristics that result in a population's or species's unique niche in an ecosystem.
- Describes and analyzes energy flow through various types of ecosystems.
- Knows how populations and species modify and affect ecosystems.

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DOMAIN IV—EARTH AND SPACE SCIENCE

Competency 016

The teacher understands the structure and function of earth systems.

The beginning teacher:

- Understands the structure of Earth and analyzes constructive and destructive processes that produce geologic change.
- Understands the form and function of surface and subsurface water.
- Applies knowledge of the composition and structure of the atmosphere and its properties.
- Demonstrates an understanding of the interactions that occur among the biosphere, geosphere, hydrosphere, and atmosphere.
- Applies knowledge of how human activity and natural processes, both gradual and catastrophic, can alter earth systems.
- Identifies the sources of energy (e.g., solar, geothermal) in earth systems and describes mechanisms of energy transfer (e.g., convection, radiation).

Competency 017

The teacher understands cycles in earth systems.

The beginning teacher:

- Understands the rock cycle and how rocks, minerals, and soils are formed.
- Understands the water cycle and its relationship to weather processes.
- Understands the nutrient (e.g., carbon, nitrogen) cycle and its relationship to earth systems.
- Applies knowledge of how human and natural processes affect earth systems.
- Understands the dynamic interactions that occur among the various cycles in the biosphere, geosphere, hydrosphere, and atmosphere.

Competency 018

The teacher understands the role of energy in weather and climate.

The beginning teacher:

- Understands the elements of weather (e.g., humidity, wind speed, pressure, temperature) and how they are measured.
- Compares and contrasts weather and climate.
- Analyzes weather charts and data to make weather predictions.
- Applies knowledge of how transfers of energy among earth systems affect weather and climate.
- Analyzes how Earth's position, orientation, and surface features affect weather and climate.

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Competency 019

The teacher understands the characteristics of the solar system and the universe.

The beginning teacher:

- Understands the properties and characteristics of celestial objects.
- Applies knowledge of the earth-moon-sun system and the interactions among them (e.g., seasons, lunar phases, eclipses).
- Identifies properties of the components of the solar system.
- Recognizes characteristics of stars and galaxies and their distribution in the universe.
- Demonstrates an understanding of scientific theories of the origin of the universe.

Competency 020

The teacher understands the history of the earth system.

The beginning teacher:

- Understands the scope of the geologic time scale and its relationship to geologic processes.
- Demonstrates an understanding of theories about the earth's origin and geologic history.
- Demonstrates an understanding of how tectonic forces have shaped landforms over time.
- Understands the formation of fossils and the importance of the fossil record in explaining the earth's history.

DOMAIN V—SCIENCE LEARNING, INSTRUCTION, AND ASSESSMENT

Competency 021

The teacher has theoretical and practical knowledge about teaching science and about how students learn science.

The beginning teacher:

- Understands how the developmental characteristics, prior knowledge and experience, and attitudes of students influence science learning.
- Selects and adapts science curricula, content, instructional materials, and activities to meet the interests, knowledge, understanding, abilities, experiences, and needs of all students, including English Language Learners.
- Understands how to use situations from students' daily lives to develop instructional materials that investigate how science can be used to make informed decisions.

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- Understands common misconceptions in science and effective ways to address these misconceptions.
- Understands the rationale for the use of active learning and inquiry processes for students.
- Understands questioning strategies designed to elicit higher-level thinking and how to use them to move students from concrete to more abstract understanding.
- Understands the importance of planning activities that are inclusive and accommodate the needs of all students.
- Understands how to sequence learning activities in a way that allows students to build upon their prior knowledge and challenges them to expand their understanding of science.

Competency 022

The teacher understands the process of scientific inquiry and its role in science instruction.

The beginning teacher:

- Plans and implements instruction that provides opportunities for all students to engage in nonexperimental and experimental inquiry investigations.
- Focuses inquiry-based instruction on questions and issues relevant to students and uses strategies to assist students with generating, refining, and focusing scientific questions and hypotheses.
- Instructs students in the safe and proper use of a variety of grade-appropriate tools, equipment, resources, technology, and techniques to access, gather, store, retrieve, organize, and analyze data.
- Knows how to guide students in making systematic observations and measurements.
- Knows how to promote the use of critical-thinking skills, logical reasoning, and scientific problem solving to reach conclusions based on evidence.
- Knows how to teach students to develop, analyze, and evaluate different explanations for a given scientific result.
- Knows how to teach students to demonstrate an understanding of potential sources of error in inquiry-based investigation.
- Knows how to teach students to demonstrate an understanding of how to communicate and defend the results of an inquiry-based investigation.

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Competency 023

The teacher knows the varied and appropriate assessments and assessment practices to monitor science learning in laboratory, field, and classroom settings.

The beginning teacher:

- Understands the relationships among science curriculum, assessment, and instruction and bases instruction on information gathered through assessment of students' strengths and needs.
- Understands the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis.
- Understands the importance of carefully selecting or designing formative and summative assessments for the specific decisions they are intended to inform.
- Selects or designs and administers a variety of appropriate assessment methods (e.g., performance assessment, self-assessment, formal/informal, formative/summative) to monitor student understanding and progress.
- Uses formal and informal assessments of student performance and products (e.g., projects, lab journals, rubrics, portfolios, student profiles, checklists) to evaluate student participation in and understanding of the inquiry process.
- Understands the importance of sharing evaluation criteria and assessment results with students.