EC-6 Core Subjects: Science
TExES #291 Review

• Approximately 19% of the test
• Approximately 52 Items
• 40 minutes
• Averages 46 seconds per question

Domain IV – Science

• Competency I: Lab Processes, Equipment and Safety
• Competency II: History and Nature of Science
• Competency III: Impact of Science
• Competency IV: Concepts and Processes
• Competency V: Students as Learners and Science Instruction
• Competency VI: Science Assessment
• Competency VII: Forces and Motion
• Competency VIII: Physical and Chemical Properties
• Competency IX: Energy and Interactions
• Competency X: Energy Transformations and Conservation
The teacher understands how to manage learning activities, tools, materials, equipment and technologies to ensure the safety of all students.

The beginning teacher:
A. Understands safety regulations and guidelines for science facilities and science instruction.
B. Knows procedures for and sources of information regarding the appropriate handling, use, disposal, care and maintenance of chemicals, materials, specimens and equipment.
C. Knows procedures for the safe handling and ethical care and treatment of organisms and specimens.
D. Selects and safely uses appropriate tools, technologies, materials and equipment needed for instructional activities.

Competency 001: Lab Processes, Equipment and Safety

The teacher understands how to manage learning activities, tools, materials, equipment and technologies to ensure the safety of all students.

The beginning teacher:
E. Understands concepts of precision, accuracy and error with regard to reading and recording numerical data from a scientific instrument.
F. Understands how to gather, organize, display and communicate data in a variety of ways (e.g., charts, tables, graphs, diagrams, written reports, oral presentations).
G. Understands the international system of measurement (i.e., metric system) and performs unit conversions within measurement systems, including the use of nonstandard units.

Competency 001: Lab Processes, Equipment and Safety

Problem:
The Texas Essential Knowledge and Skills requires that students participate in laboratory and field studies as part of their science instruction. Where would a teacher find out the state regulations for science laboratory and field investigations?

A. Occupational Safety and Health Administration (OSHA) guidelines
B. Texas Hazardous Substance Act
C. School District Handbook
D. Texas Science Safety Standards
Competency 001: Lab Processes, Equipment and Safety

The teacher understands how to manage learning activities, tools, materials, equipment and technologies to ensure the safety of all students.

Answer:

C is the correct answer. (Texas Science Safety Standards)
• The Texas Education Agency document, Texas Safety Standards for Kindergarten-Grade 12, outlines safety guidelines for each grade level for laboratory investigations as well as field experiences. Science teachers must be familiar with these state guidelines and follow them when planning experiences for their students.

Competency 002: History and Nature of Science

The teacher understands the history and nature of science, the process and role of scientific inquiry and the role of inquiry in science instruction.

A. Understands, plans, designs and implements instruction that provides opportunities for all students to engage in nonexperimental and experimental inquiry investigations.
B. 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.
C. Understands and instructs students in the safe and proper use of a variety of grade-appropriate tools, equipment, resources, technology and techniques to access, gather, store, refine, organize and analyze data.
D. Knows how to guide students in making systematic observations and measurements and posing questions to guide investigations.
E. Knows how to promote the use of critical-thinking skills, logical reasoning and scientific problem solving to reach conclusions based on evidence.

The beginning teacher:

A. Understands, plans, designs and implements instruction that provides opportunities for all students to engage in nonexperimental and experimental inquiry investigations.
B. 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.
C. Understands and instructs students in the safe and proper use of a variety of grade-appropriate tools, equipment, resources, technology and techniques to access, gather, store, refine, organize and analyze data.
D. Knows how to guide students in making systematic observations and measurements and posing questions to guide investigations.
E. Knows how to promote the use of critical-thinking skills, logical reasoning and scientific problem solving to reach conclusions based on evidence.
The teacher understands the history and nature of science, the process and role of scientific inquiry and the role of inquiry in science instruction.

F. Knows how to teach students to develop, analyze and evaluate different explanations for a given scientific result, including that repeated investigations may increase reliability.

G. Knows how to teach students to demonstrate an understanding of potential sources of error in inquiry-based investigation.

H. Knows how to teach students to demonstrate an understanding of how to communicate and defend the results of an inquiry-based investigation.

I. Understands principles of scientific ethics.

J. Understands the roles that logical reasoning, verifiable evidence, prediction and peer review play in the process of generating and evaluating scientific knowledge.

K. Understands the historical development of science (e.g., cell theory, plate tectonics, laws of nature) and technology and the contributions that diverse cultures and individuals of both genders have made to scientific and technological knowledge.

Competency 002: History and Nature of Science

Problem:
Sixth grade students engage in a study of Texas horned toads in their county. As part of the study, they identify all the factors that could possibly affect the toad population. The type of study that the students are participating in is most likely--

A. Descriptive field investigation
B. Comparative field investigation
C. Correlative field investigation
D. Experimental field investigation

Answer:
The correct answer is A. Descriptive field investigation

- A descriptive field investigation is one that describes or quantifies parts of a national system and identifies factors that might affect the organism.
Competency 003: Impact of Science

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

The beginning teacher:
A. Understands that decisions about the use of science are based on factors such as ethical standards, economics and personal and societal needs.
B. Applies scientific principles to analyze the advantages of, disadvantages of or alternatives to a given decision or course of action.
C. 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.
D. Understands concepts, characteristics and issues related to changes in populations and human possible growth.
E. Identifies and understands the types and uses of natural resources and the effects of human consumption on the renewal and depletion of resources.
F. Understands the role science and scientists can play in helping resolve personal, societal and global challenges.

Problem:
Leaders of the world gathered in Copenhagen, Denmark in November, 2009, to discuss Global Warming. Representatives from China, India, Brazil and South Africa protested recommendations to half global emissions by 2050. A possible reason for protesting this policy is –

A. Not all countries in the world have the same population density, so the policy is unfair.
B. It is not possible to reduce emissions without banning automobiles.
C. Emissions do not have a direct effect on global warming, so the policy will not affect global warming.
D. Some industrialized countries have been creating emissions for decades and should be asked to cut back more.

Answer:
The correct answer is D. (Some industrialized countries have been creating emissions for decades and should be asked to cut back more)

• The protesting countries point out that industrialized nations have contributed to global warming because of emissions from factories, automobiles and other sources for decades. According the protesters, the policy is not equitable.
The teacher knows and understands the unifying concepts and processes that are common to all sciences.

A. Understands how a unifying, explanatory framework across the science disciplines is provided by the concepts and processes of systems, order and organization; evidence, models and explanation; change, constancy and measurements; and form and function.
B. Demonstrates an understanding of how patterns in observations and data can be used to make explanations and predictions.
C. Analyzes interactions and interrelationships between systems and subsystems.
D. Applies unifying concepts to explore similarities in a variety of natural phenomena.
E. Understands how properties and patterns of systems can be described in terms of space, time, energy and matter.
F. Understands how change and constancy occur in systems.

Problem:
First grade students are beginning a unit of study about objects in the sky. The students will create a daily log and draw what they see in the sky at a set time during the day and in the evening before they go to bed. The learning experience described above is an opportunity for the teacher to highlight each of these unifying concepts in science except—

A. Cycles
B. Patterns
C. Form and function
D. Systems

Answer:
The correct answer choice is C. (Form and function)
- Recording the day and night sky through a daily journal is a rich opportunity to help students begin to understand the big ideas of science - patterns, constancy and change, and systems.
The teacher has theoretical and practical knowledge about teaching science and about how students learn science.

The beginning teacher:

A. Understands how developmental characteristics, prior knowledge and experience and students’ attitudes influence science learning.
B. Selects and adapts science curricula, content, instructional materials, collaborations, vocabulary and activities to meet the levels of interest, knowledge and understanding as well as the abilities, experiences and needs of all students, including English-language learners.
C. Understands how to use students’ experiences and daily lives to develop instructional materials that investigate how science can be used to make informed decisions.
D. Understands common misconceptions in science and has effective ways to address those misconceptions.
E. Understands developmentally appropriate design and implementation of hands-on learning experiences in science and selects effective, appropriate instructional practices, activities, technologies and materials to promote students’ scientific knowledge, skills and inquiry processes.
F. Understands questioning strategies designed to elicit higher-level thinking and how to use them to move students from concrete to more abstract understanding.
G. Understands the importance of planning activities that are inclusive and that accommodate the needs of all students.
H. Understands how to sequence learning activities in a way that enables students to build on their prior knowledge and that challenges them to expand their understanding of science.

Problem:
Mr. Smith’s 5th grade classroom consists of a number of English Language Learners (ELL) as well as students of mixed ability levels. How can Mr. Smith design his upcoming science unit so that students are successful, engaged, and challenged?

A. Buy trade books at different levels on science topics and allow students to choose their own books
B. Set up after school tutorials for students who are struggling with the language and information.
C. Run off puzzle pages on science vocabulary for students to work on if they finish their work early.
D. Require students to complete a set of core activities, then allow students to choose from a list of related activities.
Competency 005: Student as Learners and Science Instruction

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

Answer:

D is the correct answer. (Requires students to complete a set of core activities, then allow students to choose from a list of related activities)

- While the other choices represent legitimate options for supporting student learning, D represents the best choice for organizing instruction to ensure that all students learn the key concepts and have the opportunity to select activities appropriate to their individual levels.

Competency 006: Science Assessment

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

The beginning teacher:

A. Understands the relationships between a science curriculum, assessment and instruction and bases instruction on information gathered through assessment of students' strengths and needs.

B. Understands the importance of monitoring and assessing students' understanding of science concepts and skills on an ongoing basis, including how to use formal and informal assessments of student performance and how to use products (e.g., projects, lab journals, science portfolios, student self-evaluations, checklists) to evaluate students' understanding and participation in the inquiry process.

C. Selects — or designs — and administers a variety of appropriate assessments (e.g., performance assessment, formative assessment, standardized assessment, formative/summative assessment) to monitor students' understanding and progress and to plan for instruction.

D. Understands the importance of communicating evaluation criteria and assessment results to students.

Problem:

Which of the statements below does not describe a characteristic of high quality assessment in the classroom?

A. Assessment is a continuous, ongoing process.

B. Formative assessment is used to guide instruction.

C. Prior knowledge/student misconceptions are an important part of assessment.

D. All are characteristics of a high quality assessment.
Competency 006: Science Assessment

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

Answer:
The correct answer is D. (All are characteristics of a high quality assessment)
• Each of the assessment pieces listed are an important part of a high quality assessment program. Utilizing multiple types of assessments give the teachers a more complete picture of student learning.

Competency 007: Forces and Motion

The teacher understands forces and motion and their relationships.

The beginning teacher:
A. Demonstrates an understanding of the properties of universal forces (e.g., gravitational, electrical, magnetic).
B. Understands how to measure, graph and describe changes in motion by using concepts of position, direction of motion and speed.
C. Analyzes the ways unbalanced forces acting on an object cause changes in the position or motion of the object.
D. Analyzes the relationship between force and motion in a variety of situations (e.g., simple machines, geologic processes).

Problem:
Which of these is most likely not a result of unbalanced forces?
A. Triple-beam balance at 0
B. Block pushed off desk
C. Toy car rolling down ramp
D. Volcano erupting
Competency 007: Forces and Motion
The teacher understands forces and motion and their relationships.

Answer:
The correct response is A. (Triple-beam balance at 0)
- Resetting a triple beam balance to 0 results in a balanced system. All the other examples are the result of unbalanced forces which result in movement and/or a change in position.

Competency 008: Physical and Chemical Properties
The teacher understands the physical and chemical properties of and changes in matter.

The beginning teacher:
A. Describes and measures the physical and chemical properties of substances (e.g., size, shape, temperature, magnetism, hardness, mass, conduction, density).
B. Describes the physical properties of solids, liquids and gases.
C. Distinguishes between physical and chemical changes in matter.
D. Applies knowledge of physical and chemical properties (including atomic structure) of and changes in matter to processes and situations that occur in life and in earth and space science.
E. Distinguishes between elements, compounds, mixtures and solutions and describes their properties.
F. Describes and explains the occurrence and 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).

Competency 008: Physical and Chemical Properties
The teacher understands the physical and chemical properties of and changes in matter.

Problem:
Which of these mixtures would be easiest to separate?
A. Fruit salad
B. Powdered lemonade
C. Hot chocolate
D. Instant pudding
Competency 008: Physical and Chemical Properties

The teacher understands the physical and chemical properties of and changes in matter.

Answer:
The correct response is A. (Fruit salad)
• The fruit salad would be the easiest mixture to separate because one can easily see what makes up the mixture. With the other choices, you cannot see the different properties that make up the mixture.

Competency 009: Lab Processes, Equipment and Safety

The teacher understands energy and interactions between matter and energy.

The beginning teacher:
A. Understands conservation of energy and energy transformations and analyzes how energy is transformed from one form to another (e.g., potential, kinetic, mechanical, sound, heat, light, chemical, electrical) in a variety of everyday situations and how increasing or decreasing amounts affect objects.
B. Understands the basic concepts of heat energy and related processes (e.g., melting, evaporation, boiling, condensation, conduction, convection, and radiation).
C. Understands the principles of electricity and magnetism and their applications (e.g., electric circuits, electromagnetic fields, motors, audio speakers, lightning).
D. Applies knowledge of properties of light (e.g., reflection, refraction) to describe the functioning of optical systems and phenomena (e.g., camera, microscope, binoculars, eye).
E. Demonstrates an understanding of the properties, production, and transmission of sound.

Problem:
Ice cream in a bowl changed from solid to liquid in a few minutes. Which of the following most likely caused this change?
A. Bacteria grew in the ice cream.
B. Heat was added to the ice cream.
C. Water evaporated from the ice cream.
D. Frozen berries were sprinkled on the ice cream.
Competency 009: Lab Processes, Equipment and Safety

The teacher understands energy and interactions between matter and energy.

Answer:
The correct response is B. (Heat was added to the ice cream.)
• Applying heat to a liquid will change it from a solid to a liquid. None of the other options will cause this to happen.

Competency 010: Energy Transformations and Conservation

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

The beginning teacher:
A. Describes sources of electrical energy and processes of energy transformation for human uses (e.g., fossil fuels, solar panels, hydroelectric plants).
B. Applies knowledge of 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 and energy pyramids).
C. Understands applications of energy transformations and the conservation of matter and energy in life and in earth and space science.

Problem:
Fossil fuels formed over a long period of time because heat and pressure were applied to —
A. carbon filtered through limestone
B. organisms buried in the ground
C. bacteria on top of the mud
D. nitrogen mixed in the water
Competency 010: Energy Transformations and Conservation
The teacher understands energy transformations and the conservation of matter and energy.

Answer:
The correct answer is B. (organisms buried in the ground)
- Fossil fuels are created from plants and animals that were buried in sediment millions of years ago. As the sediment builds over time, heat and pressure causes the plant and animal decay to turn into peat, then into coal, oil, petroleum or natural gas.

Competency 011: Structure and Function of Living Things
The teacher understands the structure and function of living things.

The beginning teacher:
A. Understands that living systems have different structures that perform different functions.
B. Understands and describes stages in the life cycles of common plants and animals (including animals that experience complete and incomplete metamorphosis).
C. Understands that organisms have basic needs.
D. Analyzes how structure complements function in cells, tissues, organs, organ systems and organisms.
E. Identifies human body systems and describes their functions.
F. Understands the relationship between characteristics, structures, and functions and corresponding taxonomic classifications.

Problem:
The petals of flowers often are brightly colored. These petals provide a benefit for the plant because they —
A. prevent insects from taking pollen to other flowers
B. hide the plant from predators that would eat its flowers
C. protect the leaves from injury by birds and insects
D. attract insects that can carry the pollen needed for plant reproduction
Competency 011: Structure and Function of Living Things

The teacher understands the structure and function of living things.

Answer:

The correct answer is D. (attract insects that can carry the pollen needed for plant reproductive)

• The function of the petals on a flower is to attract insects so they can carry pollen to other plants.

Competency 012: Reproduction and the Mechanisms of Heredity

The teacher understands reproduction and the mechanisms of heredity.

The beginning teacher:

A. Describes the processes by which plants and animals reproduce and explains how hereditary information is passed from one generation to the next.
B. Compares and contrasts inherited traits and learned characteristics.
C. Understands the organization of hereditary material and 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.
D. Distinguishes between dominant and recessive traits and predicts the probable outcomes of genetic combinations.
E. Evaluates the influence of environmental and genetic factors on the traits of an organism.

Competency 012: Reproduction and the Mechanisms of Heredity

The teacher understands reproduction and the mechanisms of heredity.

Problem:

One example of a trait passed from a parent plant to its offspring is —

A. the amount of water in the plant’s environment
B. the amount of sunlight shining on the plant
C. the color of the flowers on the plant
D. the nutrients in the soil where the plant grows
Competency 012: Reproduction and the Mechanisms of Heredity

The teacher understands reproduction and the mechanisms of heredity.

Answer:
The correct answer is C. (the color of the flowers on the plant)
- The color of a flower (it's phenotype) is determined by it's genotype, or it's genetic makeup. Parents pass their genes on to their offspring. C is the only example of this.

Competency 013: Adaptations and Evolution

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

The beginning teacher:
A. Demonstrates knowledge of adaptive characteristics and explains how adaptations influence the survival of populations or species.
B. Describes how populations and species change through time.
C. Describes processes that enable traits to change through time, including selective breeding, mutation and other natural occurrences.

Problem:
Which tool below best models the way a dog’s jaws work?

- A. Tongue
- B. Jaw/teeth
- C. Nailer
- D. Screw
Competency 013: Adaptations and Evolution

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

Answer:
The correct answer is A. (Tongs)

- The tongs are similar to a dog’s jaw because it is hinged and allow someone to pick up and hold materials.

Competency 014: Organisms and the Environment

The teacher understands the relationships between organisms and the environment.

The beginning teacher:
A. Understands that organisms respond to internal or external stimuli and analyzes the role of internal and external stimuli in the behavior of organisms.
B. Understands relationships between organisms and the environment and describes ways that living organisms depend on each other and on the environment to meet their basic needs.
C. Identifies organisms, populations, or species with similar needs and analyzes how they compete with one another for resources.
D. Analyzes the interrelationships and interdependence among producers, consumers, and decomposers in an ecosystem (e.g., food webs, host-parasite, competition, predation).
E. Identifies factors that influence the size and growth of populations in an ecosystem.
F. Analyzes adaptive characteristics that result in a population’s or species’ unique niche in an ecosystem.
G. Knows how populations and species modify and affect ecosystems.

Problem:
A teacher prepares a chart to display in the classroom at the beginning of a life science lesson. The purpose of the lesson is to learn about a concept that all items in List A demonstrate. The lesson is most likely about –

- A. Living things
- B. Nonliving things
- C. Decomposers
- D. Producers
Competency 014: Organisms and the Environment

The teacher understands the relationships between organisms and the environment.

Answer:
The correct answer is D. (Producers)

- All the members of List A are green plants, or producers, and none of the members of List B are able to produce their own food.

---

Competency 015: Structure and Function of Earth Systems

The teacher understands the structure and function of Earth systems.

The beginning teacher:

A. Understands the structure of Earth and analyzes constructive and destructive processes (including plate tectonics, weathering and erosion) that produce geologic change, including how these processes have affected Earth history.
B. Understands the form and function of surface water and groundwater.
C. Applies knowledge of the composition and structure of the atmosphere and its properties.
D. Applies knowledge of how human activity and natural processes, both gradual and catastrophic, can alter Earth systems.

---

Competency 015: Structure and Function of Earth Systems

The teacher understands the structure and function of Earth systems.

Problem:
The Davis Mountains in West Texas used to be taller than they are now. Which of the following conditions most likely caused the mountains to become shorter over time?

A. Heat and pressure  
B. Soil formation  
C. Rain and wind  
D. River formation

---
Competency 015: Structure and Function of Earth Systems

The teacher understands the structure and function of Earth systems.

Answer:
The correct answer is C. (Rain and wind)
- Erosion, either by wind or rain, will cause the size of land formations to decrease over time.

Competency 016: Cycles in Earth Systems

The teacher understands cycles in Earth systems.

The beginning teacher:
A. Understands the rock cycle and how rocks, minerals and soils are formed, and their respective properties.
B. Understands the water cycle and its relationship to weather processes.
C. Understands the nutrient (e.g., carbon, nitrogen) cycle and its relationship to Earth systems.
D. Applies knowledge of how human and natural processes affect Earth systems.
E. Understands and describes the properties and uses of Earth materials (e.g., rocks, soils, water, atmospheric gases).

Problem:
After lake water flows through a dam, which processes help replace the water in the lake?
A. Rainfall and runoff
B. Erosion and weathering
C. Refraction and reflection
D. Separating and evaporating
Competency 016: Cycles in Earth Systems

The teacher understands cycles in Earth systems.

Answer:
The correct answer is A. (Rainfall and runoff)
- New rainfall and runoff of water will replenish a lake. When there are drought conditions, the level of a lake will drop due to the fact there is no new water to replace the water lost.

Competency 017: Energy in Weather and Climate

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

The beginning teacher:
A. Understands the elements of weather (e.g., humidity, wind speed and direction, air pressure, temperature) and the tools used for measurement.
B. Compares and contrasts weather and climate.
C. Analyzes weather charts and data to make weather predictions.
D. Applies knowledge of how transfers of energy between Earth systems affect weather and climate.
E. Analyzes how Earth’s position, orientation, and surface features affect weather and climate.

Problem:
Hurricanes most commonly occur in the shaded areas on the map. June through November marks the hurricane season in the Atlantic Ocean. Based on the given information, the conditions which are conducive to hurricane formation are –

A. Cool, dense air
B. Cool, moist air
C. Warm, dense air
D. Warm, moist air
**Competency 017: Energy in Weather and Climate**

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

**Answer:**

D is the correct answer. (Warm, moist air)

- Warm, moist air combined with other factors, lead to the formation of tropical storms. Some of these storms reach hurricane status.

---

**Competency 018: Solar System and the Universe**

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

**The beginning teacher:**

A. Understands the properties and characteristics of objects in the sky.
B. Applies knowledge of the Earth–Moon–Sun system and the interactions among them (e.g., day and night, seasons, lunar phases, eclipses).
C. Identifies properties of the components of the solar system.

---

**Problem:**

Which of these is the center of our solar system?

A. Mars
B. The moon
C. Jupiter
D. The sun
Competency 018: Solar System and the Universe

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

Answer:
The correct answer is C. (The sun)

- The sun is the center of our universe. The others choices are either planets or moons found in the solar system. Mars and Jupiter rotate around the sun like Earth does. The moon rotates around the Earth.