

The Praxis® Study Companion

# Middle School Science

5442



# Welcome to *The Praxis*® Study Companion

## Prepare to Show What You Know

You have been working to acquire the knowledge and skills you need for your teaching career. Now you are ready to demonstrate your abilities by taking a *Praxis*® test.

Using *The Praxis*® Study Companion is a smart way to prepare for the test so you can do your best on test day. This guide can help keep you on track and make the most efficient use of your study time.

The Study Companion contains practical information and helpful tools, including:

- An overview of the *Praxis* tests
- Specific information on the *Praxis* test you are taking
- A template study plan
- Study topics
- Practice questions and explanations of correct answers
- Test-taking tips and strategies
- Frequently asked questions
- Links to more detailed information

So where should you start? Begin by reviewing this guide in its entirety and note those sections that you need to revisit. Then you can create your own personalized study plan and schedule based on your individual needs and how much time you have before test day.

Keep in mind that study habits are individual. There are many different ways to successfully prepare for your test. Some people study better on their own, while others prefer a group dynamic. You may have more energy early in the day, but another test taker may concentrate better in the evening. So use this guide to develop the approach that works best for you.

Your teaching career begins with preparation. Good luck!

## Know What to Expect

### Which tests should I take?

Each state or agency that uses the *Praxis* tests sets its own requirements for which test or tests you must take for the teaching area you wish to pursue.

Before you register for a test, confirm your state or agency's testing requirements at [www.ets.org/praxis/states](http://www.ets.org/praxis/states).

### How are the *Praxis* tests given?

*Praxis* tests are given on computer. Other formats are available for test takers approved for accommodations (see page 41).

### **What should I expect when taking the test on computer?**

When taking the test on computer, you can expect to be asked to provide proper identification at the test center. Once admitted, you will be given the opportunity to learn how the computer interface works (how to answer questions, how to skip questions, how to go back to questions you skipped, etc.) before the testing time begins. Watch the [What to Expect on Test Day](#) video to see what the experience is like.

### **Where and when are the *Praxis* tests offered?**

You can select the test center that is most convenient for you. The *Praxis* tests are administered through an international network of test centers, which includes Prometric® Testing Centers, some universities, and other locations throughout the world.

Testing schedules may differ, so see the *Praxis* web site for more detailed test registration information at [www.ets.org/praxis/register](http://www.ets.org/praxis/register).

# Table of Contents

*The Praxis® Study Companion guides you through the steps to success*

<b>1. Learn About Your Test</b> .....	<b>5</b>
<i>Learn about the specific test you will be taking</i>	
<b>2. Familiarize Yourself with Test Questions</b> .....	<b>18</b>
<i>Become comfortable with the types of questions you'll find on the Praxis tests</i>	
<b>3. Practice with Sample Test Questions</b> .....	<b>22</b>
<i>Answer practice questions and find explanations for correct answers</i>	
<b>4. Determine Your Strategy for Success</b> .....	<b>32</b>
<i>Set clear goals and deadlines so your test preparation is focused and efficient</i>	
<b>5. Develop Your Study Plan</b> .....	<b>35</b>
<i>Develop a personalized study plan and schedule</i>	
<b>6. Review Smart Tips for Success</b> .....	<b>39</b>
<i>Follow test-taking tips developed by experts</i>	
<b>7. Check on Testing Accommodations</b> .....	<b>41</b>
<i>See if you qualify for accommodations to take the Praxis test</i>	
<b>8. Do Your Best on Test Day</b> .....	<b>42</b>
<i>Get ready for test day so you will be calm and confident</i>	
<b>9. Understand Your Scores</b> .....	<b>44</b>
<i>Understand how tests are scored and how to interpret your test scores</i>	
<b>Appendix: Other Questions You May Have</b> .....	<b>46</b>

# 1. Learn About Your Test

Learn about the specific test you will be taking

## Middle School Science (5442)

Test at a Glance			
<b>Test Name</b>	Middle School Science		
<b>Test Code</b>	5442		
<b>Time</b>	150 minutes		
<b>Number of Questions</b>	125		
<b>Format</b>	Selected-response questions		
<b>Test Delivery</b>	Computer delivered		
	<b>Content Categories</b>	<b>Approximate Number of Questions</b>	<b>Approximate Percentage of Examination</b>
	I. Nature and Impact of Science and Engineering II. Physical Science III. Life Science IV. Earth and Space Science	17 38 38 32	14% 30% 30% 26%
<i>All questions assess content from the above science domains. More than 40 percent of questions integrate a Science and Engineering Practice, and approximately 30 percent of questions assess content applied to a Task of Teaching Science.</i>			

## About This Test

Praxis Middle School Science is designed to measure knowledge and competencies important for safe and effective beginning practice as a teacher of middle school science. Test takers have typically completed a bachelor's degree program with appropriate coursework in science and education.

Content topics span the middle school science curriculum, including content related to (I) Nature and Impact of Science and Engineering, (II) Physical Science, (III) Life Science, and (IV) Earth and Space Science.

The assessment is designed and developed through work with practicing middle school science teachers, teacher educators, and higher education content specialists to reflect the science knowledge teachers need to teach the middle school science curriculum and to reflect state and national standards, including the National Science Teaching Association Preparation Standards for middle school science. Content and practices measured reflect the Disciplinary Core Ideas (DCIs) and Science and Engineering Practices (SEPs) established by the National Research Council in A Framework for K-12 Science Education and included in the Next Generation Science Standards.

The 125 selected-response questions measure concepts, terms, phenomena, methods, applications, data analysis, and problem solving in science. A full list of the science topics covered is provided in **Content Topics**.

Test takers will not need to use calculators in taking this test. The periodic table of the elements is available as a Help screen, along with a table of information that presents various physical constants and a few conversion factors among SI units. Whenever necessary, additional values of physical constants are included with the text of a question.

Test takers can expect forty percent or more of the questions on the test to integrate science content knowledge with one or more of the SEPs, listed under **Science and Engineering Practices**.

Test takers will also find that approximately thirty percent of questions call for application of physical science content and processes within a teaching scenario or an instructional task. Such questions—designed to measure applications of science knowledge to the kinds of decisions and evaluations a teacher must make during work with students, curriculum, and instruction—situate science content questions in tasks critical for teaching. Below, in **Tasks of Teaching Science**, is a list of tasks that are a routine part of science instruction. These tasks, identified based on research on science instruction, have been confirmed by a national committee of teachers and teacher educators as important for effective teaching of secondary science.

Note: This test may contain some questions that do not count toward your score.

## Content Topics

This list details the science topics that may be included on the test. All test questions will cover one more of these topics.

Interspersed throughout the study topics are **discussion areas**, presented as open-ended questions or statements. These discussion areas are intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to situations in the classroom or the real world. Most of the areas require you to combine several pieces of knowledge to formulate an integrated understanding and response. If you spend time on these areas, you will gain increased understanding and facility with the subject matter covered on the test. You may want to discuss these areas and your answers with a teacher or mentor.

Note that this study companion **does NOT provide answers for the discussion area questions**, but thinking about the answers to them will help improve your understanding of fundamental concepts and will probably help you answer a broad range of questions on the test.

## I. Nature and Impact of Science and Engineering

### A. Nature of Science and Engineering

1. Nature of scientific knowledge
  - a. Use of a variety of methods
  - b. Based on empirical evidence
  - c. Models, laws, and theories explain natural phenomena
  - d. Major concepts developed over time / Subject to revision in light of new evidence
  - e. Crosscutting concepts and processes
2. Engineering Design
  - a. Define problems and identify criteria and constraints
  - b. Design, test, and evaluate possible solutions with respect to how well they meet the criteria and constraints
  - c. Optimize the design solution through a systematic process of modification and testing
3. Safety, Materials, and Standard Equipment in the Laboratory and Field
  - a. Understands safety and emergency procedures in the laboratory and field
    - Equipment (e.g., eyewash stations, safety showers)
    - Appropriate student apparel and behavior (e.g., goggles, clothing)
    - Emergency procedures for minor burns and other injuries
    - Emergency procedures for mishaps (e.g., fires, chemical spills)
    - Awareness of potential hazards (e.g., allergies, asthma, environmental hazards)
  - b. Is familiar with the procedures for safe and correct preparation, storage, use, and disposal of materials in the laboratory and field
    - Safe storage
    - Proper use and safe disposal (e.g., chemicals, biohazards, sharps)
    - Proper selection and preparation
    - Use of equipment (e.g., fume hoods, safety goggles, waste containers)

- c. Is familiar with how to use standard equipment in the laboratory and field
  - Appropriate use of equipment (e.g., thermometers, microscopes, barometers, graduated cylinders, Bunsen burners, balances, pH meters, rock hammers)
  - Basic care, preparation, and maintenance of equipment

**Discussion areas: Nature and Impact of Science and Engineering**

- What is a scientific hypothesis?
- Who is largely credited with developing the theory of continental drift? Why was the theory initially rejected by many scientists?
- Explain the difference between an engineering design criterion and a constraint.
- Describe how to prepare 500 mL of 5 M NaCl solution. What safety precautions should be taken when preparing this solution?
- $1 \times 10^{-3}$  gram is equal to how many kilograms?
- What is the area, to the correct number of significant figures, of a rectangle having a width of 2 cm and a length of 6.7 cm ?
- What is a graduated cylinder typically used for?

**B. Science, Technology, Society, and the Environment**

1. Interdependence of science, engineering, and technology
  - a. Engineering advances lead to important discoveries in science.
  - b. Science and technology drive each other forward.
2. Impact of engineering, science, and technology on the environment and society
  - a. Air and water pollution
  - b. Greenhouse gases
  - c. Global climate and sea level change
  - d. Waste disposal
  - e. Acid rain
  - f. Loss of biodiversity
  - g. Ozone depletion
  - h. Urban development and land use

3. Major issues associated with energy production and the management of natural resources
  - a. Conservation and recycling
  - b. Renewable and nonrenewable energy resources
  - c. Pros and cons of power generation based on sources
  - d. Distribution, extraction, and use of Earth's resources
4. Applications of science and technology in daily life
  - a. Chemistry (e.g., properties of household products)
  - b. Physics (e.g., batteries, communications technology)
  - c. Life science (e.g., public health, selective breeding, genetic modification)
  - d. Earth and space science (e.g., agricultural practices, space technology)

**Discussion areas: Science, Technology, Society, and the Environment**

- Describe how clear-cutting of tropical rain forests negatively impacts humans and the environment.
- What is the effect of the presence of chlorofluorocarbons in the stratosphere?
- What are ways to reduce the amount of plastic waste in landfills?
- Compare the availabilities and limitations of the following sources of power: geothermal, nuclear, hydroelectric, solar, and fossil fuel.
- Compare the depletion of mineral resources with that of fossil fuels.
- What is the connection between genetically modified crops and pesticide use?
- What are the advantages to using DNA analysis over other forms of analysis such as fingerprinting and blood typing to identify individuals during a criminal investigation?
- Explain why antibiotics are not prescribed to treat the common cold.
- Compare the applications of and benefits of using an MRI to those of x-rays to diagnose and evaluate medical conditions.



## II. Physical Science

### A. Matter and Its Interactions

#### 1. Structure and properties of matter

- Atomic structure, including atomic models (protons, neutrons, electrons), atomic number, atomic mass, isotopes/radioactive isotopes (carbon 14), and electron arrangements
- How the periodic table is organized in groups with similar chemical and physical properties (e.g., metals, nonmetals, noble gases)
- States of matter (e.g., solids, liquids, gases)
  - Use the particle model to describe solids, liquids and gases.
  - Describe the effect that changes in temperature/kinetic energy have on particle motion.
- Classification of matter: elements, compounds, and mixtures
- Characteristics of mixtures: heterogeneous and homogenous, saturated and unsaturated solutions, dilute and concentrated solutions, acids and bases (pH), and factors that affect the dissolving process (e.g., temperature, particle size)
- Elements and simple compounds: formulas and structures, ionic, covalent, and metallic bonding
- Phase changes and the effect of transfer of thermal energy on matter (e.g., melting, evaporation, freezing, condensation, cooling and heating curves)

#### 2. Chemical reactions

- Identifying the difference between chemical and physical changes
- Conservation of matter in chemical reactions (e.g., balancing simple chemical reactions using visual and mathematical models)
- Types of chemical reactions (e.g., combustion, acid-base, synthesis, decomposition)
- Energy in chemical reactions (e.g., exothermic and endothermic)

#### Discussion areas: Matter and Its Interactions

- How many neutrons are in  $^{14}_6\text{C}$  ?
- If a sample that initially contains 100 g of a radioactive isotope that has a half-life of 2 days, how much of the isotope remains after 6 days?

- What is the most common isotope of carbon?
- What is the relationship between the position of an element on the periodic table and the number of valence electrons in the atoms of the element?
- Locate the following elements on the periodic table: Na, S, and Ar. Classify each element as a metal, a nonmetal, or a noble gas. Which element will react most readily with chlorine?
- How are solids different from liquids?
- What entropy changes occur when a substance changes from a liquid to a gas?
- A solute is completely dissolved in a solvent. Is the solution saturated or unsaturated? Can adding more solute help determine if the solution is saturated or unsaturated?
- What is the pH of a base?
- What will happen to the pH of an aqueous solution of HCl when a base such as NaOH is added?
- What factors affect the rate of dissolving?
- Will increasing temperature always increase solubility?
- When  $\text{CaCl}_2$  is dissolved in water, what ions are formed?
- What types of bonding are exhibited by MgO,  $\text{SO}_2$ , and  $\text{O}_2$  ?
- Write the electron dot and structural formulas for methane ( $\text{CH}_4$ ).
- What are the correct names for  $\text{Na}_2\text{S}$ ,  $\text{Na}_2\text{SO}_4$ ,  $\text{SCl}_2$ , and  $\text{H}_2\text{SO}_4$  ?
- If a sample of gas is heated at a constant volume, what will happen to the pressure of the gas?
- What phase changes require the input of energy?
- How much energy is needed to heat 100 g of water at  $20^\circ\text{C}$  to a temperature of  $30^\circ\text{C}$  ?
- How are physical changes in a substance different from chemical changes?
- How many oxygen atoms are in 3 moles of  $\text{CO}_2$  ?



- Balance the following equation:  
 $\text{Na} + \text{MgSO}_4 \rightarrow \text{Mg} + \text{Na}_2\text{SO}_4$ . What type of chemical reaction is it?
- When a reaction in solution produces energy, what happens to the temperature of the solution?

## B. Motion and Stability: Forces and Interactions

1. Forces and motion
  - a. Descriptions of motion
    - Distance and displacement
    - Speed and velocity
    - Acceleration
  - b. Forces
    - Newton's laws of motion and their applications
    - Buoyancy (e.g., sink or float, relative density)
    - Gravitational forces related to mass and distance (e.g., weight vs. mass on Earth vs. Moon)
    - Vector nature of force (e.g., magnitude and direction)
2. Electricity and magnetism
  - a. Electricity
    - Electrostatics (attraction and repulsion between charges)
    - Simple circuits (identifying series and parallel circuits)
    - Conductors and insulators
  - b. Magnetism
    - Magnets
    - Magnetic fields
  - c. Applications of electricity and magnetism (e.g., electromagnets, generators, electrical motors)

### Discussion areas: Motion and Stability: Forces and Interactions

- Draw a velocity-versus-time graph for an object moving with constant acceleration.
- Does mass affect the acceleration of a falling object?
- If the distance between two masses is doubled, what happens to the gravitational force between the two masses?
- In the absence of air resistance, what is the only force acting on a projectile?

- What affects the buoyant force acting on an object?
- If the distance between two charges is halved, what happens to the electrostatic force between the two charges?
- What is the current flowing through a  $10\ \Omega$  resistor that is connected in series to a  $50\ \text{V}$  source?
- Which circuit has the larger equivalent resistance: a circuit with two  $10\ \Omega$  resistors connected in parallel or a circuit with two  $10\ \Omega$  resistors connected in series?

## C. Energy and Waves

1. Energy
  - a. Types of energy
    - Kinetic energy (e.g., its relationship to speed and mass)
    - Potential energy
  - b. Forms of energy (e.g., sound, light, thermal, electrical, chemical)
  - c. Conservation of energy (e.g., pendulums, springs, roller coasters)
  - d. Energy transfer between the system and its surroundings
  - e. Thermal energy transfer (e.g., convection, conduction, radiation)
  - f. Energy transformations (e.g., chemical to electrical and electrical to mechanical)
2. Waves and Their Applications
  - a. Properties of waves (e.g., frequency, wavelength, amplitude, period, speed)
  - b. Basic characteristics and types of waves
    - Longitudinal, transverse
    - Electromagnetic waves (e.g., visible light, microwave, infrared, ultraviolet)
    - Mechanical (e.g., sound, water, seismic)
  - c. Wave phenomena (e.g., absorption, transmission, reflection, refraction, the Doppler effect)
  - d. Information technology and instrumentation (e.g., advantages and disadvantages of digital and analog signals)

### Discussion areas: Energy and Waves

- If the speed of an object is doubled, by what factor does its kinetic energy change?

- What energy change occurs to a mass that starts from rest and slides from the top to the bottom of an inclined plane in the absence of friction?
  - What additional energy changes occur when there is friction between the mass and the inclined plane?
  - What variables affect the period of a pendulum?
  - When a moving object collides with an object at rest, is it possible for both objects to be at rest after the collision?
  - Compare and contrast light waves and sound waves.
  - How are the energy and frequency of red light different from that of blue light?
  - Describe the size and location of an image formed in a plane mirror.
- b. Effect of environmental and genetic factors on plant and animal growth
  - c. Reproduction
    - Plant structures and adaptations
    - Animal behaviors and adaptations
3. Matter and energy flow in organisms
    - a. Important biomolecules (e.g., ATP, sugars)
    - b. Photosynthesis in plants
    - c. Cellular respiration in plants and animals
    - d. Fermentation (e.g., by yeast)
    - e. Differentiation between matter and energy
  4. Sensory information processing in animals
    - a. Stimuli (e.g., light, sound, chemical) and sensory receptors (e.g., eyes, ears)
    - b. Transmission and processing (e.g., nerve, brain) and responses (e.g., behavior or memory)

### III. Life Science

#### A. From Molecules to Organisms: Structures and Processes

1. Structure and function
  - a. Cells
    - Organelles (e.g., nucleus, mitochondria, chloroplasts)
    - Cell membranes and cell walls (e.g., passive and active transport)
  - b. Cell types
    - Prokaryotes/eukaryotes (e.g., bacteria, plants, animals)
    - Unicellular/multicellular
  - c. Characteristics of viruses
  - d. Levels of organization in multicellular organisms
    - Specialized cells and tissues
    - Organs and organ systems (circulatory, excretory, digestive, respiratory, muscular, and nervous systems)
    - Focus on system and subsystem interactions
    - Homeostasis
2. Growth and development of organisms
  - a. Cell reproduction
    - Role of mitosis
    - Role of meiosis

#### Discussion areas: From Molecules to Organisms: Structures and Processes

- Name a structure that is found in a plant cell, but not in an animal cell, and describe its function.
- List the levels of organization for the human nervous system in order from the simplest to the most complex.
- What are the major components of the human digestive system and their functions?
- What are the subunits that compose carbohydrates and proteins?
- What structures are involved in the uptake and transport of nutrients and water in vascular plants?
- Compare how a mammal and reptile maintain body temperature.
- Explain mitosis and meiosis in terms of the number of chromosomes in the parent and daughter cells.
- Why is cellular respiration important?

#### B. Ecosystems: Interactions, Energy, and Dynamics

1. Interdependent relationships in ecosystems
  - a. Impact of resources on population growth
  - b. Relationships and behavior (e.g., competition, mutualism, parasitism, predator-prey)

2. Cycling of matter and energy transfer in ecosystems
  - a. Energy flow
    - Energy transfer between producers, consumers, and decomposers
    - Food webs as models
  - b. Cycling of atoms (e.g., carbon, nitrogen) between living and nonliving components
3. Ecosystem dynamics, functioning, and resilience
  - a. Biotic and abiotic factors
  - b. Distinguish between biomes and ecosystems
  - c. Relationships between biodiversity and human resources
  - d. Stability and change within ecosystems

**Discussion areas: Ecosystems: Interactions, Energy, and Dynamics**

- What factors in an environment limit the population size of a species?
- Identify the trophic level for each of the following organisms: coyote, grass, grasshopper, hawk, meadowlark, rabbit, snake, and wildflower. Based on the trophic levels, create a food web. Describe how a drought would affect the ecosystem.
- What are the types of climate, animals, and plants that are characteristic of the major biomes?
- What is the effect of invasive species?

**C. Heredity and Biological Evolution**

1. Heredity: Inheritance and Variation of Traits
  - a. Inheritance of traits
    - Basic structure and function of DNA and RNA
    - Conceptual understanding of replication, transcription, and translation
    - Relationship between chromosomes, genes, alleles, and proteins
    - Sexual and asexual reproduction (advantages and disadvantages)
  - b. Variation of traits
    - Mendelian inheritance (simple Punnett squares)
    - Mutations (harmful, beneficial, neutral)

2. Biological Evolution: Unity and Diversity
  - a. Evidence of common ancestry and diversity
    - Patterns in fossil record found within sedimentary layers (e.g., major extinction events and emergence of new organisms)
    - Anatomical similarities and differences among modern organisms and between modern and fossil organisms
    - Similarities in embryological development
    - Classification of organisms according to shared characteristics
  - b. Natural selection and adaptation
    - Mechanisms of evolution (e.g., mutation, natural selection)
    - Distribution of traits in a population can change over time in response to environment.

**Discussion areas: Heredity and Biological Evolution**

- Describe Watson and Crick’s model for DNA structure.
- In pea plants, purple flower color is dominant to white flower color. Using a Punnett square, demonstrate how a cross between two plants with purple flowers leads to some offspring with white flower color.
- Compare and contrast the causes of cystic fibrosis and Down syndrome.
- Discuss the significance of Darwin’s finches.

**IV. Earth and Space Science**

**A. Earth’s Place in the Universe**

1. The universe and its stars
  - a. Basic characteristics and life cycles of stars (e.g. for example, composition, apparent brightness and distance from Earth)
  - b. Basic types, characteristics, and motion of galaxies
  - c. Observed motions of stars from Earth
  - d. Formation and evidence (e.g., big bang theory)
2. Earth and the solar system
  - a. Formation of the solar system and the role of gravity
  - b. Properties of objects in the solar system (e.g., models, scales, structure, composition, surface features)

- c. Patterns of movement in the Sun-Earth-Moon system (e.g., Moon phases, eclipses, tides)
  - d. Effect of Earth's tilt on seasons and climate
3. The history of planet Earth
- a. Basic principles of historical geology and the geological timescale
    - Stratigraphy (e.g., superposition, intrusive relationships, crosscutting relationships, fossil succession)
    - Major events (e.g., extinction events, volcanic eruptions, glaciation, asteroid impacts)
  - b. Relative and absolute dating (e.g., fossil record, radiometric dating)

**Discussion areas: Earth's Place in the Universe**

- How do the Sun and other stars generate their energy?
- What information about stars and their life cycle can be obtained from a Hertzsprung-Russell (H-R) diagram?
- What type of galaxy is the Milky Way?
- What limitation of Earth-based telescopes has been solved by the Hubble Space Telescope?
- What is the origin of the astronomical unit?
- What are the characteristics that distinguish the inner planets from the outer planets?
- What are the relative positions of Earth, the Moon, and the Sun during a solar eclipse?
- What is the relationship between Earth's rotation, longitude, and time zone?
- How do the Sun and Moon influence tides?
- Is radioactive dating used to determine relative or absolute age?
- How can fossils be useful to a geologist in correlating the north and south walls of the Grand Canyon?

**B. Earth's Systems**

- 1. Earth materials and systems
  - a. Rock types and their formation processes (e.g., energy flow, the rock cycle)
  - b. Minerals and their properties (e.g., color, streak, hardness, acid test)

- c. Weathering, erosion, and deposition
    - Chemical, biological, and physical weathering
    - Agents of erosion (e.g., water, ice, wind)
    - Effect on surface features and the origin of major landforms (e.g., valleys, canyons, coastline topography)
    - Prediction of natural hazards (e.g., landslides) and mitigation of their impact on humans (e.g., retaining walls)
2. Plate tectonics and large-scale system interactions
- a. Earth's structure (e.g., layers, composition, properties, and processes, such as convection)
  - b. Plate tectonics theory and supporting evidence
    - Types of plate boundaries (e.g., convergent, divergent, transform)
    - Folding and faulting (e.g., normal, reverse, strike-slip)
    - Supporting evidence (e.g., ages of crustal rocks, hot-spot volcanoes, distribution of rocks and fossils, continental shapes)
  - c. Landforms (e.g., mountain ranges, rift valleys, mid-ocean ridges)
  - d. Prediction of natural hazards (e.g., earthquakes, volcanoes, tsunamis) and mitigation of their impact on humans (e.g., earthquake-resistant structures)
3. Roles of water in Earth's surface processes
- a. Distribution of water
    - Oceans
    - Freshwater (e.g., lakes, rivers, streams, polar ice, icebergs, glaciers)
  - b. Water cycle, including the transfer of energy and the role of gravity
    - Evaporation, sublimation, transpiration
    - Condensation and crystallization
    - Precipitation
    - Runoff and infiltration
  - c. Oceanography
    - Tides, waves, currents
    - Global ocean circulation (e.g., driven by seawater density, transfer of heat)
    - Ocean floor topography (e.g., continental shelf, continental slope, abyssal plain, islands, reefs)
  - d. Surface features and underground formations (e.g., watersheds, deltas, groundwater features)

- e. Prediction of natural hazards (e.g., floods, storm surge) and mitigation of their impact on humans (e.g. for example, dams, levees)
4. Weather and climate
- a. Meteorology
    - Elements of weather and their measurement (e.g., temperature, pressure, humidity, precipitation, wind)
    - Interpretation of basic weather data (e.g., maps, radar, probability, predictions)
    - Effects of thermal energy transfer on the atmosphere
    - Properties, motions, and interactions of air masses, including the Coriolis effect
    - Prediction of severe weather events (e.g., hurricanes, tornadoes) and mitigation of their impact on humans (e.g., basements in tornado-prone regions)
  - b. Climate
    - Effect of Earth's tilt, latitude, and elevation on climatic zones
    - Atmospheric patterns due to uneven heating and rotation of Earth
    - Effect of landforms (e.g., rain shadow effect)
    - Proximity to water (e.g., heat capacity of land and water, sea and land breezes, lake effect, ocean currents)
    - Climate change (e.g., natural and human causes, effects and management)
- What cloud types are generally associated with precipitation?
  - Why do weather systems generally move across the United States from west to east?
  - How do ocean currents, landforms, and global wind belts affect the climate of a region?
  - How can a volcanic eruption affect both regional and worldwide climate conditions?

**Discussion areas: Earth's Systems**

- Describe how each type of rock can be changed into the other types of rock.
- What is the relationship between minerals and rocks?
- What are the major agents of erosion?
- What is the difference between weathering and erosion?
- What are the characteristics of each of Earth's layers?
- Describe the processes that occur at plate boundaries and the landforms that result.
- What is a hot spot?
- What are the roles of gravity and the Sun in the water cycle?
- What are the relative amounts of fresh and salt water on Earth?

## Science and Engineering Practices

The SEPs represent eight practices that scientists and engineers—and students and teachers—use to investigate the world and to design and build systems. Many test questions will integrate one or more of these practices.

1. Asking questions (for science) and defining problems (for engineering)
  - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
  - Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument.
  - Ask questions to determine relationships between independent and dependent variables and relationships in models.
  - Ask questions to clarify and/or refine a model, an explanation, or an engineering problem.
  - Ask questions that require sufficient and appropriate empirical evidence to answer.
  - Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.
  - Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.
  - Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
2. Developing and using models
  - Evaluate limitations of a model for a proposed object or tool.
  - Develop or modify a model—based on evidence—to match what happens if a variable or component of a system is changed.
  - Use and/or develop a model of simple systems with uncertain and less predictable factors.
  - Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.
  - Develop and/or use a model to predict and/or describe phenomena.
3. Planning and carrying out investigations
  - Develop a model to describe unobservable mechanisms.
  - Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.
4. Analyzing and interpreting data
  - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
  - Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
  - Evaluate the accuracy of various methods for collecting data.
  - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.
  - Collect data about the performance of a proposed object, tool, process or system under a range of conditions.
5. Developing a model to describe unobservable mechanisms
  - Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
  - Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships.
  - Distinguish between causal and correlational relationships in data.
  - Analyze and interpret data to provide evidence for phenomena.
  - Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible.
  - Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials).
  - Analyze and interpret data to determine similarities and differences in findings.

- Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.
5. Using mathematics and computational thinking
    - Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.
    - Use mathematical representations to describe and/or support scientific conclusions and design solutions.
    - Create algorithms (a series of ordered steps) to solve a problem.
    - Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.
    - Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.
  6. Constructing explanations (for science) and designing solutions (for engineering)
    - Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.
    - Construct an explanation using models or representations.
    - Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
    - Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
    - Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.
    - Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.
    - Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
    - Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and re-testing.
  7. Engaging in argument from evidence
    - Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.
    - Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail.
    - Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
    - Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.
    - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.
  8. Obtaining, evaluating, and communicating information
    - Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).
    - Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.
    - Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.
    - Evaluate data, hypotheses, and/or conclusions in scientific and technical texts in light of competing information or accounts.
    - Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, system) in writing and/or through oral presentations.



## Tasks of Teaching Science

This list includes instructional tasks that teachers engage in that are essential for effective science teaching. Many test questions will measure content through application to one or more of these tasks.

### Scientific Instructional Goals, Big Ideas, and Topics

1. Selecting or sequencing appropriate instructional goals or big ideas for a topic
2. Identifying the big idea or instructional goal of an instructional activity
3. Choosing which science ideas or instructional activities are most closely related to a particular instructional goal
4. Linking science ideas to one another and to particular activities, models, and representations within and across units

### Scientific Investigations and Demonstrations

5. Selecting investigations or demonstrations, including virtual, that facilitate understanding of disciplinary core ideas, scientific practices, or crosscutting concepts
6. Evaluating investigation questions for quality (e.g., testable, empirical)
7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
8. Critiquing scientific procedures, data, observations, or results for their quality, accuracy, or appropriateness
9. Supporting students in generating questions for investigation or identifying patterns in data and observations

### Scientific Resources (texts, curriculum materials, journals, and other print and media-based resources)

10. Evaluating instructional materials and other resources for their ability to address scientific concepts; engage students with relevant phenomena; develop and use scientific ideas; promote students' thinking about phenomena, experiences, and knowledge; take account of students' ideas and background; and assess student progress
11. Choosing resources that support the selection of accurate, valid, and appropriate goals for science learning

### Student Ideas (including common misconceptions, alternate conceptions, and partial conceptions)

12. Analyzing student ideas for common misconceptions regarding intended scientific learning
13. Selecting diagnostic items and eliciting student thinking about scientific ideas and practices to identify common student misconceptions and the basis for those misconceptions
14. Developing or selecting instructional moves, approaches, or representations that provide evidence about common student misconceptions and help students move toward a better understanding of the idea, concept, or practice

### Scientific Language, Discourse, Vocabulary, and Definitions

15. Selecting scientific language that is precise, accurate, grade-appropriate, and illustrates key scientific concepts
16. Anticipating scientific language and vocabulary that may be difficult for students
17. Modeling the use of appropriate verbal and written scientific language in critiquing arguments or explanations, in describing observations, or in using evidence to support a claim, etc.
18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation

### Scientific Explanations (includes claim, evidence, and reasoning)

19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
20. Selecting explanations of natural phenomena that are accurate and accessible to students

### Scientific Models and Representations (analogies, metaphors, simulations, illustrations, diagrams, data tables, performances, videos, animations, graphs, and examples)

21. Evaluating or selecting scientific models and representations that predict or explain scientific phenomena or address instructional goals
22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal

23. Evaluating student models or representations for evidence of scientific understanding
24. Generating or selecting diagnostic questions to evaluate student understanding of specific models or representations
25. Evaluating student ideas about what makes for good scientific models and representations

## 2. Familiarize Yourself with Test Questions

*Become comfortable with the types of questions you'll find on the Praxis tests*

The *Praxis* assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by clicking on a sentence in a text or by clicking on part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

### Understanding Computer-Delivered Questions

Questions on computer-delivered tests are interactive in the sense that you answer by selecting an option or entering text on the screen. If you see a format you are not familiar with, read the directions carefully. The directions always give clear instructions on how you are expected to respond.

For most questions, you respond by clicking an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- **Clicking more than one oval** to select answers from a list of answer choices.
- **Typing in an entry box.** When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one place to enter a response.
- **Clicking check boxes.** You may be asked to click check boxes instead of an oval when more than one choice within a set of answers can be selected.
- **Clicking parts of a graphic.** In some questions, you will select your answers by clicking on a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- **Clicking on sentences.** In questions with reading passages, you may be asked to choose your answers by clicking on a sentence (or sentences) within the reading passage.
- **Dragging and dropping answer choices into targets on the screen.** You may be asked to select answers from a list of choices and drag your answers to the appropriate location in a table, paragraph of text or graphic.
- **Selecting answers from a drop-down menu.** You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Perhaps the best way to understand computer-delivered questions is to view the [Computer-delivered Testing Demonstration](#) on the Praxis web site to learn how a computer-delivered test works and see examples of some types of questions you may encounter.

## Understanding Selected-Response Questions

Many selected-response questions begin with the phrase “which of the following.” Take a look at this example:

**Which of the following is a flavor made from beans?**

- (A) Strawberry
- (B) Cherry
- (C) Vanilla
- (D) Mint

### How would you answer this question?

All of the answer choices are flavors. Your job is to decide which of the flavors is the one made from beans.

Try following these steps to select the correct answer.

- 1) **Limit your answer to the choices given.** You may know that chocolate and coffee are also flavors made from beans, but they are not listed. Rather than thinking of other possible answers, focus only on the choices given (“which of the following”).
- 2) **Eliminate incorrect answers.** You may know that strawberry and cherry flavors are made from fruit and that mint flavor is made from a plant. That leaves vanilla as the only possible answer.
- 3) **Verify your answer.** You can substitute “vanilla” for the phrase “which of the following” and turn the question into this statement: “Vanilla is a flavor made from beans.” This will help you be sure that your answer is correct. If you’re still uncertain, try substituting the other choices to see if they make sense. You may want to use this technique as you answer selected-response questions on the practice tests.

### Try a more challenging example

The vanilla bean question is pretty straightforward, but you’ll find that more challenging questions have a similar structure. For example:

**Entries in outlines are generally arranged according to which of the following relationships of ideas?**

- (A) Literal and inferential
- (B) Concrete and abstract
- (C) Linear and recursive
- (D) Main and subordinate

You’ll notice that this example also contains the phrase “which of the following.” This phrase helps you determine that your answer will be a “relationship of ideas” from the choices provided. You are supposed to find the choice that describes how entries, or ideas, in outlines are related.

Sometimes it helps to put the question in your own words. Here, you could paraphrase the question in this way: “How are outlines usually organized?” Since the ideas in outlines usually appear as main ideas and subordinate ideas, the answer is (D).

**QUICK TIP:** Don't be intimidated by words you may not understand. It might be easy to be thrown by words like "recursive" or "inferential." Read carefully to understand the question and look for an answer that fits. An outline is something you are probably familiar with and expect to teach to your students. So slow down, and use what you know.

### Watch out for selected-response questions containing "NOT," "LEAST," and "EXCEPT"

This type of question asks you to select the choice that does not fit. You must be very careful because it is easy to forget that you are selecting the negative. This question type is used in situations in which there are several good solutions or ways to approach something, but also a clearly wrong way.

### How to approach questions about graphs, tables, or reading passages

When answering questions about graphs, tables, or reading passages, provide only the information that the questions ask for. In the case of a map or graph, you might want to read the questions first, and then look at the map or graph. In the case of a long reading passage, you might want to go ahead and read the passage first, noting places you think are important, and then answer the questions. Again, the important thing is to be sure you answer the questions as they refer to the material presented. So read the questions carefully.

### How to approach unfamiliar formats

New question formats are developed from time to time to find new ways of assessing knowledge. Tests may include audio and video components, such as a movie clip or animation, instead of a map or reading passage. Other tests may allow you to zoom in on details in a graphic or picture.

Tests may also include interactive questions. These questions take advantage of technology to assess knowledge and skills in ways that standard selected-response questions cannot. If you see a format you are not familiar with, **read the directions carefully**. The directions always give clear instructions on how you are expected to respond.

**QUICK TIP:** Don't make the questions more difficult than they are. Don't read for hidden meanings or tricks. There are no trick questions on *Praxis* tests. They are intended to be serious, straightforward tests of your knowledge.

## Understanding Constructed-Response Questions

Constructed-response questions require you to demonstrate your knowledge in a subject area by creating your own response to particular topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Take a look at a few sample essay topics:

- "Celebrities have a tremendous influence on the young, and for that reason, they have a responsibility to act as role models."
- "We are constantly bombarded by advertisements—on television and radio, in newspapers and magazines, on highway signs, and the sides of buses. They have become too pervasive. It's time to put limits on advertising."
- "Advances in computer technology have made the classroom unnecessary, since students and teachers are able to communicate with one another from computer terminals at home or at work."

### Keep these things in mind when you respond to a constructed-response question

- 1) **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
- 2) **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
- 3) **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
- 4) **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
- 5) **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

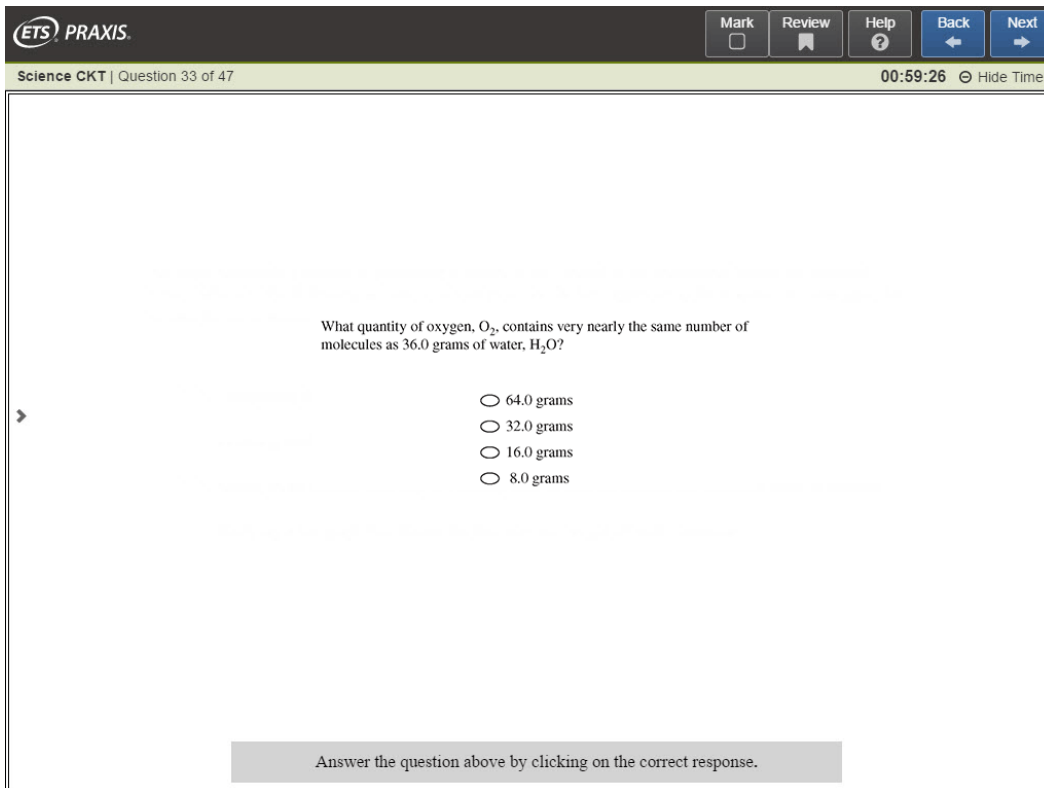
**QUICK TIP:** You may find that it helps to take notes on scratch paper so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.

## 3. Practice with Sample Test Questions

Answer practice questions and find explanations for correct answers

### Computer Delivery

This test is available via computer delivery. To illustrate what the computer-delivered test looks like, the following sample question shows an actual screen used in a computer-delivered test. For the purposes of this guide, sample questions are provided as they would appear in a paper-delivered test.



The screenshot shows a computer-delivered test interface. At the top left is the ETS PRAXIS logo. To the right are navigation buttons: Mark (checkbox icon), Review (bookmark icon), Help (question mark icon), Back (left arrow icon), and Next (right arrow icon). Below the navigation buttons, the text "Science CKT | Question 33 of 47" is displayed on the left, and "00:59:26 Hide Time" is displayed on the right. The main content area contains the following text:

What quantity of oxygen,  $O_2$ , contains very nearly the same number of molecules as 36.0 grams of water,  $H_2O$ ?

Four radio button options are listed:

- 64.0 grams
- 32.0 grams
- 16.0 grams
- 8.0 grams

At the bottom of the question area, a grey bar contains the instruction: "Answer the question above by clicking on the correct response."



## Sample Test Questions

The sample questions that follow illustrate the types of questions in the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

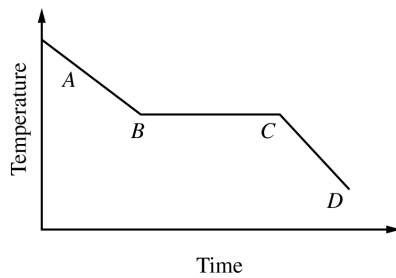
**Directions:** Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case.

- The American badger, *Taxidea taxus*, is a mammal with 16 chromosomes in its sex cells. The badger's body cells must have a total of
  - 8 chromosomes
  - 16 chromosomes
  - 32 chromosomes
  - 64 chromosomes
- A teacher asks students to identify the number of neutrons in an atom of  $^{19}_9\text{F}$ , the only stable isotope of fluorine. Which of the following best represents the misconception held by a student who claims that there are 9 neutrons in an atom of  $^{19}_9\text{F}$ ?
  - Number of neutrons = atomic number + mass number
  - Number of neutrons = atomic number
  - Number of neutrons = mass number – atomic number
  - Number of neutrons =  $2 \times$  atomic number
- Fossil A is several layers above fossil B in a series of undisturbed sedimentary layers. Paleontologists use which of the following principles to determine that fossil A is younger than fossil B?
  - Superposition
  - Uniformitarianism
  - Natural selection
  - Uncertainty principle
- During a lesson on electrostatics, a teacher demonstrates two balloons repelling each other. Which **TWO** of the following claims are possibly true about the charges on each balloon?
  - One balloon is positively charged, and the other is negatively charged.
  - Both balloons are positively charged.
  - Both balloons are negatively charged.
  - Both balloons are neutral.
- The structure of a DNA molecule is most similar to which of the following?
  - A twisted ladder
  - An apple sliced in half
  - A leafy tree
  - A rectangular box without a lid
- Which of the following instructional goals would an investigation in which students collect data on the color, hardness, luster, and streak of different minerals best address?
  - Describing the processes of the rock cycle
  - Identifying minerals based on their different properties
  - Outlining the mineral composition of Earth's crust
  - Identifying rocks as either sedimentary, igneous, or metamorphic
- Newton's second law of motion is concerned with which of the following quantities?
  - Velocity and mass
  - Acceleration and time
  - Force, velocity, and time
  - Force, acceleration, and mass

8. Which of the following correctly pairs the specialized cell with its primary function in the body?
- |     | <u>Specialized Cell</u> | <u>Primary Function in the Body</u>           |
|-----|-------------------------|---|
| (A) | Nerve cell              | Transports oxygen in the blood                |
| (B) | Red blood cell          | Builds new bone tissue                        |
| (C) | Skeletal muscle cell    | Enables movement by contracting and relaxing  |
| (D) | Skin cell               | Transmits electrical information to the brain |
9. Aluminum reacts with oxygen to form a white solid. Which of the following best describes the solid?
- (A) It is an alloy.  
 (B) It is a compound.  
 (C) It is an element.  
 (D) It is a heterogeneous mixture of elements.
10. Petroleum, natural gas, and coal are examples of
- (A) biomass  
 (B) fossil fuels  
 (C) carbohydrates  
 (D) renewable resources
11. Which of the following documentary topics will best facilitate a discussion on artificial selection?
- (A) The history of the five most-popular domestic dog breeds in the country  
 (B) The mapping of the genomes of the birds on the Galápagos Islands  
 (C) The advances in current gene therapies for human diseases  
 (D) The global effect of climate change on marine organisms
12. Which of the following properties of light determines the color of an opaque object?
- (A) Refraction  
 (B) Polarization  
 (C) Transmission  
 (D) Reflection
13. An oceanic plate is subducted beneath a continental plate because oceanic plates are
- (A) denser than continental plates are  
 (B) smaller than continental plates are  
 (C) older than continental plates are  
 (D) thinner than continental plates are
14. Students use a pan, water, and dark-colored vegetable oil to model an oceanic oil spill. They have different tools to remove as much oil from their pans of water as possible. The tools represent three common methods that environmental engineers typically use for cleaning up an oil spill: skimming, absorbing, and dispersing. Which **THREE** of the following learning goals are met by this activity?
- (A) Students can provide solutions to prevent a future oil spill.  
 (B) Students can describe how each method is used to clean up an oil spill.  
 (C) Students can discuss the effectiveness of each method.  
 (D) Students can organize and analyze data collected from the activity.
15. Which of the following equations represents a combustion reaction?
- (A)  $2 \text{O}_3 \rightarrow 3 \text{O}_2$   
 (B)  $\text{H}_2\text{SO}_4 + 2 \text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$   
 (C)  $2 \text{HCl} + \text{Fe} \rightarrow \text{FeCl}_2 + \text{H}_2$   
 (D)  $\text{C}_3\text{H}_8 + 5 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$

16. A student argues that all genetic mutations are harmful to organisms. Which **TWO** of the following pieces of evidence would best challenge the student's argument?

- (A) A mutation that results in the same protein as the original gene, resulting in the same trait
- (B) A mutation that causes damage to the eye, resulting in blindness
- (C) A mutation that causes a buildup of excess mucus, blocking airways and the digestive tract
- (D) A mutation that increases bone density, making bones resistant to breaks and degeneration



17. At point A on the cooling curve above, H<sub>2</sub>O is in the liquid phase. Based on the cooling curve, which of the following statements is true?

- (A) Heat is being absorbed by the H<sub>2</sub>O during the intervals A – B and C – D.
- (B) The volume of the H<sub>2</sub>O is decreasing during the interval B – C .
- (C) The H<sub>2</sub>O is in the process of sublimating during the interval A – B.
- (D) The H<sub>2</sub>O is in the process of freezing during the interval B – C .

18. Which of the following is a true statement about tornadoes?

- (A) They typically form along weather fronts.
- (B) They usually form over warm water.
- (C) They often cause severe flooding.
- (D) They occur most frequently in the winter.

19. Students often mistakenly classify parasites as predators because both depend on other organisms for food. However, parasites slowly feed off their hosts. Which of the following questions about a predator would help students understand the difference between a predator and a parasite?

- (A) What size is the predator as compared to its prey?
- (B) How does a predator get nutrients from its prey?
- (C) Where are the predators' primary prey located?
- (D) During what season do most prey animals give birth?

20. During a total solar eclipse, when the Moon completely covers the disk of the Sun, which of the following can most easily be seen?

- (A) Core
- (B) Photosphere
- (C) Sunspots
- (D) Corona

Nut Type	Average Calories per Nut
1	15,700
2	20,200
3	11,900

21. An experiment on squirrel food sources was conducted. Data on three nut types, which are all approximately the same size without the shells, are shown above. Which of the following statements is consistent with the data?

- (A) Nut type 2 is denser than types 1 or 3.
- (B) Nut type 2 is the most efficient source of energy.
- (C) Nut type 2 is more abundant than types 1 or 3.
- (D) Nut type 2 is most attractive to squirrels.

22. Students use a simulation to investigate how a frog population might change in response to environmental changes. The frogs in the population have either a green coloration or a brown coloration, and they rely on their coloration to avoid detection by predators. During the simulation, the color of the frogs' surroundings changes over many years from brown to green. Which of the following statements best predicts how the frog population will change over several generations in response to the environmental changes?
- (A) The frequency of green frogs will increase.
  - (B) The frequency of green frogs will decrease.
  - (C) The frequency of brown frogs will increase.
  - (D) The frequency of brown frogs will stay the same.
23. A 4.0 kg piece of metal absorbs 64.0 kJ of heat, increasing in temperature from 20°C to 100°C. How much heat is needed to increase the temperature of a 2.0 kg piece of this same metal from 20°C to 100°C ?
- (A) 128 kJ
  - (B) 64 kJ
  - (C) 32 kJ
  - (D) 16 kJ
24. During a lesson on cellular organelles, a student claims that plant cells have chloroplasts but do not contain mitochondria. What does the misconception suggest?
- (A) Plant cells carry out mitosis but not meiosis.
  - (B) Plant cells carry out fermentation but not photosynthesis.
  - (C) Plant cells carry out photosynthesis but not cellular respiration.
  - (D) Plant cells carry out passive transport but not active transport.
25. A highly productive, diverse, and partially enclosed coastal area that contains ocean water mixed with freshwater supplied by rivers is known as
- (A) an estuary
  - (B) a continental shelf
  - (C) an atoll
  - (D) an abyssal plain
26. A sample of a material was collected from the surface of a pond. Which of the following characteristics will most clearly suggest that the material is alive?
- (A) The material is composed of dividing cells.
  - (B) The material contains water and minerals.
  - (C) The material is green in color.
  - (D) The material includes a radioactive isotope of carbon.
27. Evidence supporting the big bang theory of the origin of the universe includes which of the following?
- (A) Retrograde motion of planets
  - (B) Cosmic microwave background radiation
  - (C) Highly elliptical orbits of comets
  - (D) Production of energy by the Sun through nuclear fusion in its core
28. Which of the following best represents the energy flow among the organisms of a community that includes autotrophs, heterotrophs, omnivores, and carnivores?
- (A) An energy pyramid
  - (B) A food chain
  - (C) A food web
  - (D) A nutrient cycle
29. Which of the following student statements best defines the process of condensation in the water cycle?
- (A) Liquid water changes to water vapor.
  - (B) Water vapor escapes the leaves of plants.
  - (C) Ice changes directly to water vapor.
  - (D) Water vapor changes to liquid water.

30. A student performed an experiment to determine the effect of temperature and light on the feeding behavior of *Daphnia magna*. The student placed 25 *Daphnia* in each of two identical glass bowls and then placed one bowl in a sunny, warm window and the other in a cooler, dark closet. The student measured the amount of food consumed in one week. Which of the following is the major flaw in this experiment?
- (A) Each *Daphnia* should have its own bowl.
  - (B) The length of the experiment is too long.
  - (C) There are too many independent variables.
  - (D) The sample size is too large.
31. A car traveling along a straight, level road at 10 m/s uniformly increases its speed to 25 m/s in 3 s. What is the magnitude of acceleration of the car?
- (A)  $3 \text{ m/s}^2$
  - (B)  $5 \text{ m/s}^2$
  - (C)  $10 \text{ m/s}^2$
  - (D)  $15 \text{ m/s}^2$

## Answers to Sample Questions

The answers to the sample test questions are provided below, along with explanations and classifications. Each question focuses on a specific topic and subtopic listed in **Content Topics** in chapter 1. Some questions integrate science content knowledge with one or more **Science and Engineering Practices** and/or **Tasks of Teaching Science**, also in chapter 1.

1. The correct answer is (C). A sex cell is haploid ( $n = 16$ ), is created through the process of meiosis, and only has one set of chromosomes. A body cell of the same organism would have two sets of chromosomes and therefore be diploid ( $2n = 32$ ).

Content:	III A
Science and Engineering Practice	5

2. The correct answer is (B). The atomic number of fluorine is 9, and the mass number of the fluorine isotope is 19, as represented by the symbol  ${}^{19}_9\text{F}$ . The number of neutrons in an atom in the isotope is equal to mass number – atomic number, which is  $19 - 9 = 10$ . The claim suggests that the student has a misconception that the number of neutrons is equal to the atomic number of the element.

Content	II A
Task of Teaching Science	12

3. The correct answer is (A). According to the principle of superposition, in a series of undisturbed sedimentary rock layers, the younger rock layers overlie the older rock layers; thus fossil A is younger than fossil B.

Content	IV A
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4. The correct answers are (B) and (C). During the demonstration the balloons repelled each other, indicating that they have like charges. In this case, the charges on the balloons could either both be positive or both be negative.

Content	II B
Science and Engineering Practice	6
Task of Teaching Science	19

5. The correct answer is (A). DNA is made of two strands of nucleotides. Each nucleotide has a phosphate group and deoxyribose that make up the sides of the ladder and a nitrogenous base that is complementary to a base on the other strand. The pairs of complementary bases make up the rungs of the ladder. The ladder forms a double helical structure.

Content	III C
Science and Engineering Practice	2
Task of Teaching Science	21

6. The correct answer is (B). Different minerals have different properties that can easily be observed or tested in a classroom, such as color, hardness, luster, and streak. This activity would best address the instructional goal of students identifying minerals based on their different properties.

Content	IV B
Task of Teaching Science	2

7. The correct answer is (D). Based on Newton's second law of motion, the force  $F$  acting on an object is equal to its mass  $m$  multiplied by its acceleration  $a$ . It is represented by the equation  $F = ma$ .

Content	II B
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8. The correct answer is (C). Muscle cells are elongated and have contractile fibers, which allow them to contract (shorten) and relax (lengthen), enabling movement.

Content	III A
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9. The correct answer is (B). Aluminum ( $\text{Al}$ ) reacts with oxygen ( $\text{O}_2$ ) to form aluminum oxide ( $\text{Al}_2\text{O}_3$ ), a compound. A compound is a substance that is composed of two or more elements chemically bonded.

Content	II A
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10. The correct answer is (B). Petroleum, natural gas, and coal are fossil fuels. They were formed by natural processes over a very long period from the buried remains of organisms. They are considered to be nonrenewable resources because they cannot be replenished as quickly as they are used.

Content	I B
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11. The correct answer is (A). Humans have artificially selected traits of the domestic dog to create over 340 breeds with distinct physical characteristics. All the breeds of domestic dogs are the same species, *Canis lupus familiaris*. Of the options, option A is the only option that identifies an accurate example of artificial selection.

Content	I B
Science and Engineering Practice	8
Task of Teaching Science	10

12. The correct answer is (D). An object is opaque when light does not pass through it. Some wavelengths of light are absorbed, while others are reflected. The color of the object is determined by the wavelengths of the reflected light.

Content	II C
---------	------

13. The correct answer is (A). At subduction zones along convergent plate boundaries, denser oceanic plates are subducted beneath less dense continental plates as the plates are being pushed toward each other.

Content	IV B
Science and Engineering Practice	6
Task of Teaching Science	20

14. The correct answers are (B), (C), and (D). The focus of the activity is finding the best solution for remediation of an oil spill rather than prevention. By completing the activity, students will learn how to organize and analyze data and use the data to discuss the effectiveness of each solution. The students will also be able to describe how each method is used.

Content	I A
Science and Engineering Practice	1
Task of Teaching Science	2

15. The correct answer is (D). A combustion reaction is the exothermic reaction of a substance with an oxidizer, such as oxygen ( $O_2$ ). Combustion reactions of oxygen with hydrocarbons like  $C_3H_8$  produce carbon dioxide and water.

Content	II A
Science and Engineering Practice	2

16. The correct answers are (A) and (D). Genetic mutations can be neutral or beneficial in addition to being harmful to organisms. If the mutation has no effect on the expression of the organism's genes, it is considered a neutral mutation; whereas, if the genetic mutation results in a trait that increases the organism's fitness, it is considered a beneficial mutation.

Content	III C
Science and Engineering Practice	7
Task of Teaching Science	18

17. The correct answer is (D). The  $H_2O$  is in the process of freezing during the interval  $B-C$ . During the phase change from liquid to solid, the temperature of the  $H_2O$  remains constant until it has completely frozen. Heat is released from the sample of  $H_2O$  during all intervals represented on the graph.

Content	II A
Science and Engineering Practice	2
Task of Teaching Science	21

18. The correct answer is (A). Tornadoes usually form along weather fronts where two air masses meet and certain wind conditions cause air to rotate.

Content	IV B
---------	------

19. The correct answer is (B). The primary difference between a parasite and a predator is that a parasite gets nutrients from one host over a long time period and the host is not always killed; whereas a predator hunts and kills many prey over a short time period for food. For a predator to obtain adequate nutrients, the prey organism is always killed.

Content	III B
Science and Engineering Practice	1
Task of Teaching Science	13

20. The correct answer is (D). The Sun's corona has extremely low density and is much dimmer than the Sun's surface. Consequently, it is visible only during a total solar eclipse, when the Moon completely covers the disk of the Sun, or by using a coronagraph.

Content	IV A
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21. The correct answer is (B). A calorie is a unit of energy. Therefore, nut type 2 contains more energy per nut and is the most efficient source of energy. Although the statements in (A), (C), and (D) may be true, the data do not support the statements.

Content	I A
Science and Engineering Practice	4

22. The correct answer is (A). If the color of the frogs' surroundings changes from brown to green, there will be directional selection in favor of the frogs with green coloration. As a result of natural selection, the population frequency of green frogs will gradually increase and that of brown frogs will gradually decrease.

Content	III C
---------	-------

23. The correct answer is (C). The amount of heat absorbed or lost by a sample of a pure substance is  $q = mc\Delta T$ , where  $m$  is the mass of the sample,  $c$  is the specific heat capacity, and  $\Delta T$  is the change in temperature. Based on the equation, if the mass of the piece of metal is one-half that of the first piece, then one-half the amount of heat is needed to increase its temperature by the same amount.

Content	II C
Science and Engineering Practice	5

24. The correct answer is (C). A common student misconception is that since plant cells have chloroplasts to carry out photosynthesis and convert light energy into high-energy sugars, they do not need to carry out cellular respiration to break down the sugars to release energy. In this case, a student might claim that plant cells do not contain mitochondria, since this is the primary location of cellular respiration.

Content	III A
Task of Teaching Science	12

25. The correct answer is (A). Estuaries are found along coastlines where rivers feed freshwater into the ocean. The mixture of freshwater and ocean water (brackish water) creates environments that are high in both animal and plant biodiversity, in addition to high biological productivity.

Content	IV B
---------	------

26. The correct answer is (A). If the material is composed of dividing cells, then it is alive. Cells are the smallest units of life that can replicate independently.

Content	III A
Science and Engineering Practice	7

27. The correct answer is (B). The cosmic microwave background is remnant radiation that originated from the early universe when it was much hotter and more dense than it is today. This provides evidence to support the big bang model, which predicts that the universe has expanded and cooled over cosmic time.

Content	IV A
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28. The correct answer is (C). A food web best represents the energy flow in a community. A food web can include more than one species at higher levels. A food chain typically includes a single species at each level. Autotrophs are organisms that produce their own food through photosynthesis or chemosynthesis. Heterotrophs obtain their energy by consuming other organisms and can be herbivores, carnivores, or omnivores.

Content	III B
Science and Engineering Practice	2
Task of Teaching Science	21

29. The correct answer is (D). Condensation is the process in which water vapor cools and undergoes a phase change from a gas to a liquid.

Content	IV B
Task of Teaching Science	16

30. The correct answer is (C). The student manipulated two variables (the amount of light and temperature) during the experiment. As a result, the student cannot determine the individual effect of either temperature or light on the feeding behavior of the Daphnia. To improve the experimental plan, the student should have varied the amount of light at a constant temperature or varied the temperature while keeping the amount of light constant.

Content	I A
Science and Engineering Practice	3
Task of Teaching Science	8

31. The correct answer is (B). Acceleration is the change in speed per unit of time. The change in speed of the car is equal to  $25 \text{ m/s} - 10 \text{ m/s} = 15 \text{ m/s}$ , and the time is 3 s. The acceleration is  $15 \text{ m/s} \div 3 \text{ s} = 5 \text{ m/s}^2$ .

Content	II B
Science and Engineering Practice	5

## 4. Determine Your Strategy for Success

*Set clear goals and deadlines so your test preparation is focused and efficient*

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Otherwise, you may not feel ready and confident on test day.

### 1) Learn what the test covers.

You may have heard that there are several different versions of the same test. It's true. You may take one version of the test and your friend may take a different version a few months later. Each test has different questions covering the same subject area, but both versions of the test measure the same skills and content knowledge.

You'll find specific information on the test you're taking on page 5, which outlines the content categories that the test measures and what percentage of the test covers each topic. Visit [www.ets.org/praxis/testprep](http://www.ets.org/praxis/testprep) for information on other *Praxis* tests.

### 2) Assess how well you know the content.

Research shows that test takers tend to overestimate their preparedness—this is why some test takers assume they did well and then find out they did not pass.

The *Praxis* tests are demanding enough to require serious review of likely content, and the longer you've been away from the content, the more preparation you will most likely need. If it has been longer than a few months since you've studied your content area, make a concerted effort to prepare.

### 3) Collect study materials.

Gathering and organizing your materials for review are critical steps in preparing for the *Praxis* tests. Consider the following reference sources as you plan your study:

- Did you take a course in which the content area was covered? If yes, do you still have your books or your notes?
- Does your local library have a high school-level textbook in this area? Does your college library have a good introductory college-level textbook in this area?

Practice materials are available for purchase for many *Praxis* tests at [www.ets.org/praxis/testprep](http://www.ets.org/praxis/testprep). Test preparation materials include sample questions and answers with explanations.

### 4) Plan and organize your time.

You can begin to plan and organize your time while you are still collecting materials. Allow yourself plenty of review time to avoid cramming new material at the end. Here are a few tips:

- Choose a test date far enough in the future to leave you plenty of preparation time. Test dates can be found at [www.ets.org/praxis/register/dates\\_centers](http://www.ets.org/praxis/register/dates_centers).
- Work backward from that date to figure out how much time you will need for review.
- Set a realistic schedule—and stick to it.

### 5) Practice explaining the key concepts.

*Praxis* tests with constructed-response questions assess your ability to explain material effectively. As a teacher, you'll need to be able to explain concepts and processes to students in a clear, understandable way. What are the major concepts you will be required to teach? Can you explain them in your own words accurately, completely, and clearly? Practice explaining these concepts to test your ability to effectively explain what you know.

### 6) Understand how questions will be scored.

Scoring information can be found on page 44.

### 7) Develop a study plan.

A study plan provides a road map to prepare for the *Praxis* tests. It can help you understand what skills and knowledge are covered on the test and where to focus your attention. Use the study plan template on page 37 to organize your efforts.

And most important—get started!

## Would a Study Group Work for You?

### Using this guide as part of a study group

People who have a lot of studying to do sometimes find it helpful to form a study group with others who are working toward the same goal. Study groups give members opportunities to ask questions and get detailed answers. In a group, some members usually have a better understanding of certain topics, while others in the group may be better at other topics. As members take turns explaining concepts to one another, everyone builds self-confidence.

If the group encounters a question that none of the members can answer well, the group can go to a teacher or other expert and get answers efficiently. Because study groups schedule regular meetings, members study in a more disciplined fashion. They also gain emotional support. The group should be large enough so that multiple people can contribute different kinds of knowledge, but small enough so that it stays focused. Often, three to six members is a good size.

Here are some ways to use this guide as part of a study group:

- **Plan the group's study program.** Parts of the study plan template, beginning on page 37, can help to structure your group's study program. By filling out the first five columns and sharing the worksheets, everyone will learn more about your group's mix of abilities and about the resources, such as textbooks, that members can share with the group. In the sixth column ("Dates I will study the content"), you can create an overall schedule for your group's study program.
- **Plan individual group sessions.** At the end of each session, the group should decide what specific topics will be covered at the next meeting and who will present each topic. Use the topic headings and subheadings in the Test at a Glance table on page 5 to select topics, and then select practice questions, beginning on page 22.
- **Prepare your presentation for the group.** When it's your turn to present, prepare something that is more than a lecture. Write two or three original questions to pose to the group. Practicing writing actual questions can help you better understand the topics covered on the test as well as the types of questions you will encounter on the test. It will also give other members of the group extra practice at answering questions.

- **Take a practice test together.** The idea of a practice test is to simulate an actual administration of the test, so scheduling a test session with the group will add to the realism and may also help boost everyone's confidence. Remember, complete the practice test using only the time that will be allotted for that test on your administration day.
- **Learn from the results of the practice test.** Review the results of the practice test, including the number of questions answered correctly in each content category. For tests that contain constructed-response questions, look at the Sample Test Questions section, which also contain sample responses to those questions and shows how they were scored. Then try to follow the same guidelines that the test scorers use.
- **Be as critical as you can.** You're not doing your study partner(s) any favors by letting them get away with an answer that does not cover all parts of the question adequately.
- **Be specific.** Write comments that are as detailed as the comments about the sample responses. Indicate where and how your study partner(s) are doing an inadequate job of answering the question. Writing notes in the margins of the answer sheet may also help.
- **Be supportive.** Include comments that point out what your study partner(s) got right.

Then plan one or more study sessions based on aspects of the questions on which group members performed poorly. For example, each group member might be responsible for rewriting one paragraph of a response in which someone else did an inadequate job.

Whether you decide to study alone or with a group, remember that the best way to prepare is to have an organized plan. The plan should set goals based on specific topics and skills that you need to learn, and it should commit you to a realistic set of deadlines for meeting those goals. Then you need to discipline yourself to stick with your plan and accomplish your goals on schedule.

## 5. Develop Your Study Plan

*Develop a personalized study plan and schedule*

Planning your study time is important because it will help ensure that you review all content areas covered on the test. Use the sample study plan below as a guide. It shows a plan for the *Core Academic Skills for Educators: Reading* test. Following that is a study plan template that you can fill out to create your own plan. Use the "Learn about Your Test" and "Test Specifications" information beginning on page 5 to help complete it.

**Use this worksheet to:**

- 1. Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
- 2. Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
- 3. Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
- 4. Study:** Create and commit to a schedule that provides for regular study periods.

**Praxis Test Name (Test Code):** Core Academic Skills for Educators: Reading (5712)

**Test Date:** 9/15/15

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
<b>Key Ideas and Details</b>						
Close reading	Draw inferences and implications from the directly stated content of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/15/15	7/15/15
Determining Ideas	Identify summaries or paraphrases of the main idea or primary purpose of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/17/15	7/17/15
Determining Ideas	Identify summaries or paraphrases of the supporting ideas and specific details in a reading selection	3	Middle and high school English textbook	College library, middle and high school teachers	7/20/15	7/21/15
<b>Craft, Structure, and Language Skills</b>						
Interpreting tone	Determine the author's attitude toward material discussed in a reading selection	4	Middle and high school English textbook	College library, middle and high school teachers	7/25/15	7/26/15
Analysis of structure	Identify key transition words and phrases in a reading selection and how they are used	3	Middle and high school English textbook, dictionary	College library, middle and high school teachers	7/25/15	7/27/15
Analysis of structure	Identify how a reading selection is organized in terms of cause/effect, compare/contrast, problem/solution, etc.	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Author's purpose	Determine the role that an idea, reference, or piece of information plays in an author's discussion or argument	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Language in different contexts	Determine whether information presented in a reading selection is presented as fact or opinion	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Contextual meaning	Identify the meanings of words as they are used in the context of a reading selection	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Figurative Language	Understand figurative language and nuances in word meanings	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/8/15	8/8/15
Vocabulary range	Understand a range of words and phrases sufficient for reading at the college and career readiness level	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/15/15	8/17/15
<b>Integration of Knowledge and Ideas</b>						
Diverse media and formats	Analyze content presented in diverse media and formats, including visually and quantitatively, as well as in words	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/22/15	8/24/15
Evaluation of arguments	Identify the relationship among ideas presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/24/15	8/24/15
Evaluation of arguments	Determine whether evidence strengthens, weakens, or is relevant to the arguments in a reading selection	3	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/27/15	8/27/15
Evaluation of arguments	Determine the logical assumptions upon which an argument or conclusion is based	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/28/15	8/30/15
Evaluation of arguments	Draw conclusions from material presented in a reading selection	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/30/15	8/31/15
Comparison of texts	Recognize or predict ideas or situations that are extensions of or similar to what has been presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/3/15	9/4/15
Comparison of texts	Apply ideas presented in a reading selection to other situations	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/5/15	9/6/15



## My Study Plan

Use this worksheet to:

1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): \_\_\_\_\_

Test Date: \_\_\_\_\_

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for this content?	Where can I find the resources I need?	Dates I will study this content	Date completed

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1-5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed

## 6. Review Smart Tips for Success

### *Follow test-taking tips developed by experts*

Learn from the experts. Take advantage of the following answers to questions you may have and practical tips to help you navigate the *Praxis* test and make the best use of your time.

#### **Should I guess?**

Yes. Your score is based on the number of questions you answer correctly, with no penalty or subtraction for an incorrect answer. When you don't know the answer to a question, try to eliminate any obviously wrong answers and then guess at the correct one. Try to pace yourself so that you have enough time to carefully consider every question.

#### **Can I answer the questions in any order?**

You can answer the questions in order or skip questions and come back to them later. If you skip a question, you can also mark it so that you can remember to return and answer it later. Remember that questions left unanswered are treated the same as questions answered incorrectly, so it is to your advantage to answer every question.

#### **Are there trick questions on the test?**

No. There are no hidden meanings or trick questions. All of the questions on the test ask about subject matter knowledge in a straightforward manner.

#### **Are there answer patterns on the test?**

No. You might have heard this myth: the answers on tests follow patterns. Another myth is that there will never be more than two questions in a row with the correct answer in the same position among the choices. Neither myth is true. Select the answer you think is correct based on your knowledge of the subject.

#### **Can I write on the scratch paper I am given?**

Yes. You can work out problems on the scratch paper, make notes to yourself, or write anything at all. Your scratch paper will be destroyed after you are finished with it, so use it in any way that is helpful to you. But make sure to select or enter your answers on the computer.

### **Smart Tips for Taking the Test**

- 1. Skip the questions you find extremely difficult.** Rather than trying to answer these on your first pass through the test, you may want to leave them blank and mark them so that you can return to them later. Pay attention to the time as you answer the rest of the questions on the test, and try to finish with 10 or 15 minutes remaining so that you can go back over the questions you left blank. Even if you don't know the answer the second time you read the questions, see if you can narrow down the possible answers, and then guess. Your score is based on the number of right answers, so it is to your advantage to answer every question.

2. **Keep track of the time.** The on-screen clock will tell you how much time you have left. You will probably have plenty of time to answer all of the questions, but if you find yourself becoming bogged down, you might decide to move on and come back to any unanswered questions later.
3. **Read all of the possible answers before selecting one.** For questions that require you to select more than one answer, or to make another kind of selection, consider the most likely answers given what the question is asking. Then reread the question to be sure the answer(s) you have given really answer the question. Remember, a question that contains a phrase such as “Which of the following does NOT . . .” is asking for the one answer that is NOT a correct statement or conclusion.
4. **Check your answers.** If you have extra time left over at the end of the test, look over each question and make sure that you have answered it as you intended. Many test takers make careless mistakes that they could have corrected if they had checked their answers.
5. **Don’t worry about your score when you are taking the test.** No one is expected to answer all of the questions correctly. Your score on this test is not analogous to your score on the *GRE*<sup>®</sup> or other tests. It doesn’t matter on the *Praxis* tests whether you score very high or barely pass. If you meet the minimum passing scores for your state and you meet the state’s other requirements for obtaining a teaching license, you will receive a license. In other words, what matters is meeting the minimum passing score. You can find passing scores for all states that use the *Praxis* tests at <https://www.ets.org/praxis/institutions/scores/passing/> or on the web site of the state for which you are seeking certification/licensure.
6. **Use your energy to take the test, not to get frustrated by it.** Getting frustrated only increases stress and decreases the likelihood that you will do your best. Highly qualified educators and test development professionals, all with backgrounds in teaching, worked diligently to make the test a fair and valid measure of your knowledge and skills. Your state painstakingly reviewed the test before adopting it as a licensure requirement. The best thing to do is concentrate on answering the questions.

## 7. Check on Testing Accommodations

*See if you qualify for accommodations to take the Praxis test*

### What if English is not my primary language?

*Praxis* tests are given only in English. If your primary language is not English (PLNE), you may be eligible for extended testing time. For more details, visit [www.ets.org/praxis/register/plne\\_accommodations/](http://www.ets.org/praxis/register/plne_accommodations/).

### What if I have a disability or other health-related need?

The following accommodations are available for *Praxis* test takers who meet the Americans with Disabilities Act (ADA) Amendments Act disability requirements:

- Extended testing time
- Additional rest breaks
- Separate testing room
- Writer/recorder of answers
- Test reader
- Sign language interpreter for spoken directions only
- Perkins Braille
- Braille slate and stylus
- Printed copy of spoken directions
- Oral interpreter
- Audio test
- Braille test
- Large print test book
- Large print answer sheet
- Listening section omitted

For more information on these accommodations, visit [www.ets.org/praxis/register/disabilities](http://www.ets.org/praxis/register/disabilities).

**Note:** Test takers who have health-related needs requiring them to bring equipment, beverages, or snacks into the testing room or to take extra or extended breaks must request these accommodations by following the procedures described in the *Bulletin Supplement for Test Takers with Disabilities or Health-Related Needs* (PDF), which can be found at [www.ets.org/s/praxis/pdf/bulletin\\_supplement\\_test\\_takers\\_with\\_disabilities\\_health\\_needs.pdf](http://www.ets.org/s/praxis/pdf/bulletin_supplement_test_takers_with_disabilities_health_needs.pdf).

You can find additional information on available resources for test takers with disabilities or health-related needs at [www.ets.org/disabilities](http://www.ets.org/disabilities).

## 8. Do Your Best on Test Day

*Get ready for test day so you will be calm and confident*

You followed your study plan. You prepared for the test. Now it's time to prepare for test day.

Plan to end your review a day or two before the actual test date so you avoid cramming. Take a dry run to the test center so you're sure of the route, traffic conditions, and parking. Most of all, you want to eliminate any unexpected factors that could distract you from your ultimate goal—passing the *Praxis* test!

On the day of the test, you should:

- be well rested
- wear comfortable clothes and dress in layers
- eat before you take the test
- bring an acceptable and valid photo identification with you
- bring an approved calculator only if one is specifically permitted for the test you are taking (see Calculator Use, at [http://www.ets.org/praxis/test\\_day/policies/calculators](http://www.ets.org/praxis/test_day/policies/calculators))
- be prepared to stand in line to check in or to wait while other test takers check in

You can't control the testing situation, but you can control yourself. Stay calm. The supervisors are well trained and make every effort to provide uniform testing conditions, but don't let it bother you if the test doesn't start exactly on time. You will have the allotted amount of time once it does start.

You can think of preparing for this test as training for an athletic event. Once you've trained, prepared, and rested, give it everything you've got.

### What items am I restricted from bringing into the test center?

You cannot bring into the test center personal items such as:

- handbags, knapsacks, or briefcases
- water bottles or canned or bottled beverages
- study materials, books, or notes
- pens, pencils, scrap paper, or calculators, unless specifically permitted for the test you are taking (see Calculator Use, at [http://www.ets.org/praxis/test\\_day/policies/calculators](http://www.ets.org/praxis/test_day/policies/calculators))
- any electronic, photographic, recording, or listening devices

Personal items are not allowed in the testing room and will not be available to you during the test or during breaks. You may also be asked to empty your pockets. At some centers, you will be assigned a space to store your belongings, such as handbags and study materials. Some centers do not have secure storage space available, so please plan accordingly.

Test centers assume no responsibility for your personal items.

If you have health-related needs requiring you to bring equipment, beverages or snacks into the testing room or to take extra or extended breaks, you need to request accommodations in advance. Procedures for requesting accommodations are described in the [Bulletin Supplement for Test Takers with Disabilities or Health-related Needs \(PDF\)](#).

**Note:** All cell phones, smart phones (e.g., Android® devices, iPhones®, etc.), and other electronic, photographic, recording, or listening devices are strictly prohibited from the test center. If you are seen with such a device, you will be dismissed from the test, your test scores will be canceled, and you will forfeit your test fees. If you are seen *using* such a device, the device will be confiscated and inspected. For more information on what you can bring to the test center, visit [www.ets.org/praxis/test\\_day/bring](http://www.ets.org/praxis/test_day/bring).

### Are You Ready?

Complete this checklist to determine whether you are ready to take your test.

- Do you know the testing requirements for the license or certification you are seeking in the state(s) where you plan to teach?
- Have you followed all of the test registration procedures?
- Do you know the topics that will be covered in each test you plan to take?
- Have you reviewed any textbooks, class notes, and course readings that relate to the topics covered?
- Do you know how long the test will take and the number of questions it contains?
- Have you considered how you will pace your work?
- Are you familiar with the types of questions for your test?
- Are you familiar with the recommended test-taking strategies?
- Have you practiced by working through the practice questions in this study companion or in a study guide or practice test?
- If constructed-response questions are part of your test, do you understand the scoring criteria for these questions?
- If you are repeating a *Praxis* test, have you analyzed your previous score report to determine areas where additional study and test preparation could be useful?

If you answered “yes” to the questions above, your preparation has paid off. Now take the *Praxis* test, do your best, pass it—and begin your teaching career!

## 9. Understand Your Scores

*Understand how tests are scored and how to interpret your test scores*

Of course, passing the *Praxis* test is important to you so you need to understand what your scores mean and what your state requirements are.

### What are the score requirements for my state?

States, institutions, and associations that require the tests set their own passing scores. Visit [www.ets.org/praxis/states](http://www.ets.org/praxis/states) for the most up-to-date information.

### If I move to another state, will my new state accept my scores?

The *Praxis* tests are part of a national testing program, meaning that they are required in many states for licensure. The advantage of a national program is that if you move to another state that also requires *Praxis* tests, you can transfer your scores. Each state has specific test requirements and passing scores, which you can find at [www.ets.org/praxis/states](http://www.ets.org/praxis/states).

### How do I know whether I passed the test?

Your score report will include information on passing scores for the states you identified as recipients of your test results. If you test in a state with automatic score reporting, you will also receive passing score information for that state.

A list of states and their passing scores for each test are available online at [www.ets.org/praxis/states](http://www.ets.org/praxis/states).

### What your *Praxis* scores mean

You received your score report. Now what does it mean? It's important to interpret your score report correctly and to know what to do if you have questions about your scores.

Visit [http://www.ets.org/s/praxis/pdf/sample\\_score\\_report.pdf](http://www.ets.org/s/praxis/pdf/sample_score_report.pdf) to see a sample score report.

To access *Understanding Your Praxis Scores*, a document that provides additional information on how to read your score report, visit [www.ets.org/praxis/scores/understand](http://www.ets.org/praxis/scores/understand).

### Put your scores in perspective

Your score report indicates:

- Your score and whether you passed
- The range of possible scores
- The raw points available in each content category
- The range of the middle 50 percent of scores on the test

If you have taken the same *Praxis* test or other *Praxis* tests in last 10 years, your score report also lists the highest score you earned on each test taken.



## Content category scores and score interpretation

Questions on the *Praxis* tests are categorized by content. To help you in future study or in preparing to retake the test, your score report shows how many raw points you earned in each content category. Compare your “raw points earned” with the maximum points you could have earned (“raw points available”). The greater the difference, the greater the opportunity to improve your score by further study.

## Score scale changes

ETS updates *Praxis* tests on a regular basis to ensure they accurately measure the knowledge and skills that are required for licensure. When tests are updated, the meaning of the score scale may change, so requirements may vary between the new and previous versions. All scores for previous, discontinued tests are valid and reportable for 10 years, provided that your state or licensing agency still accepts them.

These resources may also help you interpret your scores:

- *Understanding Your Praxis Scores* (PDF), found at [www.ets.org/praxis/scores/understand](http://www.ets.org/praxis/scores/understand)
- *The Praxis Passing Scores* (PDF), found at [www.ets.org/praxis/scores/understand](http://www.ets.org/praxis/scores/understand)
- State requirements, found at [www.ets.org/praxis/states](http://www.ets.org/praxis/states)

# Appendix: Other Questions You May Have

Here is some supplemental information that can give you a better understanding of the *Praxis* tests.

## What do the *Praxis* tests measure?

The *Praxis* tests measure the specific knowledge and skills that beginning teachers need. The tests do not measure an individual's disposition toward teaching or potential for success, nor do they measure your actual teaching ability. The assessments are designed to be comprehensive and inclusive but are limited to what can be covered in a finite number of questions and question types. Teaching requires many complex skills that are typically measured in other ways, including classroom observation, video recordings, and portfolios.

Ranging from Agriculture to World Languages, there are more than 80 *Praxis* tests, which contain selected-response questions or constructed-response questions, or a combination of both.

## Who takes the tests and why?

Some colleges and universities use the *Praxis* Core Academic Skills for Educators tests (Reading, Writing, and Mathematics) to evaluate individuals for entry into teacher education programs. The assessments are generally taken early in your college career. Many states also require Core Academic Skills test scores as part of their teacher licensing process.

Individuals entering the teaching profession take the *Praxis* content and pedagogy tests as part of the teacher licensing and certification process required by many states. In addition, some professional associations and organizations require *Praxis* Subject Assessments for professional licensing.

## Do all states require these tests?

The *Praxis* tests are currently required for teacher licensure in approximately 40 states and United States territories. These tests are also used by several professional licensing agencies and by several hundred colleges and universities. Teacher candidates can test in one state and submit their scores in any other state that requires *Praxis* testing for licensure. You can find details at [www.ets.org/praxis/states](http://www.ets.org/praxis/states).

## What is licensure/certification?

Licensure in any area—medicine, law, architecture, accounting, cosmetology—is an assurance to the public that the person holding the license possesses sufficient knowledge and skills to perform important occupational activities safely and effectively. In the case of teacher licensing, a license tells the public that the individual has met predefined competency standards for beginning teaching practice.

Because a license makes such a serious claim about its holder, licensure tests are usually quite demanding. In some fields, licensure tests have more than one part and last for more than one day. Candidates for licensure in all fields plan intensive study as part of their professional preparation. Some join study groups, others study alone. But preparing to take a licensure test is, in all cases, a professional activity. Because a licensure exam surveys a broad body of knowledge, preparing for a licensure exam takes planning, discipline, and sustained effort.

## Why does my state require the *Praxis* tests?

Your state chose the *Praxis* tests because they assess the breadth and depth of content—called the “domain”—that your state wants its teachers to possess before they begin to teach. The level of content knowledge, reflected in the passing score, is based on recommendations of panels of teachers and teacher educators in

each subject area. The state licensing agency and, in some states, the state legislature ratify the passing scores that have been recommended by panels of teachers.

### How were the tests developed?

ETS consulted with practicing teachers and teacher educators around the country during every step of the *Praxis* test development process. First, ETS asked them what knowledge and skills a beginning teacher needs to be effective. Their responses were then ranked in order of importance and reviewed by hundreds of teachers.

After the results were analyzed and consensus was reached, guidelines, or specifications, for the selected-response and constructed-response tests were developed by teachers and teacher educators. Following these guidelines, teachers and professional test developers created test questions that met content requirements and [\*ETS Standards for Quality and Fairness\*](#).\*

When your state adopted the research-based *Praxis* tests, local panels of teachers and teacher educators evaluated each question for its relevance to beginning teachers in your state. During this “validity study,” the panel also provided a passing-score recommendation based on how many of the test questions a beginning teacher in your state would be able to answer correctly. Your state’s licensing agency determined the final passing-score requirement.

ETS follows well-established industry procedures and standards designed to ensure that the tests measure what they are intended to measure. When you pass the *Praxis* tests your state requires, you are proving that you have the knowledge and skills you need to begin your teaching career.

### How are the tests updated to ensure the content remains current?

*Praxis* tests are reviewed regularly. During the first phase of review, ETS conducts an analysis of relevant state and association standards and of the current test content. State licensure titles and the results of relevant job analyses are also considered. Revised test questions are then produced following the standard test development methodology. National advisory committees may also be convened to review and revise existing test specifications and to evaluate test forms for alignment with the specifications.

### How long will it take to receive my scores?

Scores for tests that do not include constructed-response questions are available on screen immediately after the test. Scores for tests that contain constructed-response questions or essays aren’t available immediately after the test because of the scoring process involved. Official score reports are available to you and your designated score recipients approximately two to three weeks after the test date for tests delivered continuously, or two to three weeks after the testing window closes for other tests. See the test dates and deadlines calendar at [www.ets.org/praxis/register/dates\\_centers](http://www.ets.org/praxis/register/dates_centers) for exact score reporting dates.

### Can I access my scores on the web?

All test takers can access their test scores via My *Praxis* Account free of charge for one year from the posting date. This online access replaces the mailing of a paper score report.

The process is easy—simply log into My *Praxis* Account at [www.ets.org/praxis](http://www.ets.org/praxis) and click on your score report. If you do not already have a *Praxis* account, you must create one to view your scores.

**Note:** You must create a *Praxis* account to access your scores, even if you registered by mail or phone.

\*[\*ETS Standards for Quality and Fairness\*](#) (2014, Princeton, N.J.) are consistent with the [\*Standards for Educational and Psychological Testing\*](#), industry standards issued jointly by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (2014, Washington, D.C.).

Your teaching career is worth preparing for, so start today!  
Let the Praxis® Study Companion guide you.

To search for the *Praxis* test prep resources  
that meet your specific needs, visit:

**[www.ets.org/praxis/testprep](http://www.ets.org/praxis/testprep)**

To purchase official test prep made by the creators  
of the *Praxis* tests, visit the ETS Store:

**[www.ets.org/praxis/store](http://www.ets.org/praxis/store)**

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