

The Praxis® Study Companion

Elementary Education: Content Knowledge

5018



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.

How are the *Praxis* tests given?

Praxis tests are given on computer. Other formats are available for test takers approved for accommodations (see page 55).

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.

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1. Learn About Your Test

Learn about the specific test you will be taking

Elementary Education: Content Knowledge (5018)

Test at a Glance			
Test Name	Elementary Education: Content Knowledge		
Test Code	5018		
Time	150 minutes		
Number of Questions	140		
Format	Selected-response and numeric-entry questions, scientific calculator provided		
Test Delivery	Computer delivered		
	Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
	I. Reading and Language Arts	49	35%
II. Mathematics	41	29%	
III. Social Studies	25	18%	
IV. Science	25	18%	

About This Test

The Elementary Education: Content Knowledge test is designed for candidates who are preparing to enter the field of elementary education. The test measures the knowledge, skills, and abilities judged by a national advisory committee and a survey of education experts to be necessary for safe and effective practice. Test takers are typically completing an undergraduate degree program in elementary education or have a degree in a content area and are seeking an additional endorsement.

The 140 test questions focus on knowledge in four major content areas: reading and language arts, mathematics, social studies, and science. Test takers are asked to show their knowledge of the topics covered on the test in multiple ways using various types of responses: conceptual understanding, procedural awareness, interpretation, integration, and application. The test is aligned with the Common Core State Standards for English Language Arts and Mathematics, as well as Social Studies content standards. The development of the science test questions reflect the National Science Education Standards (NSES) and the National Science Teacher Association (NSTA) standards.

An on-screen scientific calculator is provided for the computer-delivered test. Please consult the [Praxis Calculator Use](#) web page for further information. You are expected to know how and when to use the scientific calculator since it will be helpful for some questions. You are expected to become familiar with its functionality before taking the test. To practice using the calculator, [download the 30-day trial version and view tutorials on how to use it](#). The calculator may be used to perform calculations, such as exponents, roots, and percents.

This test may contain some questions that will not count toward your score.

Test Specifications

Test specifications in this chapter describe the knowledge and skills measured by the test. Study topics to help you prepare to answer test questions can be found in page 36.

I. Reading and Language Arts

A. Reading: Foundational Skills

1. Understands the role of phonological awareness in literacy development
 - a. Explains the importance of phonological awareness as a foundational skill for literacy development
 - b. Identifies and provides examples of phonemes, syllables, onsets, and rimes
 - c. Identifies and provides examples of blending, segmenting, substituting, and deleting phonemes, syllables, onsets, rimes
2. Understands the role of phonics and word analysis in literacy development
 - a. Explains the importance of phonics and word analysis in literacy development
 - b. Distinguishes among common letter-sound correspondences and spelling conventions
 - c. Distinguishes high-frequency sight words from decodable words appropriate for particular grades
 - d. Identifies roots and affixes to decode unfamiliar words
 - e. Recognizes various stages of language acquisition (e.g., WIDA taxonomy)
 - f. Delineates common phonics and word-recognition approaches for ELLs (pedagogy)
 - g. Differentiates syllabication patterns (e.g., open, closed, CVC)
3. Understands the role of fluency (e.g., rate, accuracy) in literacy development
 - a. Defines fluency and related terms (e.g., accuracy, rate, prosody)
 - b. Explains the impact of fluency on comprehension

B. Reading: Literature and Informational Text

1. Understands how to use key ideas and details to comprehend literature and informational text
 - a. Identifies the key details, moral, and/or theme of a literary text, citing specific textual evidence
 - b. Identifies the key details and/or central idea of an informational text, citing specific textual evidence
 - c. Makes inferences from a text and supports them with appropriate evidence
 - d. Summarizes information from a text
 - e. Analyzes the characters, setting, and plot of a literary text
 - f. Analyzes the relationships among individuals, events, ideas, and concepts in an informational text
2. Understands how features and structures of text across genres affect comprehension
 - a. Identifies structural elements of literature across genres (e.g., casts of characters and stage directions in drama, rhyme and meter in poetry)
 - b. Uses text features (e.g., headings, sidebars, hyperlinks) to locate information in a print or digital informational text
 - c. Identifies organizational structures of informational text (e.g., cause/effect, problem/solution)
 - d. Identifies how structural elements contribute to the development of a literary text as a whole
3. Understands the concept of point of view using evidence from the text
 - a. Identifies author's point of view in various genres and supports conclusions with evidence from the text
 - b. Compares multiple accounts of the same event or topic to identify similarities or differences in point of view
 - c. Identifies how point of view impacts the overall structure of a literary or informational text

4. Understands how to integrate and compare written, visual, and oral information from texts and multimedia sources
 - a. Explains how visual and oral elements enhance the meaning and effect of a literary text (e.g., picture book, graphic novel, multimedia presentation of a folktale)
 - b. Compares the written version of a literary text with an oral, staged, or filmed version
 - c. Compares two or more literary texts that address the same theme
 - d. Compares two or more informational texts that address the same topic
 - e. Interprets visual and multimedia elements in literary and informational texts
 - f. Evaluates key claims in a text and supports them with reasons and evidence from the text
5. Knows the role of text complexity in reading development
 - a. Explains the three factors (i.e., quantitative, qualitative, and reader and task) that measure text complexity
 - b. Identifies features of text-leveling systems

C. Writing

1. Understands the characteristics of common types of writing
 - a. Distinguishes among common types of writing (e.g., opinion/argument, informative/explanatory, narrative)
 - b. Identifies the purpose, key components, and subgenres (e.g., speeches, advertisements, narrative poems) of each common type of writing
 - c. Evaluates the effectiveness of writing samples of each type
2. Understands the characteristics of effective writing
 - a. Evaluates the appropriateness of a particular piece of writing for a specific task, purpose, and audience
 - b. Evaluates the development, organization, or style of a piece of writing
 - c. Identifies appropriate revisions to strengthen a piece of writing

D. Language

- d. Writes clearly and coherently
 - e. Identifies the interrelationships among planning, revising, and editing in the process of writing
 3. Knows the developmental stages of writing (e.g., picture, scribble)
 - a. Identifies the grade-appropriate continuum of student writing
 4. Knows the importance of digital tools for producing and publishing writing and for interacting with others
 - a. Identifies the characteristics and purposes of a variety of digital tools for producing and publishing writing
 - b. Identifies the purposes of a variety of digital tools for interacting with others
 5. Knows the research process
 - a. Identifies the steps in the research process
 - b. Distinguishes between primary and secondary sources and their uses
 - c. Distinguishes between reliable and unreliable sources
 - d. Distinguishes between paraphrasing and plagiarizing
 - e. Knows how to locate credible print and digital sources, locate information within the sources, and cite the sources
1. Knows the conventions of standard English grammar, usage, mechanics, and spelling when writing, speaking, reading, and listening
 - a. Explains the function of different parts of speech
 - b. Corrects errors in usage, mechanics, and spelling
 - c. Identifies examples of different sentence types (e.g., simple, compound, compound-complex)
 - d. Identify how varieties of English (e.g., dialects, registers) used in stories, dramas, or poems support the overall meaning
 2. Understands how to determine the meaning of words and phrases
 - a. Determines the literal meaning of unknown words and phrases from context, syntax, and/or knowledge of roots and affixes
 - b. Identifies types of figurative language

- c. Interprets figurative language
 - d. Analyzes the relationship between word choice and tone in a text
3. Understands characteristics of conversational, academic, and domain-specific language
 - a. Differentiates among the three tiers of vocabulary
 - b. Identifies relevant features of language such as word choice, order, and punctuation

E. Speaking and Listening

1. Knows the characteristics of effective collaboration to promote comprehension
 - a. Identifies techniques to communicate for a variety of purposes with diverse partners
 - b. Identifies the characteristics of active listening
2. Knows the characteristics of engaging oral presentations
 - a. Identifies elements of engaging oral presentations (e.g., volume, articulation, awareness of audience)

II. Mathematics

A. Numbers and Operations

1. Understands the place value system
 - a. Writes numbers using base-10 numerals, number names, and expanded form
 - b. Composes and decomposes multi-digit numbers
 - c. Given a digit, identifies the place the digit is in and its value in that place
 - d. Recognizes that a digit in one place represents ten times what it represents in the place to its right and one-tenth what it represents in the place to its left, and extends this recognition to several places to the right or left
 - e. Uses whole-number exponents to denote powers of 10
 - f. Rounds multi-digit numbers to any place value
2. Understands operations and properties of rational numbers
 - a. Solves multistep mathematical and real-world problems using addition, subtraction, multiplication, and division of rational numbers
 - Identifies different problem situations for the operations (e.g., adding to, taking from, putting together, taking apart, and comparing for subtraction)
 - Uses the relationship between addition and subtraction and the relationship between multiplication and division to solve problems (e.g., inverse operations)
 - Interprets remainders in division problems
 - b. Understands various strategies and algorithms used to perform operations on rational numbers
 - c. Recognizes concepts of rational numbers and their operations
 - Identifies examples where multiplication does not result in a product greater than both factors and division does not result in a quotient smaller than the dividend
 - Composes and decomposes fractions, including the use of unit fractions.
 - Recognizes that the value of a unit fraction decreases as the value of the denominator increases
 - Recognizes that the same whole must be used when comparing fractions
 - d. Solves problems using the order of operations, including problems involving whole number exponents
 - e. Identifies properties of operations (e.g., commutative, associative, distributive) and uses them to solve problems
 - f. Represents rational numbers and their operations in different ways
 - Uses, interprets, and explains concrete models or drawings of the addition, subtraction, multiplication, and division of rational numbers
 - Represents rational numbers and sums and differences of rational numbers on a number line
 - Illustrates and explains multiplication and division problems using equations, rectangular arrays, and area models

- g. Compares, classifies, and orders rational numbers
 - h. Converts between fractions, decimals, and percents
3. Understands proportional relationships and percents
 - a. Applies the concepts of ratios and unit rates to describe relationships between two quantities
 - b. Understands percent as a rate per 100
 - c. Solves unit-rate problems
 - d. Uses proportional relationships to solve ratio and percent problems
 4. Knows how to use basic concepts of number theory
 - a. Identifies and uses prime and composite numbers
 - b. Finds factors and multiples of numbers
 5. Knows a variety of strategies to determine reasonableness of results
 - a. Recognizes the reasonableness of results within the context of a given problem
 - b. Uses mental math, estimation, and rounding strategies to solve problems and determine reasonableness of results

B. Algebraic Thinking

1. Knows how to evaluate and manipulate algebraic expressions, equations, and formulas
 - a. Differentiates between algebraic expressions and equations
 - b. Adds and subtracts linear algebraic expressions
 - c. Uses the distributive property to generate equivalent linear algebraic expressions
 - d. Evaluates simple algebraic expressions (i.e., one variable, binomial) for given values of variables
 - e. Uses mathematical terms to identify parts of expressions and describe expressions
 - f. Translates between verbal statements and algebraic expressions or equations (e.g., the phrase “the number of cookies Joe has is equal to twice the number of cookies Sue has” can be represented by the equation $j = 2s$)
 - g. Uses formulas to determine unknown quantities

- h. Differentiates between dependent and independent variables in formulas
2. Understands the meanings of the solutions to linear equations and inequalities
 - a. Solves multistep one-variable linear equations and inequalities
 - b. Interprets solutions of multistep one-variable linear equations and inequalities (e.g., graphs the solution on a number line, states constraints on a situation)
 - c. Uses linear relationships represented by equations, tables, and graphs to solve problems
 3. Knows how to recognize and represent patterns (e.g., number, shape)
 - a. Identifies, extends, describes, or generates number and shape patterns
 - b. Makes conjectures, predictions, or generalizations based on patterns
 - c. Identifies relationships between the corresponding terms of two numerical patterns (e.g., find a rule for a function table)

C. Geometry and Measurement

1. Understands how to classify one-, two-, and three-dimensional figures
 - a. Uses definitions to identify lines, rays, line segments, parallel lines, and perpendicular lines
 - b. Classifies angles based on their measure
 - c. Composes and decomposes two- and three-dimensional shapes
 - d. Uses attributes to classify or draw polygons and solids
2. Knows how to solve problems involving perimeter, area, surface area, and volume
 - a. Represents three-dimensional figures with nets
 - b. Use nets that are made of rectangles and triangles to determine the surface area of three-dimensional figures
 - c. Finds the area and perimeter of polygons, including those with fractional side lengths
 - d. Finds the volume and surface area of right rectangular prisms, including those with fractional edge lengths
 - e. Determines how changes to dimensions change area and volume

3. Knows the components of the coordinate plane and how to graph ordered pairs on the plane
 - a. Identifies the x -axis, the y -axis, the origin, and the four quadrants in the coordinate plane
 - b. Solves problems by plotting points and drawing polygons in the coordinate plane
4. Knows how to solve problems involving measurement
 - a. Solves problems involving elapsed time, money, length, volume, and mass
 - b. Measures and compares lengths of objects using standard tools
 - c. Knows relative sizes of United States customary units and metric units
 - d. Converts units within both the United States customary system and the metric system

D. Data, Statistics, and Probability

1. Is familiar with basic statistical concepts
 - a. Identifies statistical questions
 - b. Solves problems involving measures of center (mean, median, mode) and range
 - c. Recognizes which measure of center best describes a set of data
 - d. Determines how changes in data affect measures of center or range
 - e. Describes a set of data (e.g., overall patterns, outliers)
2. Knows how to represent and interpret data presented in various forms
 - a. Interprets various displays of data (e.g., box plots, histograms, scatterplots)
 - b. Identifies, constructs, and completes graphs that correctly represent given data (e.g., circle graphs, bar graphs, line graphs, histograms, scatterplots, double bar graphs, double line graphs, box plots, and line plots/dot plots)
 - c. Chooses appropriate graphs to display data
3. Is familiar with how to interpret the probability of events
 - a. Interprets probabilities relative to likelihood of occurrence

III. Social Studies

A. Geography, Anthropology, and Sociology

1. Knows world and regional geography
 - a. Is familiar with spatial terms and can identify spatial patterns of people, places, and environments
 - b. Identifies the characteristics of places and regions
 - c. Locates major physical features of geography (e.g., mountain ranges, bodies of water)
 - d. Locates major political features of geography (e.g., continents, countries, states, cities)
 - e. Demonstrates basic geographic literacy (e.g., uses and interpretations of different types of maps, understanding of the concepts of absolute and relative location, identification of cardinal and intermediate directions)
2. Understands the interaction of physical and human systems
 - a. Demonstrates knowledge of how humans change the environment
 - b. Demonstrates knowledge of how the environment affects human activities
 - c. Understands the importance of natural and human resources
3. Knows the uses of geography
 - a. Applies geography to interpret the past and the present and to plan for the future
4. Knows how people of different backgrounds interact with their environment, self, family, neighborhood, and organizations.
 - a. Demonstrates knowledge of how human behavior is influenced by society and by society's groups, institutions, and organizations.

B. World History

1. Knows the major contributions of classical civilizations such as Egypt, Greece, and Rome
 - a. Demonstrates knowledge of how modern civilizations reflect, mirror, and learn from the contributions of ancient civilizations
2. Understands twentieth-century developments and transformations in world history
 - a. Demonstrates knowledge of the causes and effects of the First and Second World Wars and the Cold War

- b. Demonstrates knowledge of technological developments (e.g., transportation, communication, tools)
- c. Demonstrates knowledge of the causes and effects of globalization
- 3. Understands the role of cross-cultural comparisons in world history instruction
 - a. Demonstrates knowledge of various psychological, sociological, and cultural factors needed to assess the similarities and/or diversities in two or more different cultures or societies
 - c. Demonstrates knowledge of the causes and effects of industrialization, urbanization, and immigration
 - d. Is familiar with major social and cultural developments throughout United States history
- 4. Knows about twentieth-century developments and transformations in the United States
 - a. Demonstrates knowledge of the causes and effects of the Great Depression (e.g., New Deal legislation)
 - b. Demonstrates knowledge of the causes and effects of the First and Second World Wars and the Cold War
 - c. Demonstrates knowledge of major economic developments (e.g., assembly line, mass production,) and the influence of technological developments

C. United States History

- 1. Knows about the European exploration and colonization of North America and growth and expansion of the United States
 - a. Demonstrates knowledge of Native American peoples and cultures
 - b. Demonstrates knowledge of the reasons for the colonization of North America and the development of the thirteen colonies
 - c. Is familiar with the interactions between Native American groups, colonists, and European powers
- 2. Knows about the American Revolution and the founding of the United States
 - a. Understands the causes and effects of the American Revolution
 - b. Identifies key individuals and events during the American Revolution
 - c. Demonstrates knowledge of the challenges faced by the early republic (e.g., creation of a democratic government)
- 3. Knows about the major events and developments in United States history from founding to present
 - a. Demonstrates knowledge of the causes and effects of the territorial expansion of the United States (e.g., concept of Manifest Destiny; Louisiana Purchase; impact on Native Americans; role of technological, political, and economic developments)
 - b. Understands the causes and effects of the Civil War (e.g., growth of sectionalism, the abolition movement, the Underground Railroad, the reasons for the secession of the Confederate States, the role of Abraham Lincoln, the purposes and challenges of Reconstruction)

D. Government, Citizenship, and Democracy

- 1. Understands the nature, purpose, and forms of government
 - a. Is familiar with the founding principles of the United States government (e.g., republicanism, separation of powers, checks and balances, popular sovereignty)
 - b. Demonstrates knowledge of federalism (e.g., division of power between the national and state governments)
 - c. Demonstrates knowledge of the powers of the three branches of the federal government and the interactions among them
 - d. Is familiar with basic characteristics of different political systems
- 2. Knows key documents and speeches in the history of the United States
 - a. Is familiar with the purpose and contents of the Declaration of Independence
 - b. Is familiar with the Articles of Confederation
 - c. Demonstrates knowledge of the structure of government outlined in the United States Constitution

- d. Demonstrates knowledge of the rights and protections guaranteed to United States citizens by the Constitution
- e. Is familiar with key documents and speeches (e.g., Gettysburg Address)
- 3. Knows the rights and responsibilities of citizenship in a democracy
 - a. Demonstrates knowledge of civic participation (e.g., community service, membership in civic organizations)
 - b. Demonstrates knowledge of the rights and responsibilities of citizens in the United States (e.g. voting, paying taxes, freedom of speech)

E. Economics

- 1. Knows key terms and basic concepts of economics
 - a. Demonstrates knowledge of supply and demand
 - b. Is familiar with concepts of scarcity, choice, and opportunity cost
 - c. Demonstrates knowledge of the role of money and resources in economic decision making
- 2. Understands how economics affects population, resources, and technology
 - a. Demonstrates an understanding of how people use resources to generate wealth and enhance their lives
 - b. Demonstrates an understanding of how economics drives and is driven by technological innovations
- 3. Understands the government's role in economics and the impact of economics on government
 - a. Demonstrates knowledge of the federal government's role in regulating the economy
 - b. Demonstrates knowledge of taxing and spending

F. Social Studies as Inquiry and Social Studies Processes

- 1. Understands social studies as inquiry
 - a. Demonstrates knowledge of questioning, gathering data, and drawing reasonable conclusions
- 2. Understands how to use resource and research material in social studies

- a. Understands how to evaluate the appropriate uses of a variety of resources
- b. Identifies primary and secondary sources and demonstrates knowledge of the uses of each
- c. Demonstrates knowledge of fact and opinion and knows the uses of each in social studies
- 3. Understands process skills in social studies
 - a. Understands how to interpret different types of information
 - b. Evaluates relationships among different variables
 - c. Demonstrates ability to draw conclusions using tools of the field

IV. Science

A. Earth and Space Science

- 1. Understands basic physical and historical geology
 - a. Identify Earth's basic structure (e.g., mantle, core, geographical features such as mountains, magnetic field)
 - b. Identify and describe types and characteristics of rocks and minerals
 - c. Recognize processes involved in erosion, weathering, and deposition of Earth's surface materials
 - d. Recognize Earth's internal processes including impact of plate tectonic theory (e.g., volcanoes, earthquakes)
 - e. Identify key aspects of the water cycle (e.g., evaporation, condensation, precipitation, runoff)
 - f. Recognize important events in Earth's geologic history and the importance of the rock record and fossils
- 2. Is familiar with the structure and processes of Earth's hydrosphere
 - a. Identify the geographic location of Earth's oceans and seas and the processes involved with tides and waves
 - b. Identify characteristics of lakes, streams rivers, polar ice, icebergs, glaciers, and groundwater
 - c. Identify the basic characteristics of Earth's atmosphere

- d. Recognize the basic concepts of weather (e.g., clouds, precipitation, hurricanes)
 - e. Identify factors that affect climate and seasons (e.g., climate zones, proximity to mountains and oceans)
3. Is familiar with astronomy
- a. Identify the major features of the solar system, including the Sun, the planets, moons, asteroids, and comets
 - b. Recognize the interactions of the Earth-Moon-Sun system (e.g., phases of the Moon, eclipses, seasons, tides)
 - c. Recognize the major features of the universe a (e.g., galaxies, stars, black holes)

B. Life Sciences

1. Understands the basic structure and function of cells and levels of organization in living things
 - a. Identify the structure and function of cell organelles (e.g., nucleus, cell membrane)
 - b. Recognize basic cell processes such as cell division and photosynthesis
 - c. Identify the levels of organization (cells, tissues, organs, organ systems)
2. Understands basic genetics and evolution
 - a. Apply basic genetics (e.g., relationship between genes and traits)
 - b. Recognize the basic structure and function of DNA and relationship to heredity
 - c. Recognize common human genetic disorders
 - d. Identify processes by which species change over time, including natural selection, mutation, evolution
3. Knows the hierarchical classification scheme and the characteristics of the major groups of organisms
 - a. Identify elements of classification schemes (e.g., kingdom, genus, species)
 - b. Identify major characteristics of common types of organisms (e.g. amphibians, reptiles, mammals, plants)
4. Knows the major structures and functions of plant organs and systems
 - a. Identify the basic structure and function of leaves, roots, and stems
 - b. Recognize key aspects of asexual and sexual reproduction, development, and growth

C. Physical Sciences

- c. Recognize the uptake and transport of nutrients and water
5. Knows the basic anatomy and physiology of animals, including human body systems
 - a. Identify examples of exchange with the environment involving the respiratory, excretory, and digestive systems
 - b. Recognize key aspects of internal transport and exchange in terms of the circulatory system
 - c. Recognize key aspects of support and movement in terms of the skeletal and muscular systems
 - d. Identify key aspects of reproduction and development
 - e. Recognize the function of immune systems
 - f. Identify the functions of immune systems, nervous systems, and endocrine systems
 - g. Recognize the importance of homeostasis
 6. Knows key aspects of ecology
 - a. Recognize key relationships between and among species such as territoriality, predator-prey, and parasitism
 - b. Recognize key aspects of ecosystems (e.g., biomes, energy levels, food webs, effect of disturbances)

- c. Identify the differences between chemical and physical properties/changes
 - d. Describe methods of heat transfer (convection, radiation, conduction)
 - e. Describe how the states of matter undergo phase changes and the energy changes involved
3. Understands basic chemical reactions
- a. Identify the difference between covalent and ionic bonding
 - b. Interpret simple chemical formulas
 - c. Recognize that chemical reactions involve energy changes
 - d. Identify chemical and physical properties of acids and bases and the pH scale
 - e. Recognize common types of chemical reactions such as neutralization, oxidation, and combustion
4. Understands basic concepts in mechanics
- a. Describe motion in terms of distance, speed, velocity, and acceleration
 - b. Describe the effect of forces on objects (e.g., collisions, pendulums, friction)
 - c. Recognize the effect of gravity and distinguish between mass and weight
 - d. Recognize forces and physical properties involving fluids that determine whether objects will sink or float
5. Understands basic concepts in electricity, magnetism, waves, and optics
- a. Describe basic characteristics of magnets (e.g., magnetic poles, attraction, repulsion)
 - b. Recognize electrostatic attraction and repulsion
 - c. Describe electricity in terms of the flow of electrons and identify voltage sources (batteries and generators)
 - d. Describe the basic phenomena involving light (reflection, rainbows, mirrors, prisms)
 - e. Describe basic characteristics of sound (pitch, loudness, the Doppler effect)

D. Impact of Science and Technology on Society

- 1. Knows the impact of science and technology on the environment and society
 - a. Recognize the impact of air and water pollution, greenhouse gases

- b. Recognize the impact of production and disposal of consumer products
 - c. Recognize the benefits of conservation and recycling
 - d. Identify renewable and nonrenewable energy resources
 - e. Identify the pros and cons of power generation based on various sources (e.g., fossil, nuclear, water, wind, solar, biomass, geothermal)
2. Is familiar with applications of science and technology in daily life and public health
- a. Identify applications of chemical and physical principles related to common consumer products (e.g., acid-base properties of orange juice, applications of physics in devices such as lenses)
 - b. Identify common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides)
 - c. Recognize the role of nutrition, disease, and medicine (e.g., food preservation, vitamins, vaccines, viruses)
 - d. Recognize applications of medical technologies (e.g., MRIs, X-rays, radiation therapy)

E. Science as Inquiry and Science Processes

- 1. Understands the basic elements of scientific inquiry and how they are used
 - a. Identify hypotheses, theories, models, and laws, and their role in scientific inquiry
 - b. Explain the role of the elements of experimental design, including independent and dependent variables, controls, sources of error, and drawing conclusions
 - c. Recognize that scientific knowledge is subject to change, consistent with evidence, based on reproducible evidence and includes unifying concepts and processes (e.g., systems, models, constancy and change, equilibrium, form and function)
 - d. Recognize how key concepts developed over time and identify the contribution of key historical figures (e.g., Newton's laws, Marie Curie's work with radioactivity, Mendel's development of basic genetics)

2. Understands the common methods and tools used to gather and present reliable data
 - a. Identify common units of measurement (e.g., meter, gram, liter)
 - b. Explain the appropriate use of common measurement tools (e.g., thermometers, barometers, balances)
 - c. Organize and present data (e.g., graphs, tables, charts, maps)
3. Knows how to interpret and draw conclusions from data presented in tables, graphs, charts, and maps
 - a. Identify patterns and significant points in data
 - b. Draw conclusions and make predictions based on presented data
 - c. Recognize relationships between variables
 - d. Recognize the effect of error on data and conclusions
4. Understands procedures for safe and correct use of laboratory materials and equipment
 - a. Recognize safe and appropriate methods to prepare materials for classroom use (activities and demonstrations)
 - b. Recognize when and how to use standard equipment in the laboratory (e.g., microscopes, graduated cylinders)
 - c. Explain the use of standard safety equipment (e.g., eyewash stations, safety showers)
 - d. Identify appropriate student apparel and behavior (e.g., goggles, clothing, no eating in lab)
 - e. Recognize emergency procedures for mishaps (e.g., fires, chemical spills, injuries) and evacuation procedures

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 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 answer choices 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.

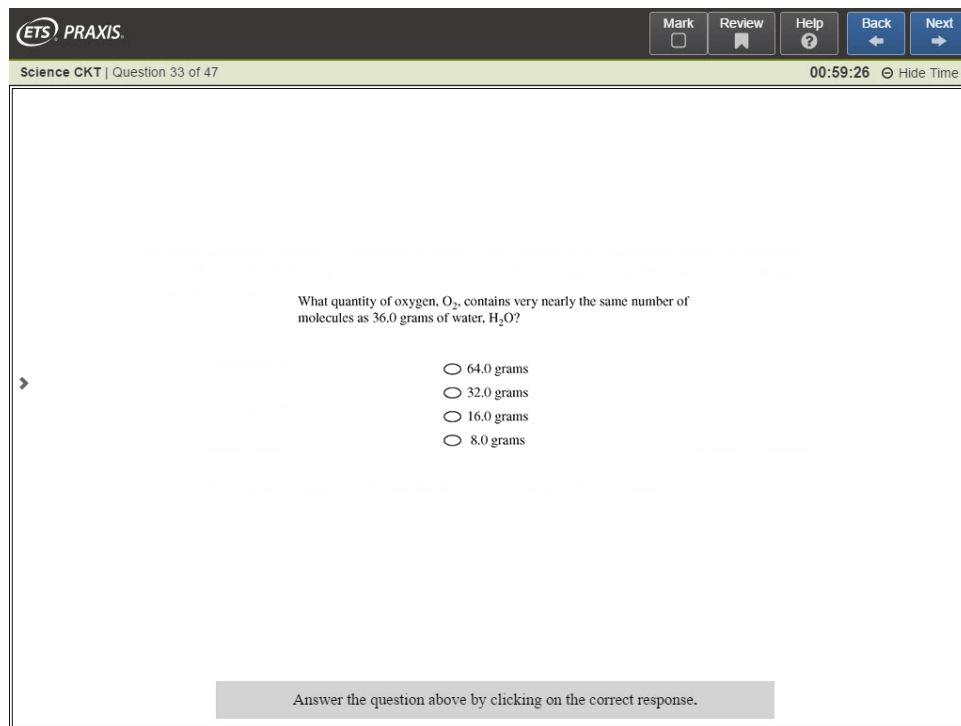
For tests that have constructed-response questions, more detailed information can be found on page 5.

3. Practice with Sample Test Questions

Answer practice questions and find explanations for correct answers

Computer Delivery

This test is available on computer. The following sample question provides a preview of the actual screen used in a computer-delivered test. For the purposes of this Study Companion, the sample questions in this chapter are shown as they would appear in a paper-delivered test.



The screenshot displays 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 bar, the text "Science CKT | Question 33 of 47" is on the left, and "00:59:26 Hide Time" is 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 interface, 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 kinds of questions on 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 statements below is followed by suggested answers or completions. Select the answer or answers that are best in each case.

I. Language Arts

- How many phonemes are in the word “ball”?
 - 1
 - 2
 - 3
 - 4
- Which TWO of the following syllable types are present in the word “remarkable”?
 - Open
 - Closed
 - Vowel team
 - R-controlled
 - Vowel-consonant-e
- Which of the following is the most appropriate strategy for using easy books to increase fluency in a nonfluent student?
 - Providing opportunities for the nonfluent student to read self-selected easy books to a younger student
 - Asking a younger, more fluent reader to read an easy book aloud to the nonfluent student
 - Assigning an easy-to-read nonfiction book to the nonfluent student for independent reading
 - Encouraging other students to interrupt and correct when the nonfluent student is reading easy books aloud
- Which of the following is most commonly used in digital text to give a reader access to additional information about a topic?
 - A citation
 - A hyperlink
 - An index
 - A glossary
- Which of the following statements best describes how graphic novels promote inferencing?
 - Readers rely on characters’ dialogue to tell the story.
 - Readers are given graphic organizers to facilitate understanding.
 - Readers can summarize the stories’ beginning, middle, and end.
 - Readers use the pictures to interpret the text.
- Which of the following is true of qualitative measures of text complexity?
 - They describe statistical measurements of a text.
 - They rely on computer algorithms to describe text.
 - They involve attributes that can be measured only by human readers.
 - They account for the different motivational levels readers bring to texts.
- Which TWO of the following can be classified as expository writing?
 - A short story
 - A technical speech
 - A personal diary
 - A scientific report
 - An editorial commentary
- Which of the following technology-based tools best facilitates both personal writing and written discussion about the writing?
 - Blogging programs
 - Interactive gaming
 - Slide-share programs
 - Interactive whiteboards

Questions 9-10 refer to the following sonnet.

The following is an excerpt from Sir Philip Sidney's sonnet "Leave me, O Love, which reachest but to dust."

Leave me, O Love, which reachest but to dust;
And thou, my mind, aspire to higher things;
Grow rich in that which never taketh rust;
Whatever fades but fading pleasure brings.

9. In line 1, "dust" serves as a metaphor for
- (A) ignorance
 - (B) death
 - (C) loneliness
 - (D) confusion
10. The lines comment on the speaker's desire to
- (A) seek out immediate pleasures
 - (B) enrich himself
 - (C) reject that which is transitory
 - (D) revive the past
11. Two hamsters sat in the cage side by side; a furtive, timid one and a glossy, bold one watched each other warily.
- The sentence above is an example of a
- (A) simple sentence
 - (B) compound sentence
 - (C) complex sentence
 - (D) compound-complex sentence
12. Which of the following is most typically included in the conclusion of an oral presentation?
- (A) An expansion of the thesis
 - (B) A summarization of the main points
 - (C) An attempt to build rapport with the audience
 - (D) A move to gain the audience's attention
13. In a student discussion about whether the school cafeteria should stop selling junk food, which of the following statements best demonstrates active listening?
- (A) "In my opinion, it would be a mistake to remove junk food from the cafeteria because no one would eat there anymore."
 - (B) "Raul thinks that our health should come before eating what we love, but Lacey argues that the schools should not take away our right to choose."
 - (C) "How many of you would actually buy lunch if the cafeteria stopped selling junk food?"
 - (D) "What if we write a formal complaint to the superintendent to voice our opinion on the food in the cafeteria?"

II. Mathematics

14. Which of the following is an example of the commutative property of addition?
- (A) $5 \times 3 = 3 \times 5$
 - (B) $(1 + 7) + 4 = 1 + (7 + 4)$
 - (C) $6 \times (4 + 2) = (6 \times 4) + (6 \times 2)$
 - (D) $8 + 9 = 9 + 8$

x	y
4	-20
7	-38
12	-68
15	-86

15. Which of the following equations gives the rule for the table shown?
- (A) $y = -8x + 4$
 - (B) $y = -7x + 4$
 - (C) $y = -6x + 4$
 - (D) $y = -5x + 4$

16. A fourth-grade class started working on math worksheets at 1:30 p.m. and stopped working at 3:10 p.m. How long did the class work on the math worksheets?

(A) 40 minutes
 (B) 80 minutes
 (C) 100 minutes
 (D) 120 minutes

17. A student plans to simultaneously toss a fair number cube, with faces numbered 1 through 6, and a fair coin. What is the probability that the cube will land with the face numbered 4 up and the coin will land heads up?

(A) $\frac{1}{12}$
 (B) $\frac{1}{8}$
 (C) $\frac{1}{6}$
 (D) $\frac{2}{3}$

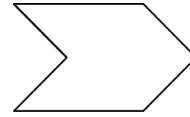
18. The only prime factors of a certain number are 2, 3, and 7. Which of the following could be the number?

(A) 18×28
 (B) 20×21
 (C) 22×63
 (D) 24×35

$$5 \leq 7 - p$$

19. Which of the following is equivalent to the inequality above?

(A) $p \leq 2$
 (B) $p \geq 2$
 (C) $p \leq -2$
 (D) $p \geq -2$



20. Which of the following best describes the polygon above?

(A) A regular hexagon
 (B) An arrow
 (C) A convex hexagon
 (D) A concave hexagon

21. After a lesson on rounding and estimation, a teacher tells students that a cook has made 157 sandwiches for 4 lunch periods. The teacher asks the students to estimate the average number of sandwiches that will be served in each lunch period. Which of the following students correctly estimated the answer?

(A) Student A: about 35
 (B) Student B: 39.25
 (C) Student C: about 40
 (D) Student D: about 45

22. Jack had three babysitting jobs this week. He worked the same number of hours H on each job. He was paid \$12 per hour at his first job, \$4 per half hour at his second job, and \$5 for each 20 minutes at his third job. Which of the following expressions could be used to find the total amount, in dollars, Jack earned?

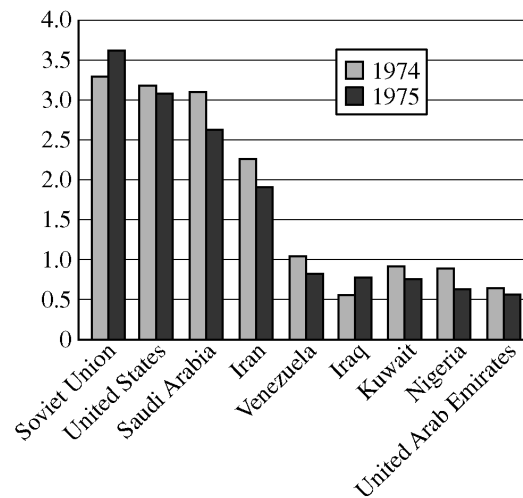
(A) $12 \times H + 4 \times H + 5 \times H$
 (B) $12 \times H + 8 \times H + 15 \times H$
 (C) $12 \times H + 8 \times H + 20 \times H$
 (D) $12 \times H + 4 \times \frac{1}{2} \times H + 5 \times \frac{1}{3} \times H$

23. To make fruit punch, Edie mixes two kinds of juices in the following ratio: 1 cup of blueberry to 3 cups of red raspberry. How many cups of red raspberry will Edie need to make 48 cups of fruit punch?
- (A) 12
 - (B) 16
 - (C) 24
 - (D) 36

III. Social Studies

24. Mount Rainier is located in which of the following mountain ranges?
- (A) The Cascades
 - (B) The Rockies
 - (C) The Appalachians
 - (D) The Alleghenies
25. Which of the following is believed to have occurred during the last Ice Age as a result of a land bridge created between what are now Siberia and Alaska?
- (A) The invention of new technologies for sheltering humans against sustained cold
 - (B) The blockage of important trade routes
 - (C) The establishment of human settlements in North America
 - (D) Widespread famine
26. Since the end of the United States Civil War in 1865, all of the following have been major objectives of groups seeking civil rights for Black people except
- (A) passage of affirmative action legislation
 - (B) desegregation of public educational facilities
 - (C) creation of a third party in national politics
 - (D) passage of anti-lynching laws

27. What percent of the seats in the United States House of Representatives are up for election every two years?
- (A) 33%
 - (B) 50%
 - (C) 66%
 - (D) 100%
28. Historically, India's society has been organized into hierarchical groups known as
- (A) tribes
 - (B) castes
 - (C) clans
 - (D) denominations

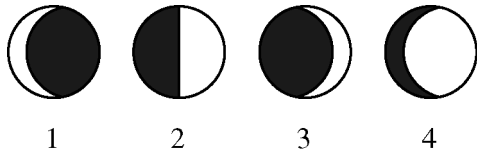


29. According to the graph above, how many of the countries shown produced more crude oil in 1975 than 1974?
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4

IV. Science

30. Which of the following geological processes adds new rock to the surface of Earth?

- (A) Volcanic activity
- (B) Glacial activity
- (C) Soil erosion
- (D) Weathering



31. When the Moon is viewed from the Northern Hemisphere at the first quarter of the lunar cycle, it appears like which of the diagrams above

- (A) 1
- (B) 2
- (C) 3
- (D) 4

32. Which THREE of the following are ways in which mammals keep themselves warm in cold weather?

- (A) Shivering
- (B) Perspiring
- (C) Fluffing out coat hair
- (D) Contracting certain blood vessels

33. If a feather and two rocks of different weights were dropped simultaneously from a height of 5 meters in a vacuum, which of the following would be true?

- (A) Both rocks would hit the ground at the same time, but before the feather.
- (B) The heavier rock would hit the ground first.
- (C) The lighter rock would hit the ground first.
- (D) The feather and the two rocks would all hit the ground at the same time.

34. Which of the following laboratory instruments would be most appropriate to use in determining the volume of a large block of wood of unknown density?

- (A) A metric ruler
- (B) A triple-beam balance
- (C) A 200 mL volumetric flask
- (D) A micrometer

35. A scientific hypothesis is a statement that?

- (A) ensures an experiment will produce positive results
- (B) is accepted by most of the scientific community
- (C) is a proposal that may lead to experimental testing
- (D) is formulated by a renowned scientist

36. Which of the following is the broadest category in the biological taxonomy?

- (A) Kingdom
- (B) Order
- (C) Genus
- (D) Species

Answers to Sample Questions

- The correct answer is (C). The word structure is /b/ /a/ /l/. "ll" is a blend so therefore makes only one sound.
- The correct answers are (A) and (D). (A) is correct because the syllable "re" is an open syllable. An open syllable ends in a long vowel sound produced by a single vowel. (D) is correct because the syllable "mar" is an r-controlled syllable. The "r" controls the vowel sound, causing the "a" to have a unique sound.
- The correct answer is (A). Fluency refers to reading smoothly, quickly, and with expression. (A) offers the nonfluent student opportunities to engage in meaningful literary experiences while gaining courage and self esteem, while also experiencing ownership.
- The correct answer is (B). The reader can follow the link provided to easily seek more information.
- The correct answer is (D). The images in a graphic novel provide information not included within the text, such as character attributes. In a graphic novel, the combination of text and images is required to produce the complete story.
- The correct answer is (C). The qualitative attributes are subjective and can only be evaluated by a human reader (i.e., "predictability of text").
- The correct answers are (B) and (D). A technical speech and a research report both require that information be collected and synthesized.
- The correct answer is (A). Blogging programs facilitate personal writing and typically have open forums that encourage readers to respond to the writing with written discussion.
- The correct answer is (B). A metaphor is a type of figurative language in which one image or idea is connected with another. In literature, the word "dust" is often associated with death because life forms decay into soil after death.
- The correct answer is (C). The word "transitory" refers to change, and the speaker mentions a desire to reject things that turn to dust, acquire dust, and start to fade. These are all types of change.
- The correct answer is (B). This sentence has two independent clauses joined by a semicolon, including one independent clause with a compound subject.
- The correct answer is (B). The conclusion of an oral presentation usually contains a clear summary of the main points to reinforce the presentation's goal.

- The correct answer is (B). The statement demonstrates paraphrasing of others' statements. An active listener spends more time listening than talking, which paraphrasing demonstrates.
- The correct answer is (D). The question requires an understanding of the properties of operations. An operation is commutative on a set of numbers if the operation can be performed on any two numbers from the set and produce the same result regardless of the order in which the numbers are written. The operation of addition is commutative on the set of real numbers, since for any two real numbers a and b , $a + b = b + a$, i.e., the sum is the same regardless of the order in which the numbers are added. The commutative property of addition thus guarantees that $8 + 9 = 9 + 8$.
- The correct answer is (C). The question requires an understanding of how to identify relationships between the corresponding terms of two numerical patterns. The slope of the equation can be found by calculating the rate of change for any two pairs (x,y) , e.g., $\frac{-38 + 20}{7 - 4} = -6$.
- The correct answer is (C). The question requires an understanding of how to solve problems involving the measurement of elapsed time. Between 1:30 p.m. and 3:10 p.m. there are 1 hour and 40 minutes, or 100 minutes.
- The correct answer is (A). The question requires an understanding of how to interpret probabilities relative to likelihood of occurrence. The coin has 2 possible outcomes: heads or tails. The probability of the coin landing heads up is 1 out of 2, or $\frac{1}{2}$. The cube has 6 possible outcomes: 1, 2, 3, 4, 5, or 6. The probability of the face numbered 4 landing up is 1 out of 6, or $\frac{1}{6}$. To find the combined probability, multiply the probabilities of the two independent events together, i.e.,

$$\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}.$$

18. The correct answer is (A). The question requires an understanding of how to find factors and multiples of numbers. The prime factorization of 18 is 2×3^2 and the prime factorization of 28 is $2^2 \times 7$. So the prime factorization of 18×28 is $2^3 \times 3^2 \times 7$, which consists only of the prime factors 2, 3, and 7.

19. The correct answer is (A). The question requires an understanding of how to solve multistep one-variable linear inequalities. The addition property of inequalities states that for any real numbers a , b , and c , if $a \leq b$, then $a + c \leq b + c$ and if $a \geq b$, then $a + c \geq b + c$. Adding -5 to both sides of the inequality yields the equivalent inequality $0 \leq 2 - p$. Adding p to both sides of the new inequality yields the equivalent inequality $p \leq 2$.

20. The correct answer is (D). The question requires an understanding of how to use attributes to classify or draw polygons. A polygon with six sides is called a hexagon. A polygon for which any two points on the polygon can be connected by a segment and the segment is entirely contained within the interior of the polygon is a convex polygon; a polygon for which this is not true is a concave polygon. A regular polygon is a polygon whose sides are all congruent and whose angles all have the same measure. The polygon shown is not regular but is a concave hexagon.

21. The correct answer is (C). The question requires an understanding of how to use rounding strategies to solve problems and determine the reasonableness of results. The average number of sandwiches served in each lunch period is found by calculating $157 \div 4$. To estimate this value, 157 can be rounded to 160, the number closest to 157 that is a multiple of 4. The estimate can be produced by mentally finding the value of $160 \div 4$, i.e., 40.

22. The correct answer is (B). The question requires an understanding of how to translate between verbal statements and algebraic expressions or equations. Jack made 12 dollars per hour at his first job. He made 4 dollars per half hour, or $4 \times 2 = 8$ dollars per hour, at his second job. Finally, Jack made 5 dollars for each 20 minutes, or $5 \times 3 = 15$ dollars per hour, at his third job. If he worked H hours at each job, he made $12 \times H + 8 \times H + 15 \times H$.

23. The correct answer is (D). The question requires an understanding of how to use proportional relationships to solve ratio problems. With 1 cup of blueberry juice and 3 cups of red raspberry juice, Edie can make 4 cups of punch. In the juice mixture, $\frac{1}{4}$ of the total number of cups is blueberry and $\frac{3}{4}$ of the total number of cups is red raspberry. Thus, in 48 cups of juice mixture, the number of cups of red raspberry juice needed is $\frac{3}{4}$ of 48, which equals 36 cups.

24. The correct answer is (A). Mount Rainier is located in the state of Washington. The greatest single-peak glacial system in the United States radiates from this dormant volcano in the Cascade Mountains.

25. The correct answer is (C). During the Ice Age, the level of the water in the Pacific Ocean lowered, exposing a land bridge across the Bering Strait. The cold northern climate encouraged many people to migrate throughout the continent in search of better living conditions.

26. The correct answer is (C). The creation of a third party in national politics would be a political action, not one of civil rights.

27. The correct answer is (D). Article 1 Section 2 of the Constitution of the United States says, "The House of Representatives shall be composed of Members chosen every second Year by the People..." All members of the House are elected at the same time every two years.

28. The correct answer is (B). In the 15th century AD, explorers from Portugal encountered the social system of India and called these groups castes. As time went on, the four basic castes gradually grew more complex, with hundreds of subdivisions.

29. The correct answer is (B). Of the nine countries shown in the graph, the Soviet Union and Iraq were the two countries that produced more oil in 1975 than in 1974.

30. The correct answer is (A). Volcanic activity is the only process by which material from inside Earth is brought to the surface. The other processes are means of wearing down Earth's surface.

31. The correct answer is (B). At the first lunar quarter the Sun, Earth, and Moon form a right triangle, with Earth at the right angle, so that the half of the Moon facing Earth appears half-illuminated and half dark. When viewed from the Northern Hemisphere, the right half will appear illuminated.

32. The correct answers are (A), (C), and (D). Shivering produces heat. Fluffing out coat hair provides insulation and helps to retain body heat. Contracting certain blood vessels reduces blood flow to extremities and thus reduces heat loss. However, perspiring does not help because the skin is cooled as energy is absorbed by the sweat as it evaporates.

33. The correct answer is (D). In a vacuum, the only external force acting on each of the objects would be the gravitational force of Earth. This gravitational force is equal to $M \times g$, where M is the object's mass and g is the constant acceleration of gravity (9.8 meters per second squared). According to Newton's second law, the acceleration, a , of an object times its mass is equal to the external force acting on it. For this situation, Newton's second law gives $M \times a = M \times g$, or $a = g$. Thus, in a vacuum, all objects fall freely with the same constant acceleration g , regardless of their mass.

34. The correct answer is (A). To find the volume of a large rectangular block of wood, first use the metric ruler to find the length, width, and height of the block. Then use the formula for the volume of a rectangular solid—length \times width \times height—to determine the volume.

35. The correct answer is (C). A hypothesis is a proposed explanation of a scientific problem. After the hypothesis is proposed, scientific experimentation may be conducted that produces data that can either support or fail to support the hypothesis.

36. The correct answer is (A). When putting living things into a biological classification scheme, the broadest category is kingdom, followed by phylum, class, order, family, genus, and species.

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 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. 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 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 58.

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 33 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 33 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 20.
- **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: 9/15/17

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
Key Ideas and Details						
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	7/15/17	7/15/17
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	7/17/17	7/17/17
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	7/20/17	7/21/17
Craft, Structure, and Language Skills						
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	7/25/17	7/26/17
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	7/25/17	7/27/17
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	8/1/17	8/1/17
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	8/1/17	8/1/17

(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	8/1/17	8/1/17
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	8/1/17	8/1/17
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	8/8/17	8/8/17
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	8/15/17	8/17/17
Integration of Knowledge and Ideas						
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	8/22/17	8/24/17
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	8/24/17	8/24/17
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	8/27/17	8/27/17
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	8/28/17	8/30/17
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	8/30/17	8/31/17
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	9/3/17	9/4/17
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	9/5/17	9/6/17

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 Study Topics

Detailed study topics with questions for discussion

Using the Study Topics That Follow

The Elementary Education: Content Knowledge test is designed to measure the knowledge and skills necessary for a beginning teacher.

This chapter is intended to help you organize your preparation for the test and to give you a clear indication of the depth and breadth of the knowledge required for success on the test.

Virtually all accredited programs address the topics covered by the test; however, you are not expected to be an expert on all aspects of the topics that follow.

You are likely to find that the topics below are covered by most introductory textbooks. Consult materials and resources, including lecture and laboratory notes, from all your coursework. You should be able to match up specific topics and subtopics with what you have covered in your courses.

Try not to be overwhelmed by the volume and scope of content knowledge in this guide. Although a specific term may not seem familiar as you see it here, you might find you can understand it when applied to a real-life situation. Many of the items on the actual test will provide you with a context to apply to these topics or terms.

Discussion Areas

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.

Study Topics

An overview of the areas covered on the test, along with their subareas, follows.

I. Reading and Language Arts

A. Reading: Foundational Skills

1. Understands the role of phonological awareness in literacy development
 - a. Explains the importance of phonological awareness as a foundational skill for literacy development
 - b. Identifies and provides examples of phonemes, syllables, onsets, and rimes
 - c. Identifies and provides examples of blending, segmenting, substituting, and deleting phonemes, syllables, onsets, rimes
2. Understands the role of phonics and word analysis in literacy development
 - a. Explains the importance of phonics and word analysis in literacy development
 - b. Distinguishes among common letter-sound correspondences and spelling conventions
 - c. Distinguishes high-frequency sight words from decodable words appropriate for particular grades
 - d. Identifies roots and affixes to decode unfamiliar words
 - e. Recognizes various stages of language acquisition (e.g., WIDA taxonomy)
 - f. Delineates common phonics and word-recognition approaches for ELLs (pedagogy)
 - g. Differentiates syllabication patterns (e.g., open, closed, CVC)
3. Understands the role of fluency (e.g., rate, accuracy) in literacy development
 - a. Defines fluency and related terms (e.g., accuracy, rate, prosody)
 - b. Explains the impact of fluency on comprehension

B. Reading: Literature and Informational Text

1. Understands how to use key ideas and details to comprehend literature and informational text
 - a. Identifies the key details, moral, and/or theme of a literary text, citing specific textual evidence
 - b. Identifies the key details and/or central idea of an informational text, citing specific textual evidence
 - c. Makes inferences from a text and supports them with appropriate evidence
 - d. Summarizes information from a text
 - e. Analyzes the characters, setting, and plot of a literary text
 - f. Analyzes the relationships among individuals, events, ideas, and concepts in an informational text
2. Understands how features and structures of text across genres affect comprehension
 - a. Identifies structural elements of literature across genres (e.g., casts of characters and stage directions in drama, rhyme and meter in poetry)
 - b. Uses text features (e.g., headings, sidebars, hyperlinks) to locate information in a print or digital informational text
 - c. Identifies organizational structures of informational text (e.g., cause/effect, problem/solution)
 - d. Identifies how structural elements contribute to the development of a literary text as a whole
3. Understands the concept of point of view using evidence from the text
 - a. Identifies author's point of view in various genres and supports conclusions with evidence from the text
 - b. Compares multiple accounts of the same event or topic to identify similarities or differences in point of view
 - c. Identifies how point of view impacts the overall structure of a literary or informational text

4. Understands how to integrate and compare written, visual, and oral information from texts and multimedia sources
 - a. Explains how visual and oral elements enhance the meaning and effect of a literary text (e.g., picture book, graphic novel, multimedia presentation of a folktale)
 - b. Compares the written version of a literary text with an oral, staged, or filmed version
 - c. Compares two or more literary texts that address the same theme
 - d. Compares two or more informational texts that address the same topic
 - e. Interprets visual and multimedia elements in literary and informational texts
 - f. Evaluates key claims in a text and supports them with reasons and evidence from the text
5. Knows the role of text complexity in reading development
 - a. Explains the three factors (i.e., quantitative, qualitative, and reader and task) that measure text complexity
 - b. Identifies features of text-leveling systems

C. Writing

1. Understands the characteristics of common types of writing
 - a. Distinguishes among common types of writing (e.g., opinion/argument, informative/explanatory, narrative)
 - b. Identifies the purpose, key components, and subgenres (e.g., speeches, advertisements, narrative poems) of each common type of writing
 - c. Evaluates the effectiveness of writing samples of each type
2. Understands the characteristics of effective writing
 - a. Evaluates the appropriateness of a particular piece of writing for a specific task, purpose, and audience
 - b. Evaluates the development, organization, or style of a piece of writing
 - c. Identifies appropriate revisions to strengthen a piece of writing

D. Language

- d. Writes clearly and coherently
 - e. Identifies the interrelationships among planning, revising, and editing in the process of writing
 3. Knows the developmental stages of writing (e.g., picture, scribble)
 - a. Identifies the grade-appropriate continuum of student writing
 4. Knows the importance of digital tools for producing and publishing writing and for interacting with others
 - a. Identifies the characteristics and purposes of a variety of digital tools for producing and publishing writing
 - b. Identifies the purposes of a variety of digital tools for interacting with others
 5. Knows the research process
 - a. Identifies the steps in the research process
 - b. Distinguishes between primary and secondary sources and their uses
 - c. Distinguishes between reliable and unreliable sources
 - d. Distinguishes between paraphrasing and plagiarizing
 - e. Knows how to locate credible print and digital sources, locate information within the sources, and cite the sources
1. Knows the conventions of standard English grammar, usage, mechanics, and spelling when writing, speaking, reading, and listening
 - a. Explains the function of different parts of speech
 - b. Corrects errors in usage, mechanics, and spelling
 - c. Identifies examples of different sentence types (e.g., simple, compound, compound-complex)
 - d. Identify how varieties of English (e.g., dialects, registers) used in stories, dramas, or poems support the overall meaning
 2. Understands how to determine the meaning of words and phrases
 - a. Determines the literal meaning of unknown words and phrases from context, syntax, and/or knowledge of roots and affixes
 - b. Identifies types of figurative language

- c. Interprets figurative language
- d. Analyzes the relationship between word choice and tone in a text
- 3. Understands characteristics of conversational, academic, and domain-specific language
 - a. Differentiates among the three tiers of vocabulary
 - b. Identifies relevant features of language such as word choice, order, and punctuation

E. Speaking and Listening

- 1. Knows the characteristics of effective collaboration to promote comprehension
 - a. Identifies techniques to communicate for a variety of purposes with diverse partners
 - b. Identifies the characteristics of active listening
- 2. Knows the characteristics of engaging oral presentations
 - a. Identifies elements of engaging oral presentations (e.g., volume, articulation, awareness of audience)

Discussion areas: English Language Arts

- What is the difference between a consonant digraph and a consonant blend?
- What are the differences between the syntactic, semantic, and graphophonic cueing systems?
- Compare the basic components of teaching phonological awareness, such as blending, segmenting, substitution, and deletion.
- How does fluency impact comprehension?
- What are the most effective methods for teaching reading to English-language learners?
- What are the elements of reading fluency?
- What is the difference between quantitative and qualitative measures when evaluating text complexity?
- How can strategies like repeated reading and choral reading improve students' fluency?
- What is the difference between prosody and automaticity?
- What are the best methods for vocabulary acquisition?

- What is the difference between the three tiers of vocabulary?
- How can students use roots and affixes, syntax, and context clues to help determine word meaning?
- How can students use metacognition to aid in reading comprehension?
- What is the difference between literal and inferential comprehension?
- What are some effective methods to activate students' prior knowledge before reading?
- What are the benefits of graphics, images, and pictures for readers?
- What are the common features of informational texts, and how can they best guide students?
- What are the common types of organizational structure of informational texts and how do they differ?
- What is the difference between factual writing and opinion writing?
- What are the elements of narrative texts?
- What are the differences between some of the subgenres of fiction such as fantasy, science fiction, mystery, and folktales?
- What are the best methods for teaching poetic elements like mood, rhythm, and structure?
- Define and compare the different types of figurative language, such as simile, metaphor, hyperbole, personification, and onomatopoeia, etc.
- Which graphic organizers are most appropriate for the different types of writing and reading?
- How can students ensure that online resources are credible and unbiased?
- What is the difference between a primary and a secondary source?
- List and define the various parts of speech.
- What is pronoun-antecedent agreement? What is subject-verb agreement?

- What are the rules for the different types of sentences: simple, compound, complex, and compound-complex?
- What are the differences between declarative, interrogative, imperative, and exclamatory sentences?
- What are the most effective ways to guide students to find the appropriate tone, purpose, and audience for the various types of writing (narrative, persuasive, informative, and descriptive)?
- What are the different stages of writing development, and what can a student do at each stage?
- What is the difference between the revision stage and the editing stage of the writing process?
- Which are the most appropriate methods of formative and summative assessments in writing?
- What are some appropriate and effective ways to utilize technology in the classroom, especially as part of the writing process?
- What elements, both verbal and nonverbal, make for an effective oral presentation?
- How can a teacher both ensure and assess active listening in students?
- How can a student best use multimedia in a presentation?
- What are the most effective ways to encourage collaboration in the classroom?
- How can different types of discussion groups, e.g., fishbowl, jigsaw, and literature circles, be utilized to encourage collaboration and comprehension?

II. Mathematics

A. Numbers and Operations

1. Understands the place value system
 - a. Writes numbers using base-10 numerals, number names, and expanded form
 - b. Composes and decomposes multi-digit numbers
 - c. Given a digit, identifies the place the digit is in and its value in that place
 - d. Recognizes that a digit in one place represents ten times what it represents in the place to its right and one-tenth what it represents in the place to its left, and extends this recognition to several places to the right or left
 - e. Uses whole-number exponents to denote powers of 10
 - f. Rounds multi-digit numbers to any place value
2. Understands operations and properties of rational numbers
 - a. Solves multistep mathematical and real-world problems using addition, subtraction, multiplication, and division of rational numbers
 - Identifies different problem situations for the operations (e.g., adding to, taking from, putting together, taking apart, and comparing for subtraction)
 - Uses the relationship between addition and subtraction and the relationship between multiplication and division to solve problems (e.g., inverse operations)
 - Interprets remainders in division problems
 - b. Understands various strategies and algorithms used to perform operations on rational numbers
 - c. Recognizes concepts of rational numbers and their operations
 - Identifies examples where multiplication does not result in a product greater than both factors and division does not result in a quotient smaller than the dividend
 - Composes and decomposes fractions, including the use of unit fractions.
 - Recognizes that the value of a unit fraction decreases as the value of the denominator increases

- Recognizes that the same whole must be used when comparing fractions
- d. Solves problems using the order of operations, including problems involving whole number exponents
- e. Identifies properties of operations (e.g., commutative, associative, distributive) and uses them to solve problems
- f. Represents rational numbers and their operations in different ways
 - Uses, interprets, and explains concrete models or drawings of the addition, subtraction, multiplication, and division of rational numbers
 - Represents rational numbers and sums and differences of rational numbers on a number line
 - Illustrates and explains multiplication and division problems using equations, rectangular arrays, and area models
- g. Compares, classifies, and orders rational numbers
- h. Converts between fractions, decimals, and percents
- 3. Understands proportional relationships and percents
 - a. Applies the concepts of ratios and unit rates to describe relationships between two quantities
 - b. Understands percent as a rate per 100
 - c. Solves unit-rate problems
 - d. Uses proportional relationships to solve ratio and percent problems
- 4. Knows how to use basic concepts of number theory
 - a. Identifies and uses prime and composite numbers
 - b. Finds factors and multiples of numbers
- 5. Knows a variety of strategies to determine reasonableness of results
 - a. Recognizes the reasonableness of results within the context of a given problem
 - b. Uses mental math, estimation, and rounding strategies to solve problems and determine reasonableness of results

B. Algebraic Thinking

1. Knows how to evaluate and manipulate algebraic expressions, equations, and formulas
 - a. Differentiates between algebraic expressions and equations
 - b. Adds and subtracts linear algebraic expressions
 - c. Uses the distributive property to generate equivalent linear algebraic expressions
 - d. Evaluates simple algebraic expressions (i.e., one variable, binomial) for given values of variables
 - e. Uses mathematical terms to identify parts of expressions and describe expressions
 - f. Translates between verbal statements and algebraic expressions or equations (e.g., the phrase “the number of cookies Joe has is equal to twice the number of cookies Sue has” can be represented by the equation $j = 2s$)
 - g. Uses formulas to determine unknown quantities
 - h. Differentiates between dependent and independent variables in formulas
2. Understands the meanings of the solutions to linear equations and inequalities
 - a. Solves multistep one-variable linear equations and inequalities
 - b. Interprets solutions of multistep one-variable linear equations and inequalities (e.g., graphs the solution on a number line, states constraints on a situation)
 - c. Uses linear relationships represented by equations, tables, and graphs to solve problems
3. Knows how to recognize and represent patterns (e.g., number, shape)
 - a. Identifies, extends, describes, or generates number and shape patterns
 - b. Makes conjectures, predictions, or generalizations based on patterns
 - c. Identifies relationships between the corresponding terms of two numerical patterns (e.g., find a rule for a function table)

C. Geometry and Measurement

1. Understands how to classify one-, two-, and three-dimensional figures
 - a. Uses definitions to identify lines, rays, line segments, parallel lines, and perpendicular lines
 - b. Classifies angles based on their measure
 - c. Composes and decomposes two- and three-dimensional shapes
 - d. Uses attributes to classify or draw polygons and solids
2. Knows how to solve problems involving perimeter, area, surface area, and volume
 - a. Represents three-dimensional figures with nets
 - b. Use nets that are made of rectangles and triangles to determine the surface area of three-dimensional figures
 - c. Finds the area and perimeter of polygons, including those with fractional side lengths
 - d. Finds the volume and surface area of right rectangular prisms, including those with fractional edge lengths
 - e. Determines how changes to dimensions change area and volume
3. Knows the components of the coordinate plane and how to graph ordered pairs on the plane
 - a. Identifies the x -axis, the y -axis, the origin, and the four quadrants in the coordinate plane
 - b. Solves problems by plotting points and drawing polygons in the coordinate plane
4. Knows how to solve problems involving measurement
 - a. Solves problems involving elapsed time, money, length, volume, and mass
 - b. Measures and compares lengths of objects using standard tools
 - c. Knows relative sizes of United States customary units and metric units
 - d. Converts units within both the United States customary system and the metric system

D. Data, Statistics, and Probability

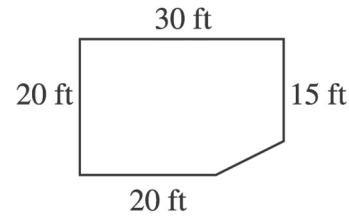
1. Is familiar with basic statistical concepts
 - a. Identifies statistical questions
 - b. Solves problems involving measures of center (mean, median, mode) and range
 - c. Recognizes which measure of center best describes a set of data
 - d. Determines how changes in data affect measures of center or range
 - e. Describes a set of data (e.g., overall patterns, outliers)
2. Knows how to represent and interpret data presented in various forms
 - a. Interprets various displays of data (e.g., box plots, histograms, scatterplots)
 - b. Identifies, constructs, and completes graphs that correctly represent given data (e.g., circle graphs, bar graphs, line graphs, histograms, scatterplots, double bar graphs, double line graphs, box plots, and line plots/dot plots)
 - c. Chooses appropriate graphs to display data
3. Is familiar with how to interpret the probability of events
 - a. Interprets probabilities relative to likelihood of occurrence

Discussion areas: Mathematics

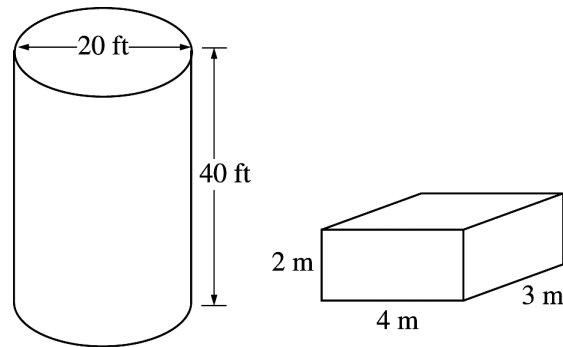
- Why is it that 3 is greater than 2, but $\frac{1}{3}$ is less than $\frac{1}{2}$?
- Is the square of a number always greater than the number? Consider numbers such as 3, -2 , $\frac{1}{4}$, and 0.
- Are 1 and 2 prime numbers? Why or why not?
- Is zero an even number or an odd number?
- Is the sum of two even numbers always even? What about the sum of two odd numbers?
- Make a factor tree for 60.
- Why do we put an arrow on the end of a number line?

- Create two or three different ways of visually representing the product of 2 and 4. Think of objects that elementary students would relate to.
- If a movie ticket was \$5 last week and this week is \$6, what was the percent increase?
- If the scale used on a blueprint is 1 inch to 4 feet and the drawing of a room is 4.5 inches wide, how wide is the room?
- Is 60 kilograms a reasonable weight for a 6-year-old child? Explain by using a benchmark for a kilogram (i.e., an easy-to-manipulate translation to pounds).
- Write a problem that uses the “working backwards” method. Be sure to give the end result from which to work.
- How would you translate the following statement into a mathematical expression that includes variables? “The number of red chips is 3 more than the number of blue chips.”
- In the previous example, if there are 41 blue chips and red chips altogether, how many are red chips?
- What is the difference between an expression and an equation?
- Why is $\frac{0}{1}$ equal to 0, but $\frac{1}{0}$ is not even defined? Consider using $\frac{20}{5} = 4$ and relating it to $20 = 5 \cdot 4$ to explain this oddity.
- Do rectangles that have the same perimeter always have the same area?
- For a given perimeter, what is the shape with the greatest area?
- If a figure is a rectangle, is it also a square?
- If a figure is a square, is it also a rectangle?

- What is the area of the following shape?

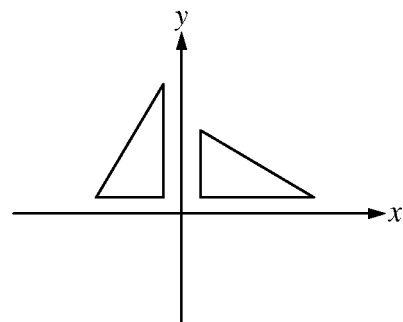


- What are the volumes of the following shapes?



Note: Figures not drawn to scale.

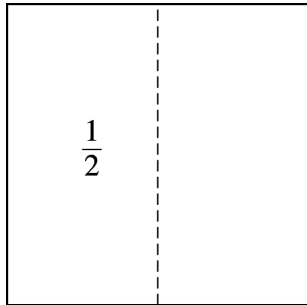
- Draw a trapezoid that can be subdivided into four congruent right triangles.
- Draw a trapezoid that can be subdivided into three equilateral triangles.
- Can a right triangle be isosceles?
- What stays the same when a transformation is applied?
- What changes when a transformation is applied?
- Describe the transformation shown below. What stays the same and what changes?



- On a number line, draw arrows to model this calculation: $16 - 8 + 4 - 2$

- On a grid, model 24 as a product of integers in four different ways.
- On a grid, model 24 as the product of mixed numbers or decimals.
- On a grid, model 24 as the product of numbers that contain square roots.
- $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$ is an infinite sequence.

Use a square to show that the sum of the sequence is 1. Hint—start this way:



- Can I find the average of 10 numbers if I know the sum of them but not the numbers themselves?
- Can I find the median of 10 numbers if I know the sum of them but not the numbers themselves?

III. Social Studies

A. Geography, Anthropology, and Sociology

1. Knows world and regional geography
 - a. Is familiar with spatial terms and can identify spatial patterns of people, places, and environments
 - b. Identifies the characteristics of places and regions
 - c. Locates major physical features of geography (e.g., mountain ranges, bodies of water)
 - d. Locates major political features of geography (e.g., continents, countries, states, cities)
 - e. Demonstrates basic geographic literacy (e.g., uses and interpretations of different types of maps, understanding of the concepts of absolute and relative location, identification of cardinal and intermediate directions)
2. Understands the interaction of physical and human systems
 - a. Demonstrates knowledge of how humans change the environment
 - b. Demonstrates knowledge of how the environment affects human activities
 - c. Understands the importance of natural and human resources
3. Knows the uses of geography
 - a. Applies geography to interpret the past and the present and to plan for the future
 - b. Demonstrates knowledge of society's groups, institutions, and organizations
 - c. Demonstrates knowledge of how human behavior is influenced by society

B. World History

1. Knows the major contributions of classical civilizations such as Egypt, Greece, and Rome
 - a. Demonstrates knowledge of how modern civilizations reflect, mirror, and learn from the contributions of ancient civilizations

- How could you estimate the surface area of a soup can using a net of the can made from graph paper?
- What natural phenomena are the basis for many of our time measurements?
- Name some countries where the English system is used and some countries where the metric system is used.
- Can a circle graph and a line graph display the same information? Why or why not?
- How is a stem-and-leaf plot like a bar graph? How is it different?
- Describe a real-life use of a mode.
- Describe a real-life situation that illustrates a direct relationship.
- Describe a real-life situation that illustrates an inverse relationship.
- Make a sample space for the possible outcomes of the toss of three fair coins. Explain why the computation $2 \cdot 2 \cdot 2$ gives the number of points in the sample space.
- Is the average of two different numbers ever greater than one of them?

2. Understands twentieth-century developments and transformations in world history
 - a. Demonstrates knowledge of the causes and effects of the First and Second World Wars and the Cold War
 - b. Demonstrates knowledge of technological developments (e.g., transportation, communication, tools)
 - c. Demonstrates knowledge of the causes and effects of globalization
3. Understands the role of cross-cultural comparisons in world history instruction
 - a. Demonstrates knowledge of various psychological, sociological, and cultural factors needed to assess the similarities and/or diversities in two or more different cultures or societies

C. United States History

1. Knows about the European exploration and colonization of North America and growth and expansion of the United States
 - a. Demonstrates knowledge of Native American peoples and cultures
 - b. Demonstrates knowledge of the reasons for the colonization of North America and the development of the thirteen colonies
 - c. Is familiar with the interactions between Native American groups, colonists, and European powers
2. Knows about the American Revolution and the founding of the United States
 - a. Understands the causes and effects of the American Revolution
 - b. Identifies key individuals and events during the American Revolution
 - c. Demonstrates knowledge of the challenges faced by the early republic (e.g., creation of a democratic government)
3. Knows about the major events and developments in United States history from founding to present
 - a. Demonstrates knowledge of the causes and effects of the territorial expansion of the United States (e.g., concept of Manifest Destiny; Louisiana Purchase; impact on Native Americans; role of technological, political, and economic developments)

- b. Understands the causes and effects of the Civil War (e.g., growth of sectionalism, the abolition movement, the Underground Railroad, the reasons for the succession of the Confederate States, the role of Abraham Lincoln, the purposes and challenges of Reconstruction)
 - c. Demonstrates knowledge of the causes and effects of industrialization, urbanization, and immigration
 - d. Is familiar with major social and cultural developments throughout United States history
4. Knows about twentieth-century developments and transformations in the United States
 - a. Demonstrates knowledge of the causes and effects of the Great Depression (e.g., New Deal legislation)
 - b. Demonstrates knowledge of the causes and effects of the First and Second World Wars and the Cold War
 - c. Demonstrates knowledge of major economic developments (e.g., assembly line, mass production,) and the influence of technological developments
 5. Understands connections between the causes and effects of events
 - a. Demonstrates the ability to draw connections between the causes and effects of significant events throughout United States history

D. Government, Citizenship, and Democracy

1. Understands the nature, purpose, and forms of government
 - a. Is familiar with the founding principles of the United States government (e.g., republicanism, separation of powers, checks and balances, popular sovereignty)
 - b. Demonstrates knowledge of federalism (e.g., division of power between the national and state governments)
 - c. Demonstrates knowledge of the powers of the three branches of the federal government and the interactions among them
 - d. Is familiar with basic characteristics of different political systems

2. Knows key documents and speeches in the history of the United States
 - a. Is familiar with the purpose and contents of the Declaration of Independence
 - b. Is familiar with the Articles of Confederation
 - c. Demonstrates knowledge of the structure of government outlined in the United States Constitution
 - d. Demonstrates knowledge of the rights and protections guaranteed to United States citizens by the Constitution
 - e. Is familiar with key documents and speeches (e.g., Gettysburg Address)
3. Knows the rights and responsibilities of citizenship in a democracy
 - a. Demonstrates knowledge of civic participation (e.g., community service, membership in civic organizations)
 - b. Demonstrates knowledge of the rights and responsibilities of citizens in the United States (e.g. voting, paying taxes, freedom of speech)

E. Economics

1. Knows key terms and basic concepts of economics
 - a. Demonstrates knowledge of supply and demand
 - b. Is familiar with concepts of scarcity, choice, and opportunity cost
 - c. Demonstrates knowledge of the role of money and resources in economic decision making
2. Understands how economics affects population, resources, and technology
 - a. Demonstrates an understanding of how people use resources to generate wealth and enhance their lives
 - b. Demonstrates an understanding of how economics drives and is driven by technological innovations
3. Understands the government's role in economics and the impact of economics on government
 - a. Demonstrates knowledge of the federal government's role in regulating the economy
 - b. Demonstrates knowledge of taxing and spending

F. Social Studies as Inquiry and Social Studies Processes

1. Understands social studies as inquiry
 - a. Demonstrates knowledge of questioning, gathering data, and drawing reasonable conclusions
2. Understands how to use resource and research material in social studies
 - a. Understands how to evaluate the appropriate uses of a variety of resources
 - b. Identifies primary and secondary sources and demonstrates knowledge of the uses of each
 - c. Demonstrates knowledge of fact and opinion and knows the uses of each in social studies
3. Understands process skills in social studies
 - a. Understands how to interpret different types of information
 - b. Evaluates relationships among different variables
 - c. Demonstrates ability to draw conclusions using tools of the field

Discussion areas: Social Studies

- What is "map projection" and what kinds of decisions does it force mapmakers to make?
- What is the primary categorization of each of these regions, and why? Arab world, North Africa, Sub-Saharan Africa, Latin America, the Caribbean, North America, Western Europe, Eastern Europe, East Asia, South Central Asia, Southeast Asia, and Oceania
- What is the difference between weather and climate?
- How do earthquakes create mountain ranges?
- What kinds of physical systems led to the creation of the Grand Canyon? What about Yosemite Valley?
- What kind of immigration patterns and effects were created by the Great Irish Famine?
- What are the major effects on the environment and people when radioactive materials get into the environment either by leakage from storage or by an accident?

- List as many ways as you can that the pyramids and burial customs of Egypt reflected aspects of Egyptian political, social, cultural, religious, bureaucratic (record keeping and writing), and artistic systems, elements, and values.
- How were the concepts of citizenship and democracy in ancient Greece similar and different from contemporary United States concepts of citizenship and democracy?
- How does a comparison of life in Athens and Sparta illuminate differences among nations in the world today?
- List important contributions in drama, sculpture, sports, architecture, mathematics, and science and the emphasis on human achievement
- How big did the Roman Empire get, with what borders, at its largest? In comparison, how small was it when it fell? What were the main reasons for the success at its largest point and its gradual shrinking?
- What has been the role of Islam in African history?
- Does the caste system survive in India today? How has the caste system shaped India's social, cultural, economic, and political histories?
- What were the effects of Japan's isolation until the 1850s? How did Japan change after Admiral Perry's "opening" of Japan?
- Why were the Spanish able to defeat the Aztec and Incan empires?
- What does "Renaissance" mean? Why was the name given to this historical period?
- What does the term "Renaissance man" or "Renaissance woman" mean, and how is the definition of the term (then and now) related to what happened during the Renaissance period?
- How did the Scientific Revolution change the way humans perceived themselves and the universe and how did it change the methods of human inquiry?
- What are the main reasons that a global culture emerged in the twentieth century? What are the consequences of this global culture?
- What were the weaknesses in the Articles of Confederation that eventually led to its replacement by the Constitution? Why were the Articles written in this way in the first place?
- What was the *Marbury v. Madison* decision in the Supreme Court and what did it establish?
- What was "Manifest Destiny" and how did it influence the expansion of United States territory?
- Make your own "immigration timeline" of the nineteenth century, noting the decades during which immigrants from various countries or regions came to the United States in large numbers.
- Post-Civil War immigration can be viewed in terms of the "melting pot" analogy or in terms of "pluralism." What does this distinction mean, and why is it important?
- What was the Supreme Court's decision in *Brown v. Board of Education of Topeka*? How was the later decision in *University of California v. Bakke* related to another important educational issue in the twentieth century?
- Compare the intended and unintended consequences of feudalism, communism, monarchy, and liberal democracies in some well-known cases: in trying to solve some problems, what problems did the founders create?
- Compare the major features of a democratic government with those of other forms of government.
- Why were the *Magna Carta*, *Mayflower Compact*, and the Declaration of Independence such milestone documents in the political history of the world?
- How does the electoral college work?

- What is the line of authority if the President and vice president are incapacitated? Who are the next few in line?
- Why is it claimed that the concept of “scarcity” is the basis for the discipline of economics?
- What are some of the government mechanisms that have been used in the United States for redistributing wealth? What are the dangers of too much government redistribution versus the dangers of too much wealth concentrated in a small percentage of the population?

IV. Science

A. Earth and Space Science

1. Understands basic physical and historical geology
 - a. Identify Earth’s basic structure (e.g., mantle, core, geographical features such as mountains, magnetic field)
 - b. Identify and describe types and characteristics of rocks and minerals
 - c. Recognize processes involved in erosion, weathering, and deposition of Earth’s surface materials
 - d. Recognize Earth’s internal processes including impact of plate tectonic theory (e.g., volcanoes, earthquakes)
 - e. Identify key aspects of the water cycle (e.g., evaporation, condensation, precipitation, runoff)
 - f. Recognize important events in Earth’s geologic history and the importance of the rock record and fossils
2. Is familiar with the structure and processes of Earth’s hydrosphere
 - a. Identify the geographic location of Earth’s oceans and seas and the processes involved with tides and waves
 - b. Identify characteristics of lakes, streams, rivers, polar ice, icebergs, glaciers, and groundwater
 - c. Identify the basic characteristics of Earth’s atmosphere
 - d. Recognize the basic concepts of weather (e.g., clouds, precipitation, hurricanes)

- e. Identify factors that affect climate and seasons (e.g., climate zones, proximity to mountains and oceans)
3. Is familiar with astronomy
 - a. Identify the major features of the solar system, including the Sun, the planets, moons, asteroids, and comets
 - b. Recognize the interactions of the Earth-Moon-Sun system (e.g., phases of the Moon, eclipses, seasons, tides)
 - c. Recognize the major features of the universe (e.g., galaxies, stars, black holes)

B. Life Sciences

1. Understands the basic structure and function of cells and levels of organization in living things
 - a. Identify the structure and function of cell organelles (e.g., nucleus, cell membrane)
 - b. Recognize basic cell processes such as cell division and photosynthesis
 - c. Identify the levels of organization (cells, tissues, organs, organ systems)
2. Understands basic genetics and evolution
 - a. Apply basic genetics (e.g., relationship between genes and traits)
 - b. Recognize the basic structure and function of DNA and relationship to heredity
 - c. Recognize common human genetic disorders
 - d. Identify processes by which species change over time, including natural selection, mutation, evolution
3. Knows the hierarchical classification scheme and the characteristics of the major groups of organisms
 - a. Identify elements of classification schemes (e.g., kingdom, genus, species)
 - b. Identify major characteristics of common types of organisms (e.g. amphibians, reptiles, mammals, plants)
4. Knows the major structures and functions of plant organs and systems
 - a. Identify the basic structure and function of leaves, roots, and stems
 - b. Recognize key aspects of asexual and sexual reproduction, development, and growth
 - c. Recognize the uptake and transport of nutrients and water

5. Knows the basic anatomy and physiology of animals, including human body systems
 - a. Identify examples of exchange with the environment involving the respiratory, excretory, and digestive systems
 - b. Recognize key aspects of internal transport and exchange in terms of the circulatory system
 - c. Recognize key aspects of support and movement in terms of the skeletal and muscular systems
 - d. Identify key aspects of reproduction and development
 - e. Recognize the function of immune systems
 - f. Identify the functions of immune systems, nervous systems, and endocrine systems
 - g. Recognize the importance of homeostasis
6. Knows key aspects of ecology
 - a. Recognize key relationships between and among species such as territoriality, predator-prey, and parasitism
 - b. Recognize key aspects of ecosystems (e.g., biomes, energy levels, food webs, effect of disturbances)

C. Physical Sciences

1. Knows the basic structure and properties of matter
 - a. Identify basic properties of solids, liquids and gases (e.g., structure, density, conductivity, solubility)
 - b. Identify and distinguish between elements, atoms, compounds, molecules, and mixtures
 - c. Describe the atomic model, including electrons, protons, neutrons, atomic number and atomic mass
 - d. Is familiar with the periodic table of the elements, its symbols and the information it provides
2. Knows the basic relationships between energy and matter
 - a. Recognize that energy and matter is conserved in various situations
 - b. Recognize how various forms of kinetic and potential energy can be transformed from one form to another
 - c. Identify the differences between chemical and physical properties/changes

- d. Describe methods of heat transfer (convection, radiation, conduction)
 - e. Describe how the states of matter undergo phase changes and the energy changes involved
3. Understands basic chemical reactions
 - a. Identify the difference between covalent and ionic bonding
 - b. Interpret simple chemical formulas
 - c. Recognize that chemical reactions involve energy changes
 - d. Identify chemical and physical properties of acids and bases and the pH scale
 - e. Recognize common types of chemical reactions such as neutralization, oxidation, and combustion
 4. Understands basic concepts in mechanics
 - a. Describe motion in terms of distance, speed, velocity, and acceleration
 - b. Describe the effect of forces on objects (e.g., collisions, pendulums, friction)
 - c. Recognize the effect of gravity and distinguish between mass and weight
 - d. Recognize forces and physical properties involving fluids that determine whether objects will sink or float
 5. Understands basic concepts in electricity, magnetism, waves, and optics
 - a. Describe basic characteristics of magnets (e.g., magnetic poles, attraction, repulsion)
 - b. Recognize electrostatic attraction and repulsion
 - c. Describe electricity in terms of the flow of electrons and identify voltage sources (batteries and generators)
 - d. Describe the basic phenomena involving light (reflection, rainbows, mirrors, prisms)
 - e. Describe basic characteristics of sound (pitch, loudness, the Doppler effect)

D. Impact of Science and Technology on Society

1. Knows the impact of science and technology on the environment and society
 - a. Recognize the impact of air and water pollution, greenhouse gases
 - b. Recognize the impact of production and disposal of consumer products

- c. Recognize the benefits of conservation and recycling
 - d. Identify renewable and nonrenewable energy resources
 - e. Identify the pros and cons of power generation based on various sources (e.g., fossil, nuclear, water, wind, solar, biomass, geothermal)
2. Is familiar with applications of science and technology in daily life and public health
 - a. Identify applications of chemical and physical principles related to common consumer products (e.g., acid-base properties of orange juice, applications of physics in devices such as lenses)
 - b. Identify common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides)
 - c. Recognize the role of nutrition, disease, and medicine (e.g., food preservation, vitamins, vaccines, viruses)
 - d. Recognize applications of medical technologies (e.g., MRIs, X-rays, radiation therapy)

E. Science as Inquiry and Science Processes

1. Understands the basic elements of scientific inquiry and how they are used
 - a. Identify hypotheses, theories, models, and laws, and their role in scientific inquiry
 - b. Explain the role of the elements of experimental design, including independent and dependent variables, controls, sources of error, and drawing conclusions
 - c. Recognize that scientific knowledge is subject to change, consistent with evidence, based on reproducible evidence and includes unifying concepts and processes (e.g., systems, models, constancy and change, equilibrium, form and function)
 - d. Recognize how key concepts developed over time and identify the contribution of key historical figures (e.g., Newton's laws, Marie Curie's work with radioactivity, Mendel's development of basic genetics)

2. Understands the common methods and tools used to gather and present reliable data
 - a. Identify common units of measurement (e.g., meter, gram, liter)
 - b. Explain the appropriate use of common measurement tools (e.g., thermometers, barometers, balances)
 - c. Organize and present data (e.g., graphs, tables, charts, maps)
3. Knows how to interpret and draw conclusions from data presented in tables, graphs, charts, and maps
 - a. Identify patterns and significant points in data
 - b. Draw conclusions and make predictions based on presented data
 - c. Recognize relationships between variables
 - d. Recognize the effect of error on data and conclusions
4. Understands procedures for safe and correct use of laboratory materials and equipment
 - a. Recognize safe and appropriate methods to prepare materials for classroom use (activities and demonstrations)
 - b. Recognize when and how to use standard equipment in the laboratory (e.g., microscopes, graduated cylinders)
 - c. Explain the use of standard safety equipment (e.g., eyewash stations, safety showers)
 - d. Identify appropriate student apparel and behavior (e.g., goggles, clothing, no eating in lab)
 - e. Recognize emergency procedures for mishaps (e.g., fires, chemical spills, injuries) and evacuation procedures

Discussion areas: Science

- What is the inside of Earth like?
- What is the difference between rocks and minerals?
- What substances are found in concrete?
- What are fossils and how are they formed?
- In which layer of the atmosphere is the aurora borealis displayed? What is the cause of this natural light show?
- What is air pressure and how is it measured?

- Why do monuments in Egypt last for thousands of years, while similar monuments in northern climates deteriorate very quickly?
- What is the “Ring of Fire”?
- What causes a volcano to erupt?
- What causes earthquakes?
- What causes tides? What do “low tide” and “high tide” mean?
- The greatest difference in water level between a low tide and a high tide occurs because of what alignment of the Moon, Sun, and Earth?
- How do storms form?
- How do oceans affect climate?
- Why do the planets circle the Sun?
- How does a solar eclipse occur?
- How are the inner planets of the solar system different from the outer planets?
- What causes the seasons on Earth? What is the positional relationship of the Sun and Earth at each season?
- Why do the stars appear to move across the sky each night while the pattern of stars stays the same?
- Why do different stars appear during different seasons?
- Why does the position of a planet as seen from Earth change in relation to the background of stars?
- Why do stars twinkle while planets do not?
- Are most cells flat? What do electronmicroscope pictures show us about cell shape?
- Why are roots, stems, and leaves important to plants?
- How does the human circulatory system work?
- How does the human digestive system work?
- What are dominant and recessive traits?
- How can two parents with brown eyes have a child with blue eyes?
- What are the steps in complete metamorphosis? Incomplete metamorphosis?
- What is meant by “survival of the fittest”?
- What makes a plant bend toward the light? What is the scientific term associated with this?
- How does the human body maintain a constant body temperature?
- What are adaptations?
- What happens if certain kinds of organisms, such as edible plants, are introduced or removed from a food chain?
- How do food chains become food webs?
- Does air take up space?
- Sometimes when two chemicals are combined, a chemical reaction takes place. What are some of the signs of such a chemical reaction?
- What is an example of a change of state?
- Where are the protons located in an atom?
- How long does it take for a car traveling 30 miles per hour to go 3 miles?
- When a person is driving a car that is moving at the same speed as another car next to it, why does the second car appear to be still?
- What causes an object in motion to accelerate or slow down?
- What is the difference between weight and mass?
- Describe various ways in which an object can have several forces acting on it and still be at rest.
- How is the energy of a rock sitting on the top of a hill different from the energy of a rock sitting at the bottom of the same hill?
- Why does rubbing your hands together make them warmer?
- Describe how energy is transformed from potential energy to kinetic energy as a bicycle travels downhill.
- How do visible light waves differ from sound waves and water waves?
- What is an example of how each of the nonvisible waves is used in day-to-day life?
- What about the properties of light makes a red apple appear red?
- Is light that interacts with a mirror reflected or refracted?
- Which types of lenses magnify and which types produce an image reduced in size?

- How do lenses help nearsighted and farsighted people?
- What are the basic components of a simple electric circuit?
- How does a compass work?
- Some appliances can convert electrical energy to heat energy, light energy, and energy of motion. Give an example of each.
- Why does the sound that accompanies a lightning strike come after the flash of light?
- What are echoes, and what causes them?
- How does physical fitness help a person?
- In what ways can infection spread?
- How do drugs, alcohol, and tobacco affect the body?
- How do prescription medicines differ from over-the-counter medicines?
- What, historically, has been the purpose of sending humans into space?
- Give an example of a complex scientific endeavor that involves the work of hundreds of people. Give an example of a relatively straightforward scientific endeavor that involves the work of a single scientist.
- How are control variables and experimental variables used in scientific investigations?
- How do different questions require different approaches and tools in the investigation stage?
- How do mathematics and technology assist in different kinds of scientific inquiry?
- What are some examples of measuring instruments?
- How does skepticism relate to scientific inquiry?
- What is the role of ethics in scientific inquiry?
- Other than the inquiry process, what methods have led to important new scientific ideas or discoveries?
- Why is each idea considered a crucial conceptual scheme or procedural scheme, and how does each idea cut across the scientific disciplines?

7. 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*[®] 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.

8. 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 https://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.

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 https://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.

9. 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)
- 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)
- 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.

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!

10. 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 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.

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.

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 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.

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 over the 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
- *Praxis Passing Scores*, found at <https://www.ets.org/praxis/institutions/scores/passing/>
- State requirements, found at 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 the *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.

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 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 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

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

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