



The *PRAXIS*<sup>®</sup> Study Companion

**Elementary Education:  
Three Subject Bundle —  
Mathematics,  
Social Studies & Science  
(5901)**



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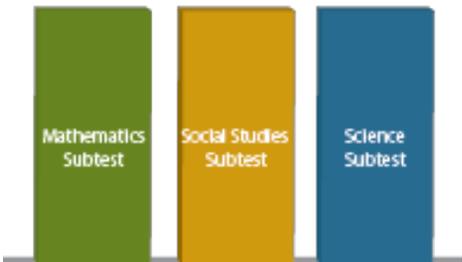
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## Elementary Education: Three Subject Bundle— Mathematics, Social Studies & Science (5901)

### Test at a Glance

<b>Test Name</b>	Elementary Education: Three Subject Bundle— Mathematics, Social Studies & Science		
<b>Test Code</b>	5901		
<b>Time</b>	3 hours and 5 minutes (three separately timed subjects)		
<b>Format</b>	The test consists of a variety of selected-response and numeric-entry questions. You can review the question types in Understanding Question Types.		
<b>Test Delivery</b>	Computer Delivered		
<b>Elementary Education: Three Subject Bundle— Mathematics, Social Studies &amp; Science</b>  	Subtests	Subject Test Length (Minutes)	Approximate Number of Questions
	5903 Mathematics	65	50
	5904 Social Studies	60	60
	5905 Science	60	55

### About The Test

The purpose of the test is to assess whether the entry-level elementary teacher has the content knowledge that is important, necessary, and needed at time of entry to the profession to teach mathematics, social studies, and science at the elementary level. The test is designed to support a generalist elementary school license.

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

## Elementary Education: Three Subject Bundle— Mathematics Subtest (5903)

Time: 65 minutes; Format: Selected-response and numeric-entry questions; on-screen scientific calculator provided

	Content Categories	Approximate Number of Questions	Approximate Percentage of Subtest
	I. Numbers and Operations	20	40%
	II. Algebraic Thinking	15	30%
	III. Geometry and Measurement, Data, Statistics, and Probability	15	30%
	<b>Total</b>	<b>50</b>	<b>100%</b>

### About The Test

The Elementary Education: Three Subject Bundle—Mathematics Subtest is designed for prospective teachers of children in primary through upper elementary school grades. The 50 questions focus on the broad knowledge of mathematics and related competencies necessary to be licensed as a beginning teacher at the elementary school level.

The test is not designed to be aligned with any particular school mathematics curriculum, but it is intended to be consistent with the recommendations of national studies on mathematics education, such as the Council for the Accreditation of Educator Preparation (CAEP) 2018 *K-6 Elementary Teacher Preparation Standards* and the Association of Mathematics Teacher Educators (AMTE) 2017 *Standards for Preparing Teachers of Mathematics*.

The test includes selected-response questions, such as single-selection multiple-choice questions with four choices and multiple selection multiple-choice questions, and numeric-entry questions.

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

## On-Screen Scientific Calculator

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, [request access to it](#). The calculator may be used to perform calculations, such as exponents, roots, and percents.

## Using Your Calculator

Take time to [access the calculator and practice with it](#) so that you are comfortable using the calculator on the test.

There are only some questions on the test for which a calculator is helpful or necessary. First, decide how you will solve a problem, then determine if you need a calculator. For many questions, there is more than one way to solve the problem. Don't use the calculator if you don't need to; you may waste time.

Sometimes answer choices are rounded, so the answer that you get might not match the answer choices in the question. Since the answer choices are rounded, plugging the choices into the question might not produce an exact answer.

Don't round any intermediate calculations. For example, if the calculator produces a result for the first step of a solution, keep the result in the calculator and use it for the second step. If you round the result from the first step and the answer choices are close to each other, you might choose the incorrect answer.

Read the question carefully so that you know what you are being asked to do. Sometimes a result from the calculator is NOT the final answer. If an answer you get is not one of the choices in the question, it may be that you didn't answer the question being asked. Read the question again. It might also be that you rounded at an intermediate step in solving the problem.

Think about how you are going to answer the question before using the calculator. You may only need the calculator in the final step or two. Don't use it more than necessary.

Check the calculator modes (floating decimal versus scientific notation) to see that these are correct for the question being asked.

Make sure that you know how to perform the basic arithmetic operations and calculations (e.g., exponents, roots).

## Content Topics

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

**Note:** The use of “e.g.” to start a list of examples implies that only a few examples are offered and the list is not exhaustive, whereas the use of “i.e.” to start a list of examples implies that the given list of examples is complete.

## Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. Answers for the discussion questions are **not** provided; however, thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. The questions are intended to help you gain increased understanding and facility with the test’s subject matter. You may want to discuss these questions with a teacher or mentor.

## I. Numbers and Operations

### A. Understands the place value system

1. Writes numbers using base-10 numerals, number names, and expanded form
2. Composes and decomposes multi-digit numbers
3. Given a digit, identifies the place the digit is in and its value in that place
4. 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
5. Uses whole-number exponents to denote powers of 10
6. Rounds multi-digit numbers to any place value

### B. Understands operations and properties of rational numbers

1. Solves multistep mathematical and real-world problems using addition, subtraction, multiplication, and division of rational numbers
  - a. Identifies different problem situations for the operations (e.g., adding to, taking from, putting together, taking apart, and comparing for subtraction)
  - b. Uses the relationship between addition and subtraction and the relationship between multiplication and division to solve problems (e.g., inverse operations)
  - c. Interprets remainders in division problems

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

### Discussion Questions: Numbers and Operations

- Express numbers in different forms (e.g., two hundred thirty-four,  $234$ ,  $200 + 30 + 4$ ,  $2 \times 100 + 3 \times 10 + 4 \times 1$ ,  $2 \times 10^2 + 3 \times 10^1 + 4 \times 10^0$ , and 23 tens and 4 ones are all different ways to express the same number).
  - Identify how many times greater the value of one digit in a number is than another digit in the number (e.g., in 23.12, the value of the 2 in the tens place is 1,000 times greater than the value of the 2 in the hundredths place).
  - Identify cases when the answer to a real-world division problem is found by ignoring the remainder, dividing the remainder into equal shares, or using the least whole number that is greater than the quotient.
  - Identify cases when a product is not greater than both factors (e.g., multiplying by 0 or 1) or when a quotient is not less than the dividend (e.g., dividing the dividend by a fraction).
  - Represent a fraction as a sum of unit fractions (e.g.,  $\frac{3}{5} = \frac{1}{5} + \frac{1}{5} + \frac{1}{5}$ ).
  - Identify an area model that represents the product of two fractions.
  - Put fractions and decimals in order from least to greatest.
  - Divide two quantities to find an equivalent unit rate (e.g., when a 20-ounce box of cereal costs \$6.99, the unit rate is \$0.3495 per ounce).
  - Solve percent problems that involve discounts or sales tax.
- Identify the prime factors of a whole number.
  - Identify real-world problems that involve finding the greatest common factor or the least common multiple of two whole numbers.

## II. Algebraic Thinking

### A. Knows how to evaluate and manipulate algebraic expressions, equations, and formulas

1. Differentiates between algebraic expressions and equations
2. Adds and subtracts linear algebraic expressions
3. Uses the distributive property to generate equivalent linear algebraic expressions
4. Evaluates simple algebraic expressions (i.e., one variable, binomial) for given values of variables
5. Uses mathematical terms to identify parts of expressions and describe expressions
6. 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  $j = 2s$  )
7. Uses formulas to determine unknown quantities
8. Differentiates between dependent and independent variables in formulas

**B. Understands the meanings of the solutions to linear equations and inequalities**

1. Solves multistep one-variable linear equations and inequalities
2. Interprets solutions of multistep one-variable linear equations and inequalities (e.g., graphs the solution on a number line, states constraints on a situation)
3. Uses linear relationships represented by equations, tables, and graphs to solve problems

**C. Knows how to recognize and represent patterns (e.g., number, shape)**

1. Identifies, extends, describes, or generates number and shape patterns
2. Makes conjectures, predictions, or generalizations based on patterns
3. Identifies relationships between the corresponding terms of two numerical patterns (e.g., find a rule for a function table)

**Discussion Questions: Algebraic****Thinking**

- Identify whether a phrase or sentence is represented by an algebraic expression or equation (e.g., the sentence “ $x$  is increased by 6” is represented by the expression  $x + 6$ ).
- Simplify expressions like  $(4x + 5y) + (3x - 2y)$  and  $(4x + 5y) - (3x - 2y)$ .
- Identify examples of mathematical vocabulary such as terms in an expression, constant term, factor, coefficient, and leading coefficient.
- Substitute numbers into a formula to find the corresponding value of a variable in the formula (e.g., given the formula for the area of a rectangle and the area and the length of the rectangle, find the width of the rectangle).
- Identify the independent variable and the dependent variable in a linear equation (e.g., in the equation  $c = 2b$ , which gives the cost  $c$ , in dollars, of  $b$  bottles of water that each cost \$2, the independent variable is  $b$  and the dependent variable is  $c$  because the total cost depends on the number of bottles of water purchased).
- Solve an equation or inequality that has variables on both sides, that involves combining like terms, or that involves the distributive property by isolating the variable on one side of the equation or inequality (e.g., solve  $8x - 17 = 3x + 13$  for  $x$ , solve  $2(5y + 8) - 6y < 36$  for  $y$ ).
- Identify differences between the graphs of the inequalities  $x > 2$ ,  $x \geq 2$ ,  $x < 2$ , and  $x \leq 2$  on the number line.
- Represent a real-world problem with an equation, a table, or a graph and then use the equation, table, or graph to answer a question about the problem.
- Determine the value of a certain term in an arithmetic sequence, or write an expression that can be used to find the value of any term in an arithmetic sequence.

- Identify an equation that represents the relationship between the  $x$ -values and the corresponding  $y$ -values in a table.

### III. Geometry and Measurement, Data, Statistics, and Probability

#### A. Understands how to classify one-, two-, and three-dimensional figures

1. Uses definitions to identify lines, rays, line segments, parallel lines, and perpendicular lines
2. Classifies angles based on their measure
3. Composes and decomposes two- and three-dimensional shapes
4. Uses attributes to classify or draw polygons and solids

#### B. Knows how to solve problems involving perimeter, area, surface area, and volume

1. Represents three-dimensional figures with nets
2. Uses nets that are made of rectangles and triangles to determine the surface area of three-dimensional figures
3. Finds the area and perimeter of polygons, including those with fractional side lengths
4. Finds the volume and surface area of right rectangular prisms, including those with fractional edge lengths
5. Determines how changes to dimensions change area and volume

#### C. Knows the components of the coordinate plane and how to graph ordered pairs on the plane

1. Identifies the  $x$ -axis, the  $y$ -axis, the origin, and the four quadrants in the coordinate plane
2. Solves problems by plotting points and drawing polygons in the coordinate plane

#### D. Knows how to solve problems involving measurement

1. Solves problems involving elapsed time, money, length, volume, and mass
2. Measures and compares lengths of objects using standard tools
3. Knows relative sizes of United States customary units and metric units
4. Converts units within both the United States customary system and the metric system

#### E. Is familiar with basic statistical concepts

1. Identifies statistical questions
2. Solves problems involving measures of center (mean, median, mode) and range
3. Recognizes which measure of center best describes a set of data
4. Determines how changes in data affect measures of center or range
5. Describes a set of data (e.g., overall patterns, outliers)

**F. Knows how to represent and interpret data presented in various forms**

1. Interprets various displays of data (e.g., boxplots, histograms, scatterplots)
2. 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, boxplots, and lineplots/dotplots)
3. Chooses appropriate graphs to display data

**G. Is familiar with how to interpret the probability of events**

1. Interprets probabilities relative to likelihood of occurrence

**Discussion Questions: Geometry and Measurement, Data, Statistics, and Probability**

- Identify acute, right, obtuse, and straight angles.
- Classify shapes (e.g., isosceles triangle, parallelogram, octagon) based on descriptions of their sides and angles.
- Find the area of a polygon by decomposing it into rectangles and triangles.
- Identify how the perimeter and area of a rectangle change when its length and width are doubled, and identify how the surface area and the volume of a right rectangular prism change when its length, width, and height are doubled.
- Identify the quadrant of the  $xy$ -plane in which a given point is located.
- Identify a reasonable measurement for an object (e.g., a reasonable height for a two-story building is 20 feet, not 20 inches, 20 yards, or 20 miles).
- Solve problems involving measurement conversions among the following sets of units: inches, feet, and yards; millimeters, centimeters, meters, and kilometers; fluid ounces, cups, pints, quarts, and gallons; milliliters and liters; ounces, pounds, and tons; and milligrams, grams, and kilograms.
- Identify when the median better represents the center of a set of data than the mean.
- Determine how the mean, median, mode, and range of a data set change when numbers are added to or removed from the data set.
- Describe relationships shown by data on a scatterplot (e.g., positive or negative, linear or nonlinear).
- Find the theoretical probability that a certain outcome will occur.

## Elementary Education: Three Subject Bundle— Social Studies Subtest (5904)

Time: 60 minutes; Format: Selected response

	Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
	I. United States History, Government, and Citizenship	27	45%
	II. Geography, Anthropology, and Sociology	18	30%
	III. World History and Economics	15	25%
	<b>Total</b>	<b>60</b>	<b>100%</b>

### About The Test

The Elementary Education: Three Subject Bundle— Social Studies subtest is designed to assess whether an examinee has the broad knowledge and competencies necessary to be licensed as a beginning teacher at the elementary school level. The 60 selected-response questions are based on the material typically covered in a bachelor's degree program in elementary education.

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

## Content Topics

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

**Note:** The use of “e.g.,” to start a list of examples implies that only a few examples are offered, and the list is not exhaustive.

## Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. Answers for the discussion questions are **not** provided; however, thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. The questions are intended to help you gain increased understanding and facility with the test’s subject matter. You may want to discuss these questions with a teacher or mentor.

## Test Specifications

- I. United States History, Government, and Citizenship
  - A. Knows European exploration and colonization in United States history and growth and expansion of the United States.
  - B. Knows about the American Revolution and the founding of the nation in United States history.
  - C. Knows the major events and developments in United States history from founding to present (e.g., westward expansion, industrialization, Great Depression)
  - D. Knows about twentieth-century developments and transformations in the United States (e.g., assembly line, space age)
  - E. Understands connections between causes and effects of events.
  - F. Understands the nature, purpose, and forms (e.g., federal, state, local) of government.
  - G. Knows key documents and speeches in the history of the United States (e.g., United States Constitution, Declaration of Independence, Gettysburg Address)
  - H. Knows the rights and responsibilities of citizenship in a democracy.

### Discussion Questions: United States History

- 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?
- Name some ways the Constitution affects our lives today.
- What was the Supreme Court's decision in *Marbury v. Madison* 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" or "multiculturalism." 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?

### Discussion Questions: Government and Citizenship

- Compare the major features of a democratic government with those of other forms of government.
- Why were the Mayflower Compact, the Declaration of Independence, and Magna Carta such milestone documents in the political history of the world?
- What is the purpose of the system of checks and balances the United States government?
- What are some examples of checks and balances?
- How has the United States Constitution impacted the relationship between the federal government and the states (e.g., the 10th Amendment, the Commerce Clause)?

## II. Geography, Anthropology, and Sociology

- A. Knows world and regional geography (e.g., spatial terms, places, regions)
- B. Understands the interaction of physical and human systems (e.g., how humans change the environment, how the environment changes humans, importance of natural and human resources)
- C. Knows the uses of geography (e.g., apply geography to interpret past, to interpret present, to plan for future)

- D. Know how people of different cultural backgrounds interact with their environment, family, neighborhoods, and communities.

**Discussion Questions: Geography**

- 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?

**III. World History and Economics**

- A. Knows the major contributions of classical civilizations (e.g., Egypt, Greece, Rome)
- B. Understands twentieth-century developments and transformations in world history.
- C. Understands the role of cross-cultural comparisons in world history instruction.
- D. Knows key terms and basic concepts of economics (e.g., supply and demand, scarcity and choice, money and resources)

- E. Understands how economics affects population, resources, and technology

- F. Understands the government’s role in economics and the impact of economics on government.

**Discussion Questions: World History**

- 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 Greece’s 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?

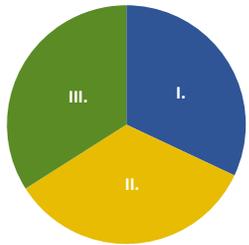
- What are the main reasons that a global culture emerged in the twentieth century? What are the consequences of this global culture?

**Discussion Questions: Economics**

- Why is it claimed that the concept of “scarcity” is the basis for the discipline of economics?

## Elementary Education: Three Subject Bundle— Science Subtest (5905)

Time: 60 minutes; Format: Selected response; on-screen scientific calculator provided

	Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
	I. Earth Science	17-18	33%
	II. Life Science	18-19	33%
	III. Physical Science	18-19	33%
	<b>Total</b>	<b>55</b>	<b>100%</b>

### About This Subtest

The Elementary Education: Three Subject Bundle— Science subtest is designed to assess whether an examinee has the broad knowledge and competencies necessary to be licensed as a beginning teacher at the elementary school level. The 55 selected-response questions are based on the material typically covered in a bachelor's degree program in elementary education. The development of the test questions and the construction of the test reflect the National Science Education Standards (NSES) and the National Science Teaching Association (NSTA) standards.

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

### On-Screen Scientific Calculator

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 become familiar with the functionality of the calculator before taking the test. To practice using the calculator, [request access to it](#).

### Using Your Calculator

Take time to [access the calculator and practice with it](#) so that you are comfortable using the calculator on the test.

For many questions, there is more than one way to solve the problem. Don't use the calculator if you don't need to; you may waste time.

## Content Topics

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

**Note:** The use of “e.g.,” to start a list of examples implies that only a few examples are offered, and the list is not exhaustive.

## Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. Answers for the discussion questions are **not** provided; however, thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. The questions are intended to help you gain increased understanding and facility with the test’s subject matter. You may want to discuss these questions with a teacher or mentor.

### I. Earth Science

- A. Understands the structure of the Earth system (e.g., structure and properties of the solid Earth, the hydrosphere, the atmosphere)
- B. Understands processes of the Earth system (e.g., processes of the solid Earth, the hydrosphere, the atmosphere)
- C. Understands Earth history (e.g., origin of Earth, paleontology, the rock record)
- D. Understands Earth and the universe (e.g., stars and galaxies; the solar system and planets; Earth, Sun, and Moon relationships)
- E. Understands Earth patterns, cycles, and change
- F. Understands science as a human endeavor, a process, and a career
- G. Understands science as inquiry (e.g., questioning, gathering data, drawing reasonable conclusions)
- H. Understands how to use resource and research material in science
- I. Understands the unifying processes of science (e.g., systems, order, organization)

#### Discussion Questions: Earth 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?

## II. Life Science

- A. Understands the structure and function of living systems (e.g., living characteristics and cells, tissues and organs, life processes)
- B. Understands reproduction and heredity (e.g., growth and development, patterns of inheritance of traits, molecular basis of heredity)
- C. Understands change over time in living things (e.g., life cycles, mutations, adaptation, and natural selection)
- D. Understands regulation and behavior (e.g., life cycles, responses to external stimuli, controlling the internal environment)
- E. Understands unity and diversity of life, adaptation, and classification
- F. Understands the interdependence of organisms (e.g., ecosystems, populations, communities)
- G. Knows about personal health (e.g., nutrition, communicable diseases, substance abuse)
- H. Understands science as a human endeavor, a process, and a career
- I. Understands science as inquiry (e.g., questioning, gathering data, drawing reasonable conclusions)

- J. Understands how to use resource and research material in science
- K. Understands the unifying processes of science (e.g., systems, order, organization)

#### **Discussion Questions: Life Science**

- Are most cells flat? What do electron microscope 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 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?

### **III. Physical Science**

- A. Understands the physical and chemical properties and structure of matter (e.g., changes of states, mixtures and solutions, atoms, and elements)
- B. Understands forces and motions (e.g., types of motion, laws of motion, forces, and equilibrium)
- C. Understands energy (e.g., forms of energy, transfer and conservation of energy, simple machines)
- D. Understands interactions of energy and matter (e.g., electricity, magnetism, sound)
- E. Understands science as a human endeavor, a process, and a career
- F. Understands science as inquiry (e.g., questioning, gathering data, drawing reasonable conclusions)
- G. Understands how to use resource and research material in science
- H. Understands the unifying processes of science (e.g., systems, order, organization)

#### **Discussion Questions: Physical Science**

- 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 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 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.

## Elementary Education: Three Subject Bundle — Mathematics Subtest (5903) Sample Test Questions

### Information about Questions That Is Specific to the Elementary Education: Three Subject Bundle — Mathematics Subtest

#### General

- Figures that accompany questions are intended to provide information that is useful in answering questions.
  - Figures are drawn to scale unless otherwise stated.
  - Lines shown as straight are straight, and angle measures are positive. Positions of points, angles, regions, etc., exist in the order shown.

#### Types of questions on the test

- Selected-response questions—select one answer choice
  - These questions allow you to select only one answer choice from a list of four choices. These questions have ovals or circles beside the answer choices.
  - Note that in most selected-response questions that ask for numerical values, you should find the exact answer. However, when a selected-response question includes a word or phrase like “approximately,” “best approximates,” or “is closest to,” it usually indicates that the correct choice will **not** be an exact value.
- Selected-response questions—select one or more answer choices
  - These questions allow you to select more than one answer choice from a list of choices. These questions have square boxes beside the answer choices.
  - Some of these questions state the number of choices you should select. In these questions, the number is capitalized, underlined, and in boldface (e.g., Which **TWO** of the following...). Be sure to select the given number of choices.
  - Some of these questions include the instruction “Select **ALL** that apply” and do not state the number of choices you should select. The number of correct choices will be at least two but fewer than the number of choices. For example, if a question of this type has six answer choices, there will be two, three, four, or five correct choices.

- Numeric-entry questions
  - Many of these questions ask you to enter your answer as an integer or a decimal in a single answer box. Equivalent forms of the correct answer, such as 2.5 and 2.50, are all correct. See question 6 in the Sample Test Questions.  
Note that in these questions, you should enter the exact answer unless the question asks you to round your answer. Therefore, if one of these questions does **not** ask you to round your answer, you should be able to enter the exact answer in the numeric-entry box. If you are unable to do so, this may indicate that your answer is incorrect.
  - A few of these questions ask you to enter your answer as a fraction in two separate boxes—one for the numerator and one for the denominator. A negative sign can be entered in either box. Equivalent forms of the correct answer, such as  $\frac{1}{2}$  and  $\frac{6}{12}$ , are all correct, though there may be cases where you need to simplify your fraction so it fits in the boxes.

The sample questions that follow represent a number of the types of questions and topics that appear 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:** The test consists of a variety of selected-response questions, where you select one or more answer choices, and questions where you enter a numeric answer in a box.

1. Which of the following is an example of the commutative property of addition?
  - (A)  $6 \times (4 + 2) = (6 \times 4) + (6 \times 2)$
  - (B)  $(1 + 7) + 4 = 1 + (7 + 4)$
  - (C)  $5 \times 3 = 3 \times 5$
  - (D)  $8 + 9 = 9 + 8$
  
2. A school bus has the following riders: 20 students in ninth grade, 10 students in tenth grade, 9 students in eleventh grade, and 7 students in twelfth grade.  
Approximately what percent of the students on the bus are in ninth grade?
  - (A) 23%
  - (B) 43%
  - (C) 46%
  - (D) 76%
  
3. To make fruit punch, Edie mixes two kinds of juices in the following ratio: 1 cup of pineapple juice to 3 cups of orange juice.  
How many cups of orange juice will Edie need in order to make 48 cups of fruit punch?
  - (A) 12
  - (B) 16
  - (C) 24
  - (D) 36

4. The only prime factors of a certain product are 2, 3, and 7.

Which of the following could be the product?

- (A)  $18 \times 28$
- (B)  $20 \times 21$
- (C)  $22 \times 63$
- (D)  $24 \times 35$

5. After a lesson on rounding and estimation, a teacher tells students that 157 rulers will be distributed to 4 teachers. The teacher asks the students to estimate the number of rulers each teacher will receive if the rulers are shared as equally as possible among the teachers.

Which of the following students produces the best estimate of the number of rulers each teacher will receive?

- (A) Student A: about 30
- (B) Student B: about 35
- (C) Student C: about 40
- (D) Student D: about 45

6. What is the value of the expression  $4x^2 + 7$  when  $x = 3.2$ ?

7. Jack had three babysitting jobs this week. He worked the same number of hours  $H$  on each job. He was paid at a rate of \$12 for every hour at his first job, \$4 for every half hour at his second job, and \$5 for every 20 minutes at his third job.

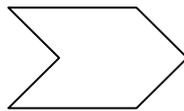
Which of the following expressions represents the total amount, in dollars, Jack was paid this week?

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

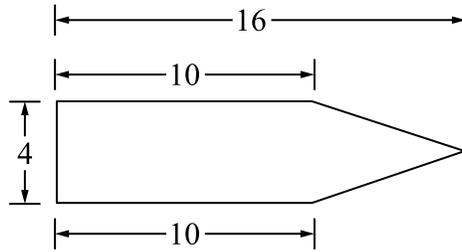
8. Which of the following is equivalent to the inequality  $5 \leq 7 - p$ ?
- (A)  $p \leq 2$
  - (B)  $p \geq 2$
  - (C)  $p \leq -2$
  - (D)  $p \geq -2$

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

9. Which of the following equations could represent the relationship shown in the preceding table?
- (A)  $y = -8x + 4$
  - (B)  $y = -7x + 4$
  - (C)  $y = -6x + 4$
  - (D)  $y = -5x + 4$



10. Which of the following terms best describes the preceding polygon?
- (A) Hexagon
  - (B) Parallelogram
  - (C) Pentagon
  - (D) Trapezoid



11. What is the area, in square units, of the preceding figure?
- (A) 32  
 (B) 52  
 (C) 64  
 (D) 104
12. A mathematics lesson in a fourth-grade class started at 1:30 P.M. and ended at 3:10 P.M.  
 How many minutes long was the mathematics lesson?
- (A) 40  
 (B) 80  
 (C) 100  
 (D) 120
13. A student plans to 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 a 4 on the top face and the coin will land heads up?
- (A)  $\frac{1}{12}$   
 (B)  $\frac{1}{8}$   
 (C)  $\frac{1}{6}$   
 (D)  $\frac{2}{3}$

## Answers

- Option (D) is correct. The question requires an understanding of the properties of operations. The commutative property of addition states that changing the order of the addends in an addition problem does not change the sum; that is, given any two numbers  $k$  and  $n$ ,  $k + n = n + k$ . Note that option (A) is an example of the distributive property of multiplication over addition, option (B) is an example of the associative property of addition, and option (C) is an example of the commutative property of multiplication.
- Option (B) is correct. The question requires an understanding of percent as a rate per 100. The word “percent” means a quantity per one hundred or a quantity for every one hundred. To calculate the percent, you must know two things: the number of ninth-grade students on the bus and the total number of students on the bus. The number of ninth-grade students, 20, is given in the problem. The total number of students is 46, which is determined by adding 20, 10, 9, and 7. To calculate the percent, divide 20 by 46 and multiply the result by 100 to get approximately 43%.

Alternatively, you can calculate the percent by setting up and solving the proportion

$$\frac{20}{46} = \frac{x}{100}.$$

Note that when a word like “approximately” is used in a question, it generally indicates that the correct option will **not** be an exact value.

- Option (D) is correct. The question requires an understanding of how to use proportional relationships to solve ratio problems. With 1 cup of pineapple juice and 3 cups of orange juice, Edie can make 4 cups of fruit punch. Since  $48 \div 4 = 12$ , you can multiply 3 cups of orange juice by 12 to get 36 cups of orange juice, which is the amount Edie needs in order to make 48 cups of fruit punch.

Alternatively, you can answer the question by setting up and solving a proportion, such as

$$\frac{3 \text{ cups of orange juice}}{4 \text{ total cups of fruit punch}} = \frac{x \text{ cups of orange juice}}{48 \text{ total cups of fruit punch}},$$

remembering that the fruit punch consists of pineapple juice and orange juice.

Note that in most multiple-choice questions that ask for numerical values, the exact answer should be found, as it should be in this question. If a multiple-choice question includes a phrase like “best approximates” or “is closest to,” it generally indicates that the correct option will **not** be an exact value.

- Option (A) is correct. The question requires an understanding of prime numbers and how to find factors and multiples of numbers. The prime factorization of 18 is  $2 \times 3 \times 3$ , or  $2 \times 3^2$ , and the prime factorization of 28 is  $2 \times 2 \times 7$ , or  $2^2 \times 7$ . Therefore, the only prime factors of  $18 \times 28$  are 2, 3, and 7. Note that in option (B), 20 has a prime factor of 5; in option (C), 22 has a prime factor of 11; and in option (D), 35 has a prime factor of 5.

5. Option (C) is correct. One way to answer the question involves an understanding of how to use rounding strategies to solve problems and determine the reasonableness of results. To estimate the number of rulers each teacher will receive, you can estimate  $157 \div 4$ . The best estimate is produced by rounding 157 to the closest number that is easily divided by 4 in a mental calculation. Rounding 157 up to 160 yields the calculation  $160 \div 4$ , which produces an estimate of 40.

Alternatively, you can calculate  $157 \div 4$ , which is 39.25, and then determine which option is closest to 39.25. The closest option to 39.25 is 40.

6. The correct answer is 47.96. The question requires an understanding of how to evaluate algebraic expressions for given values of variables. The first step is to substitute 3.2 in place of the variable  $x$ , which yields the expression  $4(3.2)^2 + 7$ . Using the order of operations, the expression is equal to  $4(10.24) + 7 = 40.96 + 7 = 47.96$ .

Note that in numeric-entry questions, the exact answer should be entered unless the question asks you to round your answer. Therefore, if a question does **not** ask you to round your answer, as in this question, you should be able to enter the exact answer in the numeric-entry box. If you are unable to do so, this may indicate that your answer is incorrect.

7. Option (B) is correct. The question requires an understanding of how to translate between verbal statements and algebraic expressions. At his first job, Jack was paid 12 dollars per hour. At his second job, he was paid 4 dollars per half hour. Since there are 2 half-hour periods in 1 hour, this is equivalent to a rate of  $4 \times 2 = 8$  dollars per hour. At his third job, he was paid 5 dollars for every 20 minutes. Since there are 3 periods of 20 minutes in 1 hour, this is equivalent to a rate of  $5 \times 3 = 15$  dollars per hour. Since Jack worked  $H$  hours at each job, he was paid  $12 \times H + 8 \times H + 15 \times H$  dollars this week.
8. Option (A) is correct. The question requires an understanding of how to solve one-variable linear inequalities. One way to solve the inequality is to start by adding  $p$  to both sides of the inequality, which yields the equivalent inequality  $p + 5 \leq 7$ . Then subtracting 5 from both sides of this inequality yields the equivalent inequality  $p \leq 2$ .

9. Option (C) is correct. The question requires an understanding of how to identify relationships between the corresponding terms of two numerical patterns. Although the question does not state that the relationship shown in the table is linear, each option is a linear equation, so you can assume that the relationship is linear. The equations in the options are written in the form  $y = mx + b$ , where  $m$  is the slope and  $b$  is the  $y$ -intercept. The slope  $m$  of the line can be found by substituting into the formula  $m = \frac{y_2 - y_1}{x_2 - x_1}$ , where

$(x_1, y_1)$  and  $(x_2, y_2)$  are two points on the line. Since the relationship is linear, any two points will yield the same slope, and substituting the ordered pairs  $(4, -20)$  and  $(7, -38)$  into the formula yields  $\frac{-38 - (-20)}{7 - 4} = \frac{-38 + 20}{3} = \frac{-18}{3} = -6$ . Since only one equation has a slope of  $-6$ , you could stop here, or you can substitute one of the ordered pairs into the equation to find the value of  $b$ . Using the ordered pair  $(4, -20)$  yields  $-20 = -6(4) + b$ , which equals  $-20 = -24 + b$ . Adding 24 to both sides of the equation yields  $4 = b$ , so the equation that represents the relationship in the table is  $y = -6x + 4$ , which is the equation in option (C).

Alternatively, one or more of the ordered pairs in the table could be substituted into each of the equations in the options, and you would find that  $y = -6x + 4$  is the only equation for which all of the ordered pairs make the equation true.

10. Option (A) is correct. The question requires an understanding of how to use attributes to classify polygons. The polygon has six sides, and a polygon with six sides is called a hexagon. Note that a parallelogram has four sides, a pentagon has five sides, and a trapezoid has four sides.
11. Option (B) is correct. The question requires an understanding of how to find the area of polygons. An important step in answering the question is noticing that the figure is composed of a rectangle on the left and a triangle on the right. The rectangle has length 10 and width 4, so its area is equal to  $10 \times 4 = 40$  square units. The triangle can be thought of as having a base of 4, since it has the same width as the rectangle, and a height of 6, since  $16 - 10 = 6$ . The area of a triangle is equal to  $\frac{1}{2}$  times its base times its height, so the area of the triangle is equal to  $\frac{1}{2} \times 4 \times 6 = 12$  square units. Therefore, the area of the figure is equal to  $40 + 12 = 52$  square units.

Note that in most multiple-choice questions that ask for numerical values, the exact answer should be found, as it should be in this question. If a multiple-choice question includes a phrase like “best approximates” or “is closest to,” it generally indicates that the correct option will **not** be an exact value.

12. Option (C) is correct. The question requires an understanding of how to solve problems involving elapsed time. From 1:30 P.M. to 2:30 P.M. is 1 hour, or 60 minutes. From 2:30 P.M. to 3:00 P.M. is 30 minutes, and from 3:00 P.M. to 3:10 P.M. is 10 minutes. Therefore, from 1:30 P.M. to 3:10 P.M. is 100 minutes, which is equal to 1 hour and 40 minutes.

Note that in most multiple-choice questions that ask for numerical values, the exact answer should be found, as it should be in this question. If a multiple-choice question includes a word like “approximately,” it generally indicates that the correct option will **not** be an exact value.

13. Option (A) is correct. The question requires an understanding of how to interpret probabilities relative to likelihood of occurrence. The cube has 6 possible outcomes: 1, 2, 3, 4, 5, or 6. The probability of the cube landing with a 4 on the top face is 1 out of 6, or  $\frac{1}{6}$ .

The coin has 2 possible outcomes: heads or tails. The probability of the coin landing heads up is 1 out of 2, or  $\frac{1}{2}$ . Since these two events are independent, the probability of both events occurring is found by multiplying the probabilities of each event occurring on its own, and  $\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$ .

Alternatively, you can create a tree diagram that pairs each of the 6 possible outcomes from the cube with each of the 2 possible outcomes from the coin to yield 12 pairs of outcomes. Since only one pair consists of a 4 on the top face of the cube and heads on the coin, the probability of both events occurring is  $\frac{1}{12}$ .

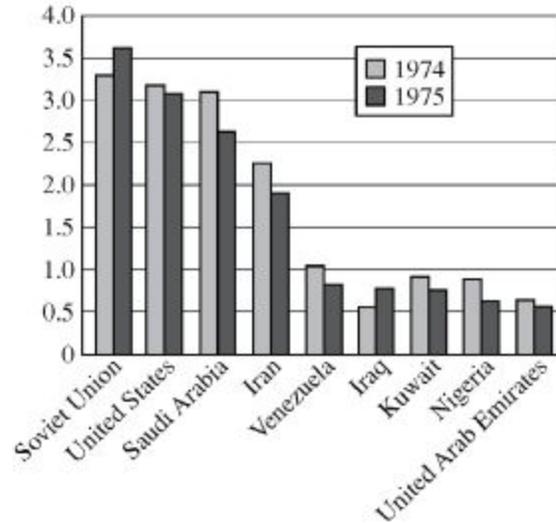
Note that in most multiple-choice questions that ask for numerical values, the exact answer should be found, as it should be in this question. If a multiple-choice question includes a phrase like “best approximates” or “is closest to,” it generally indicates that the correct option will **not** be an exact value.

## Elementary Education: Three Subject Bundle — Social Studies Subtest (5904) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear 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:** The test consists of a variety of selected-response questions, where you select one or more answer choices, and questions where you enter a numeric answer in a box.

1. Which of the following is believed to have occurred during the last Ice Age as a result of a land bridge created between what is 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
  
2. What percentage 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%
  
3. Historically India's society has been organized into hierarchical groups known as
  - (A) tribes
  - (B) castes
  - (C) clans
  - (D) denominations



4. According to the graph, how many of the countries shown produced more crude oil in 1975 than 1974?
  - (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
  
5. Which of the following mountain ranges crosses through the state of Washington?
  - (A) The Cascades
  - (B) The Himalayas
  - (C) The Appalachians
  - (D) The Alps
  
6. Which of the following types of maps shows the boundaries of countries, states, and municipalities?
  - (A) Thematic
  - (B) Topographic
  - (C) Political
  - (D) Meteorological

7. The legal doctrine known as “separate but equal” was overturned by the Supreme Court’s ruling in which of the following cases?
  - (A) *Plessy v. Ferguson*
  - (B) *Brown v. Board of Education of Topeka*
  - (C) *Miranda v. Arizona*
  - (D) *Mapp v. Ohio*
  
8. In the United States, the division of power between the national and state governments demonstrates the principle of
  - (A) checks and balances
  - (B) federalism
  - (C) separation of powers
  - (D) the rule of law
  
9. Which of the following major world religions is monotheistic?
  - (A) Hinduism
  - (B) Buddhism
  - (C) Islam
  - (D) Shintoism
  
10. Jane is saving to buy a new car. Her friends are planning a weekend trip to the beach. She wants to go but decides that saving for the car is more important. Jane’s choice best demonstrates which of the following economic concepts?
  - (A) Opportunity cost
  - (B) Supply and demand
  - (C) Scarcity of resources
  - (D) Comparative advantage

11. The Freedmen's Bureau, which was established after the Civil War, most successfully contributed to which of the following developments in the United States?
- (A) It guaranteed African American people the right to vote in federal elections.
  - (B) It funded the migration of African American people from the rural South to Northern cities.
  - (C) It established schools for African American people who had not previously been able to access education.
  - (D) It required former Confederate states to elect a specific percentage of African American politicians.

## Answers

1. Option (C) is correct. During the Ice Age, the level of the water in the Pacific Ocean lowered, thereby exposing a land bridge across the Bering Strait. The cold northern climate encouraged many people to migrate to North America in search of better living conditions.
2. Option (D) is correct. Article 1, Section 2 of the Constitution of the United States reads, "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.
3. Option (B) is correct. In the fifteenth century A.D., 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.
4. Option (B) is correct. Since the numbers on the left side of the graph increase from bottom to top, it is a matter of determining how many dark-shaded bars are higher than their corresponding light-shaded bars.
5. Option (A) is correct. The Cascade Mountains cross through the state of Washington.
6. Option (C) is correct. A political map shows boundaries of countries, states, and municipalities. A thematic map presents specific information related to a geographic area, such as the location of natural resources. A topographic map shows the physical features of the land. A meteorological map presents information about weather and climate.
7. Option (B) is correct. In *Brown v. Board of Education of Topeka*, the Supreme Court ruled that segregating schools on the basis of race was inherently discriminatory. This decision overturned the precedent set by *Plessy v. Ferguson*, which had upheld the constitutionality of racial segregation in public facilities.
8. Option (B) is correct. Federalism is the division of power between a central government and constituent governments, called states in the United States. The principle of checks and balances refers to the constitutional arrangement of powers that prevents one branch of the government from becoming too powerful. Separation of powers refers to the division of power among the three branches of the United States government. The rule of law is the principle that holds that no person is above the law.
9. Option (C) is correct. Of the major world religions listed, Islam is the only one that is monotheistic. Each of the other religions listed has as a central tenet a belief in more than one deity.
10. Option (A) is correct. Opportunity cost is the value of what is forgone when an economic choice is made. In this example, the opportunity cost of saving for a car is forgoing a weekend trip with friends.

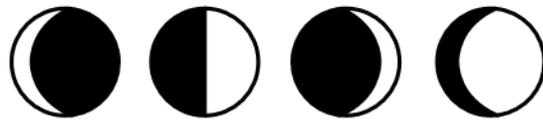
11. Option (C) is correct. The Freedmen's Bureau, which was established by an act of Congress in 1865, focused its efforts on ensuring that African American people in the formerly Confederate states could become self-sufficient after the Civil War by offering a number of services. In addition to issuing rations and clothing, running hospitals, and supervising labor contracts, the Freedmen's Bureau offered education to many African American people who had been denied such opportunities under slavery.

## Elementary Education: Three Subject Bundle — Science Subtest (5905) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear 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 incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case.

- Which of the following geological processes adds new rock to the surface of Earth?
  - Volcanic activity
  - Glacial activity
  - Soil erosion
  - Weathering



- When the Moon is viewed from the Northern Hemisphere at the first quarter of the lunar cycle, it appears like which of the preceding diagrams?
  - 1
  - 2
  - 3
  - 4
- Which **THREE** of the following are ways in which mammals keep themselves warm in cold weather?
  - Shivering
  - Perspiring
  - Fluffing out coat hair
  - Contracting certain blood vessels

4. If a feather and two rocks of different weights are dropped simultaneously from a height of 5 meters in a vacuum, which of the following will be true?
  - (A) Both rocks will hit the ground at the same time but before the feather.
  - (B) The heavier rock will hit the ground first.
  - (C) The lighter rock will hit the ground first.
  - (D) The feather and the two rocks will all hit the ground at the same time.
  
5. 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
  
6. 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
  
7. Which of the following is the broadest category in biological taxonomy?
  - (A) Kingdom
  - (B) Order
  - (C) Genus
  - (D) Species

8. Some human traits are carried by genes on the Y chromosome. A man will transmit these traits to
- (A) one-half of his male offspring
  - (B) one-half of his female offspring
  - (C) all of his male offspring
  - (D) all of his female offspring
9. A chlorine compound is added to swimming pools in order to
- (A) monitor the pH of the water
  - (B) add color to the water
  - (C) soften the water by precipitating harmful chemicals
  - (D) destroy bacteria through an oxidation reaction
10. Two campers each wrap a potato in aluminum foil before baking them in a fire. However, one camper inserts a large nail into the potato after wrapping it in the foil. After the potatoes are placed in the fire, which of the following is most likely to happen?
- (A) Both potatoes will bake at the same rate.
  - (B) Neither potato will bake because the foil will reflect most of the heat.
  - (C) The potato with the embedded nail will bake faster because heat will be conducted through the nail into the potato.
  - (D) The potato with the embedded nail will bake more slowly because heat will be conducted out of the potato through the nail.
11. Alfred Wegener proposed which of the following theories in the early 1900s?
- (A) The Sun, not Earth, is the center of the universe.
  - (B) Earth once contained a single supercontinent.
  - (C) An ocean current called the Gulf Stream flows northward along the east coast of the United States and Newfoundland.
  - (D) The Himalayas were formed by plate tectonics.

12. Which of the following is a chemical element?

- (A) Sodium chloride
- (B) Platinum
- (C) Carbon dioxide
- (D) Water

13. Of the following, which best describes an example of the Doppler effect?

- (A) As light passes through a prism, the light separates into a rainbow.
- (B) As a light beam passes from air into water, the beam changes direction.
- (C) As an emergency vehicle approaches an observer standing by the road, the perceived pitch of the siren increases.
- (D) As a sound wave hits a wall, it is reflected and creates an echo.

## Answers

1. Option (A) is correct. Volcanic activity is the only process in which material from inside Earth is brought to the surface. The other processes are means of wearing down Earth's surface.
2. Option (B) is correct. At the first lunar quarter, the Sun, the Earth, and the 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 of the Moon will appear illuminated.
3. Options (A), (C), and (D) are correct. 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.
4. Option (D) is correct. 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.
5. Option (A) is correct. 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.
6. Option (C) is correct. 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.
7. Option (A) is correct. In biological taxonomy, the broadest category is kingdom, followed by phylum, class, order, family, genus, and species.
8. Option (C) is correct. Human males generally have one X and one Y chromosome. Male offspring will only receive a Y chromosome from their father, while female offspring will only receive an X chromosome from their father. Therefore, genes on the Y chromosome are passed only to male offspring.
9. Option (D) is correct. Chlorine and certain chlorine-containing compounds are highly reactive oxidizing agents that are used as chemical disinfectants in a variety of situations, including the sanitation of swimming pools.
10. Option (C) is correct. Although the aluminum foil will reflect some radiant energy, it will not significantly reduce the flow of energy by conduction. Because a nail is a good thermal conductor, heat will flow into the potato through the nail and bake the potato from the inside as well as from the outside. Thus, the potato with the embedded nail will bake faster.

11. Option (B) is correct. In the early 1900s, Alfred Wegener proposed a theory that Earth once contained a single large landmass called Pangaea.
12. Option (B) is correct. Platinum is a chemical element found on the periodic table of elements. Its chemical symbol is Pt. Sodium chloride, carbon dioxide, and water are compounds that are each composed of combinations of two different elements.
13. Option (C) is correct. The Doppler effect can be observed as the source of a sound moves toward an observer at a fixed position and the successive sound waves arrive faster and faster at the observer's position, resulting in an increase in the frequency of the sound waves arriving at the observer's position. Because the pitch of a sound is proportional to the frequency, the perceived pitch of the sound increases as the vehicle approaches the observer.

## Understanding Question Types

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 selecting a sentence in a text or by selecting 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 seeing them on other standardized tests you have taken. If not, familiarize yourself with them so that you won't have to spend time during the test figuring out how to answer them.

### Understanding Selected-Response and Numeric-Entry Questions

For most questions you will respond by selecting an oval to choose a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by doing the following.

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting 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 to 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.

## Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essay questions and short-answer questions are types of questions that call for a constructed response.

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. For such questions, you must support your position with specific reasons and examples from your own experience, observations, or reading.

Following are a few sample essay topics to review:

- *Brown v. Board of Education of Topeka*

“We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other ‘tangible’ factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does.”

  - A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  - B. What was the rationale given by the justices for their 1954 ruling?
  
- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*
  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.
  
- *“Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people who need a job.”*
  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep the following 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 should not be filled with unnecessary information.
5. **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.
6. **Reread your response.** Check that you have written what you intended to write. Do not leave sentences unfinished or omit clarifying information.

## General Assistance For The Test

### *Praxis*® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more [here](#).

### Doing Your Best

#### Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your *Praxis* test and make the best use of your time. Learn more at [Strategy and Tips for Taking a \*Praxis\* Test](#).

#### Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at [Develop a Study Plan](#).

### Helpful Links

[Ready to Register](#) – How to register and the information you need to know to do so.

[Disability Accommodations](#) – Testing accommodations are available for test takers who meet ETS requirements.

[PLNE Accommodations \(ESL\)](#) – If English is not your primary language, you may be eligible for extended testing time.

[What To Expect on Test Day](#) – Knowing what to expect on test day can make you feel more at ease.

[Getting Your Scores](#) – Find out where and when you will receive your test scores.

[State Requirements](#) – Learn which tests your state requires you to take.

[Other Praxis Tests](#) – Learn about other *Praxis* tests and how to prepare for them.

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

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

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

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



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