



## • • • SECTION 4 • • •

### SAMPLE TEST ITEMS FOR SUBTEST II: MATHEMATICS, SCIENCE, HEALTH AND PHYSICAL EDUCATION

This section of the Oregon Educator Licensure Assessments® (ORELA®) Multiple Subjects Examination Study Guide provides sample test directions, sample multiple-choice items with an answer key, and sample constructed-response items with sample responses and scoring information for Subtest II of the Multiple Subjects Examination.

## SAMPLE TEST DIRECTIONS

A sample of the general directions for ORELA Multiple Subjects Examination Subtest II is shown in the box below.

You should have in front of you:

- (1) a test booklet,
- (2) an Answer Document A, and
- (3) a No. 2 lead pencil.

*IF YOU DO NOT HAVE ALL OF THESE MATERIALS, PLEASE INFORM THE TEST ADMINISTRATOR. PLEASE REMOVE ALL OTHER MATERIALS FROM YOUR DESK.*

### DIRECTIONS

This test consists of two sections: (1) a multiple-choice question section and (2) a constructed-response item section containing two assignments. The **first section** of this booklet contains multiple-choice questions, each of which has four answer choices. Read each question carefully and choose the ONE best answer. Record each answer on Answer Document A in the space that corresponds to the question number. Completely fill in the circle having the same letter as the answer you have chosen. *Use only a No. 2 lead pencil.*

Sample Question:

1. What is the capital of Oregon?
  - A. Pendleton
  - B. Portland
  - C. Salem
  - D. Beaverton

The correct answer to this question is C. You would indicate that on the answer document as follows:

1. (A) (B) ● (D)

Try to answer all questions. In general, if you have some knowledge about a question, it is better to try to answer it. You will not be penalized for guessing.

The **second section** of this booklet contains two constructed-response items that require written responses. Directions for the constructed-response item section appear immediately before the assignments.

You may use the margins of this booklet for scratch paper, but all of your answers, including your responses to the constructed-response items, must be recorded in Answer Document A. Only the responses recorded in Answer Document A will be scored.

You may work on the multiple-choice questions and the constructed-response items in any order that you choose. Be sure to allocate your time carefully so you are able to complete the entire test within the testing session. The words "End of Test" follow the last assignment. You may go back and review your answers at any time during the testing session. Be sure you have answered all questions, completed all assignments, and properly recorded all of your responses in your answer document before raising your hand for dismissal. Your test materials will be collected by a test administrator before you are dismissed.

FOR SECURITY REASONS, YOU MAY NOT TAKE NOTES OR REMOVE ANY OF THE TEST MATERIALS FROM THE ROOM. If you have any questions, please ask them now before beginning the test.



DO NOT GO ON UNTIL YOU ARE TOLD TO DO SO.

## SAMPLE MULTIPLE-CHOICE ITEMS

This section presents sample multiple-choice items for you to review as part of your preparation for Subtest II of the ORELA Multiple Subjects Examination. To demonstrate how the test objectives may be assessed, each sample item is preceded by the objective that it measures. On an actual test, the objectives will not be given.

The sample multiple-choice items are designed to illustrate the nature of the test items. They should not be used as a diagnostic tool to determine your individual strengths and weaknesses. The multiple-choice items require you to demonstrate more than the ability to recall factual information. They ask you to think critically about the information, to analyze it, to consider it carefully, or to apply it to a hypothetical situation.

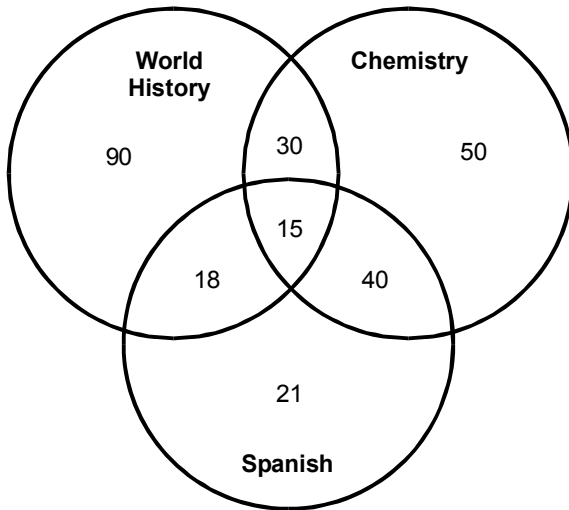
Work through each item carefully before referring to the answer key, which follows the sample multiple-choice items.

**Objective 0019**

*Understand mathematical communication.*

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1. Use the diagram below to answer the question that follows.



The Venn diagram above shows the number of students in a high school who are taking world history, Spanish, and chemistry. How many students are taking exactly two of these three courses?

- A. 15
  - B. 45
  - C. 88
  - D. 103
2. A store has advertised a sale in which all merchandise is priced at 23% off the original price. If an item from this store originally cost  $x$  dollars, how much will it cost during the sale?
- A.  $0.23x$
  - B.  $0.77x$
  - C.  $1.23x$
  - D.  $1.77x$

**Objective 0020**

*Understand numbers, number theory, and numeration.*

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3. The volume of the earth is approximately 259,000,000,000 cubic miles. Which of the following represents this figure in scientific notation?
- A.  $2.59 \times 10^9$
  - B.  $2.59 \times 10^{10}$
  - C.  $2.59 \times 10^{11}$
  - D.  $2.59 \times 10^{12}$
4. Which of the following numbers is a factor of 2400 and a multiple of 12?
- A. 3
  - B. 8
  - C. 36
  - D. 48

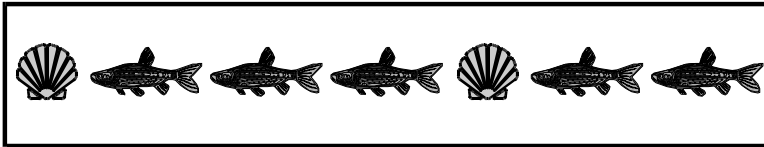
**Objective 0021**

*Understand mathematical problem solving.*

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5. A plumber charges a basic fee of \$35 per job and \$99 per hour for labor, which includes the \$32 per hour his assistant is paid. The plumber also charges customers for the cost of materials. Which of the following equations shows the total cost to the customer,  $c$ , of a 2-hour job with \$40 worth of materials?
- A.  $c = 35 + 2(99 + 40)$
  - B.  $c = 35 + 2(99) + 40$
  - C.  $c = 2(35 + 99 - 32)$
  - D.  $c = 2(35 + 99 + 32 + 40)$

6. Use the pattern below to answer the question that follows.



The pattern above appears as a border along the top edge of a wall. If the entire pattern repeats so that there are 40 fish on one wall, how many seashells will there be on the wall?

- A. 8
- B. 12
- C. 16
- D. 20

**Objective 0022**

*Understand methods of mathematical operations, calculation, and estimation.*

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7. Which of the following number properties is illustrated by the equation  $(3 + 5) + 8 = 3 + (5 + 8)$ ?
- A. transitive property
  - B. commutative property
  - C. distributive property
  - D. associative property
8. Increasing a number by  $4\frac{1}{2}\%$  is equivalent to multiplying it by which of the following?
- A. 0.045
  - B. 0.450
  - C. 1.0045
  - D. 1.045

**Objective 0023**

*Understand and apply concepts and methods of measurement.*

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9. Use the problem below to answer the question that follows.

A 5-foot-tall student casts a 12-foot-long shadow. At the same time, a nearby tree casts a 96-foot-long shadow. What is the height of the tree?

The best approach to solving the problem above involves using:

- A. number theory.
  - B. trigonometry.
  - C. the Pythagorean theorem.
  - D. similar triangles.
10. Sam plans to make 10 gallons of fresh lemonade and sell it in 8-ounce cups at a local fair. If the total cost of making the lemonade is \$16, what is the cost of making 8 ounces of lemonade?
- A. 8 cents
  - B. 10 cents
  - C. 16 cents
  - D. 20 cents



**Objective 0024**

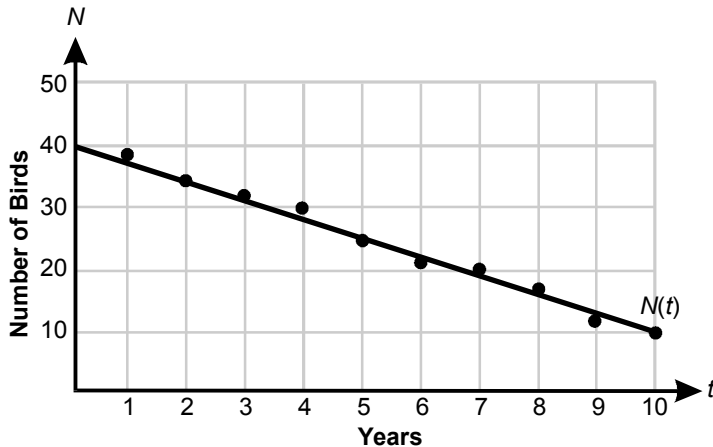
Understand patterns, relationships, and algebraic concepts.

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11. Which of the following represents the value of  $x$  that is the solution to the equation  $5x - a = 6 + 2x$ ?

- A.  $\frac{6+a}{3}$
- B.  $\frac{6-a}{3}$
- C.  $\frac{6+a}{7}$
- D.  $\frac{6-a}{7}$

12. Use the graph below to answer the question that follows.



Researchers are documenting the size of a certain bird population. The graph above shows the number of birds counted each year over a ten-year period and the best-fit line through the data points. Which of the following best represents the equation of the line through the data points?

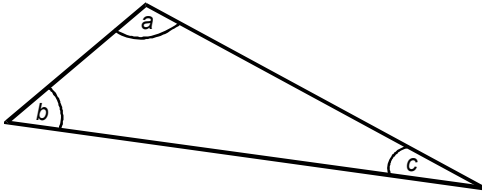
- A.  $N = -4t + 30$
- B.  $N = -3t + 30$
- C.  $N = -4t + 40$
- D.  $N = -3t + 40$

**Objective 0025**

*Understand and apply principles and properties of geometry.*

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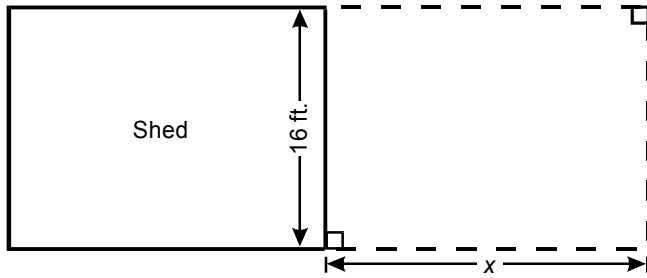
13. Use the diagram below to answer the question that follows.



If the measure of  $\angle a$  is twice the measure of  $\angle b$ , which of the following expressions could be used to find the measure of  $\angle c$  in the triangle above?

- A.  $180^\circ - 3b$
- B.  $90^\circ - (a + 2b)$
- C.  $180^\circ - 3a$
- D.  $90^\circ + 2(a + b)$

14. Use the figure below to answer the question that follows.



María plans to enclose a rectangular area of her yard using the 16-foot side of her storage shed as one side of the enclosure, as shown above. If she uses 64 feet of fencing to complete the enclosure, what will be the length,  $x$ , of the enclosure?

- A. 16 feet
- B. 18 feet
- C. 24 feet
- D. 32 feet

Section 4: Sample Test Items for Subtest II

**Objective 0026**

*Understand concepts and applications of probability.*

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15. Use the table below to answer the question that follows.

Traffic Light Color	Duration
Red	30 seconds
Yellow	15 seconds
Green	45 seconds

The table above shows the number of seconds that a traffic light is red, yellow, and green. What are the chances that the traffic light is green at any given moment?

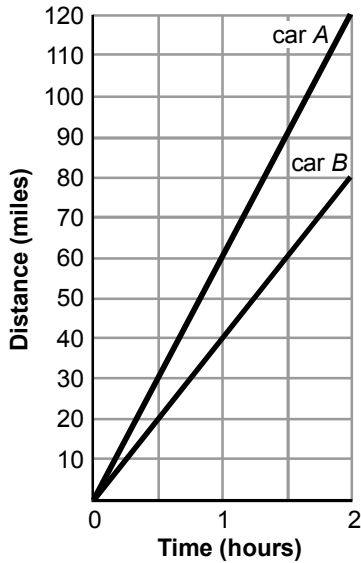
- A. 30%
- B. 50%
- C. 60%
- D. 75%

**Objective 0027**

Understand concepts and applications of statistics.

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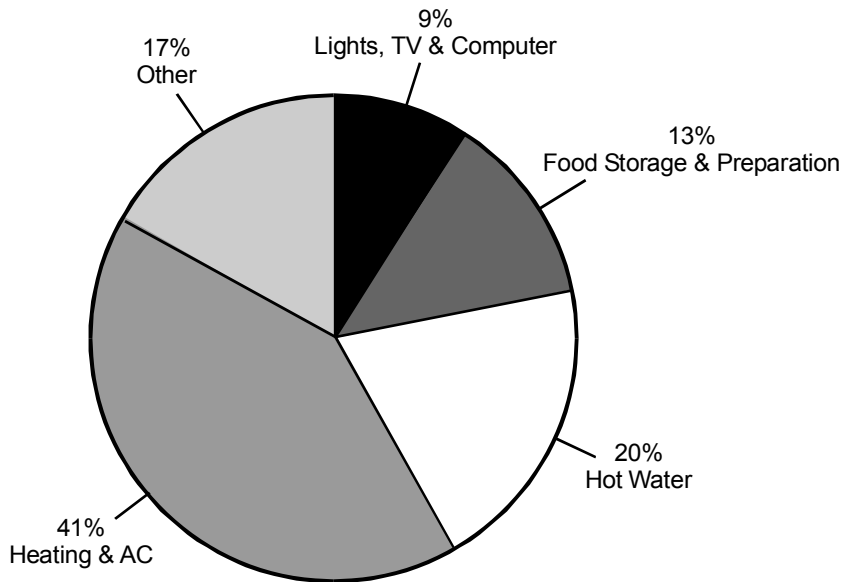
16. Use the graph below to answer the question that follows.



Cars *A* and *B* travel in the same direction for a 2-hour period and the distance they travel is represented in the graph above. If each car continues to travel in the same direction and at its current speed, what will the distance between them be after 3 hours?

- A. 40 miles
- B. 60 miles
- C. 80 miles
- D. 100 miles

17. Use the circle graph below to answer the question that follows.



The circle graph above shows the average energy use of a single-family household. For a household that uses 115 million BTUs per year, approximately how much more energy is used for hot water than for food storage and preparation?

- A. 8 million BTUs
- B. 12 million BTUs
- C. 15 million BTUs
- D. 23 million BTUs

**Objective 0028**

*Understand the nature and histories of mathematics.*

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18. The ancient Babylonians developed and used a base-60 number system. This number system is still used today in which of the following applications?
- A. scientific notation
  - B. computer programming
  - C. metric measurement
  - D. timekeeping
19. The Roman number system is an example of which of the following systems of numeration?
- A. base two
  - B. base ten
  - C. base six
  - D. base seven

**Objective 0029**

*Understand concepts and principles of physical science.*

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20. Which of the following best explains why sunlight is broken into different colors when it passes through a prism?
- A. Sunlight is composed of a single wavelength that is altered when it hits the angled surface of the prism, creating the colors of the rainbow.
  - B. The various wavelengths in sunlight excite atoms in the prism to different degrees, causing the atoms to emit the full spectrum of colors.
  - C. Sunlight hitting the angled surface of the prism is partially reflected, separating white light from the fainter colors.
  - D. The various wavelengths in sunlight are bent at different angles as they hit the prism surface, separating them into the colors of the rainbow.
21. Which of the following questions would help distinguish whether a substance is a liquid or a gas?
- A. Does it occupy space and have mass?
  - B. Does it take the shape of its container?
  - C. Does it react with other substances?
  - D. Does it have a definite volume?



**Objective 0030**

*Understand concepts and principles of life science.*

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22. B represents the dominant form of the gene that produces brown eye color, and b represents the recessive form of the gene that produces blue eye color. One parent has the genotype Bb and has brown eyes. The other parent has the genotype bb and has blue eyes. What is the probability that a child of these two parents will have brown eyes?
- A. 100%
  - B. 75%
  - C. 50%
  - D. 25%
23. In a tree, phloem cells primarily perform the function of:
- A. promoting new growth through cell division.
  - B. producing sugar through the process of photosynthesis.
  - C. enhancing structural stability of the leaves.
  - D. transporting sugar from the leaves to the rest of the tree.

**Objective 0031**

*Understand concepts and principles of earth and space science.*

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24. Which of the following is a property of water that makes it different from most other earth materials?
- A. The molecules in water are bound together by strong chemical bonds.
  - B. Water expands when it changes from a liquid to a solid.
  - C. The molecules in water vibrate even when frozen in the solid phase.
  - D. Water absorbs heat when it changes from a liquid to a gas.
25. Which of the following properties of water is the most significant factor in the mechanical weathering of exposed bedrock?
- A. Water expands as it freezes.
  - B. Water is an effective solvent.
  - C. Water is denser than most minerals.
  - D. Water changes temperature slowly.

**Objective 0032**

*Understand concepts and principles of scientific inquiry and investigation.*

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26. A researcher observes that certain shore birds move inland as major storms approach. The researcher thinks that the birds sense the change in pressure and wind direction associated with a major storm and respond by moving inland. The researcher in this situation is in the process of:
- A. forming a hypothesis.
  - B. designing an experiment.
  - C. testing a theory.
  - D. arriving at a conclusion.

**Objective 0033**

*Understand the relationships among science, technology, and society.*

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27. Which of the following technologies had the greatest influence on population growth in the western regions of the United States during the nineteenth century?
- A. railway transportation
  - B. mechanized agriculture
  - C. telegraph communications
  - D. industrialized manufacturing
28. Scientists working to identify the chemical properties of tropical plants are frequently interested in finding out how indigenous groups have traditionally used these plants. Investigating the traditional uses and chemical properties of tropical plants is helpful primarily because this information:
- A. provides researchers with insights into how the plants can be used to develop modern medicines.
  - B. offers researchers strategies for protecting the ecosystems in which the plants live.
  - C. supplies researchers with information on how the plants may be used as sources of energy.
  - D. gives researchers new ways to improve the crop yields of existing agricultural plants.

**Objective 0034**

*Understand the nature and history of science.*

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29. Which of the following is a fundamental principle that underlies the practice of science?
- A. Scientific discovery is based on intuition and good luck.
  - B. Scientific research creates a base of knowledge that is free of personal or cultural bias.
  - C. Scientific knowledge is limited to observable facts and phenomena.
  - D. Scientific understanding is based on the accumulation and interpretation of evidence.
30. Which of the following scientific disciplines is most closely related to the early development of navigational technologies?
- A. physics
  - B. oceanography
  - C. astronomy
  - D. meteorology

**Objective 0035**

*Understand basic principles and practices related to personal and community health and safety.*

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31. Which of the following body systems is primarily responsible for regulating the level of sugar in the blood?
- A. circulatory
  - B. digestive
  - C. endocrine
  - D. nervous
32. Which of the following activities is most dependent on the development of fine motor skills?
- A. clapping in rhythm
  - B. balancing on a beam
  - C. catching a ball
  - D. drawing pictures

**Objective 0036**

*Understand basic principles and practices related to lifetime physical fitness.*

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33. Which of the following would most likely help children develop positive long-term physical fitness behaviors?
- A. regular participation in a variety of enjoyable vigorous activities
  - B. weekly involvement in competitive team sports that expand endurance
  - C. frequent attendance at popular athletic events
  - D. daily workouts that increase muscle mass and improve body image
34. Elevated levels of low-density lipoproteins (LDL cholesterol) have been shown to be a major risk factor in coronary heart disease. Which of the following actions has been found to be most effective in helping to reduce many people's LDL cholesterol levels?
- A. training with weights
  - B. reducing sugar consumption
  - C. engaging in aerobic exercise
  - D. increasing protein intake

**Objective 0037**

*Understand basic principles and practices of physical education.*

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35. When children are going to be playing a game such as basketball, which of the following precautions is most important to take to minimize the likelihood of injury?
- A. warning the children of the risks involved in the game
  - B. inspecting the facility for hazards prior to use
  - C. assigning the children to teams for the game
  - D. fitting the facility with regulation-size equipment
36. Which of the following safety-related tasks is most important for a teacher to do before students use gymnastics equipment?
- A. Check over the equipment to ensure it is in good working order.
  - B. Make sure the school nurse is on duty and available for emergencies.
  - C. Check the equipment manufacturer's Web site for proper-use suggestions.
  - D. Make sure that a first aid kit is easily accessible and properly stocked.



### Answer Key for Sample Multiple-Choice Items

- |       |       |
|-------|-------|
| 1. C  | 19. B |
| 2. B  | 20. D |
| 3. C  | 21. D |
| 4. D  | 22. C |
| 5. B  | 23. D |
| 6. C  | 24. B |
| 7. D  | 25. A |
| 8. D  | 26. A |
| 9. D  | 27. A |
| 10. B | 28. A |
| 11. A | 29. D |
| 12. D | 30. C |
| 13. A | 31. C |
| 14. C | 32. D |
| 15. B | 33. A |
| 16. B | 34. C |
| 17. A | 35. B |
| 18. D | 36. A |

## INFORMATION ABOUT THE CONSTRUCTED-RESPONSE ITEMS

### Performance Characteristics and Scoring Scale

Each examinee's written responses to the constructed-response items will be scored using a method known as focused holistic scoring. In this method, scorers judge the overall effectiveness of each response in meeting specified criteria. Each response is scored by at least two scorers and is assigned a score based on a holistic scale. The score points on the holistic scoring scale reflect the extent to which the examinee demonstrates the knowledge and skills included in the set of performance characteristics that have been defined as important for the assignment. Although this method *focuses* on the specific performance characteristics, it is *holistic* in that each assigned score describes the overall effectiveness of these characteristics working in concert in response to the assignment.

### Performance Characteristics

PURPOSE	The extent to which the response addresses the assignment's charge in relation to relevant ORELA test objectives
SUBJECT MATTER KNOWLEDGE	The application of accurate subject matter knowledge as described in the relevant ORELA test objectives
SUPPORT	The appropriateness and quality of the supporting evidence in relation to relevant ORELA test objectives

### Scoring Scale

The three points of the scoring scale correspond to varying degrees of performance. The following statements describe typical responses at each score point.

SCORE POINT	SCORE POINT DESCRIPTION
3	<p>The "3" response reflects a command of the relevant knowledge and skills as defined in the ORELA test objectives.</p> <ul style="list-style-type: none"> <li>The purpose of the assignment is fully achieved.</li> <li>There is an accurate application of relevant subject matter knowledge.</li> <li>There is appropriate and specific relevant supporting evidence.</li> </ul>
2	<p>The "2" response reflects a general command of the relevant knowledge and skills as defined in the ORELA test objectives.</p> <ul style="list-style-type: none"> <li>The purpose of the assignment is largely achieved.</li> <li>There is a largely accurate application of relevant subject matter knowledge.</li> <li>There is acceptable relevant supporting evidence.</li> </ul>
1	<p>The "1" response reflects a limited or no command of the relevant knowledge and skills as defined in the ORELA test objectives.</p> <ul style="list-style-type: none"> <li>The purpose of the assignment is only partially or not achieved.</li> <li>There is limited or no application of relevant subject matter knowledge.</li> <li>There is little or no relevant supporting evidence.</li> </ul>
U	The "U" (Unscorable) is assigned to a response that is unrelated to the assignment, illegible, or primarily in a language other than English or does not contain a sufficient amount of original work to score.
B	The "B" (Blank) is assigned to a response that is blank.

## Sample Directions for the Constructed-Response Items

A sample of the directions for the constructed-response items for ORELA Multiple Subjects Examination Subtest II is shown in the box below.

### CONSTRUCTED-RESPONSE ITEM DIRECTIONS

For each constructed-response item in this section, you are to prepare a written response of up to one page and record it in the area provided on the appropriate Assignment Response Sheet in Answer Document A.

Read each assignment carefully before you begin to write. Think about how you will organize what you plan to write. You may use any blank space provided in this test booklet following each assignment to make notes, write an outline, or otherwise prepare your response. *However, each of your final responses must be written on the appropriate Assignment Response Sheet in Answer Document A.*

Your responses will be evaluated based on the following criteria.

- **PURPOSE:** the extent to which the response addresses the assignment's charge in relation to relevant ORELA test objectives
- **SUBJECT MATTER KNOWLEDGE:** the application of accurate subject matter knowledge as described in the relevant ORELA test objectives
- **SUPPORT:** the appropriateness and quality of the supporting evidence in relation to relevant ORELA test objectives

The constructed-response items are intended to assess subject matter knowledge and skills, not writing ability. Your responses, however, must be communicated clearly enough to permit a valid judgment of your knowledge and skills. Your responses should be written for an audience of educators in the field.

Your responses should be your original work, written in your own words, and not copied or paraphrased from some other work. Please write legibly. You may not use any reference materials during the test. Remember to review your work and make any changes you think will improve your responses.

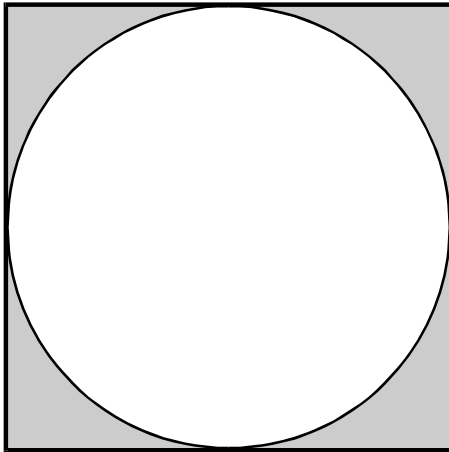
The multiple-choice section of the answer document containing your name will be removed from your written responses to maintain your anonymity during the scoring process. Do not write your name on any other portion of the answer document, and do not separate any of the sheets from the document.

Please turn the page and begin the constructed-response item section of the test.

## SAMPLE CONSTRUCTED-RESPONSE ITEMS

### Sample Constructed-Response Item 1

Use the information below to complete the exercise that follows.



In the diagram above, a circle is inscribed within a square. The circumference of the circle is  $16\pi$  cm.

Using your knowledge of the properties of geometric figures and a value for  $\pi$  of  $\frac{22}{7}$ :

- calculate the radius of the circle; and
- determine the combined area of the four shaded parts of the square that lie outside of the circle to the closest whole number.

Show your work.

### A Strong Response to Sample Constructed-Response Item 1

Area of the combined shaded parts = area of the square minus the area of the circle

Radius of the circle:

$$\text{Know } c = 2\pi r$$

$$\text{given } c = 16\pi \text{ cm}$$

$$\text{so, } 16\pi \text{ cm} = 2\pi r, r = 8 \text{ cm}$$

Area of the square:

$$\text{Length of a side: } 2(8 \text{ cm}) = 16 \text{ cm}$$

$$\text{Area of a square} = (\text{length of side})^2$$

$$A = (16 \text{ cm})^2$$

$$A = 256 \text{ cm}^2$$

Area of the circle:

$$\text{Know } A = \pi r^2$$

$$\text{so, } A = \pi(8 \text{ cm})^2$$

$$A = 64\pi \text{ cm}^2$$

So, total area of shaded parts:      Let  $\pi = \frac{22}{7}$

$$256 \text{ cm}^2 - 64\pi \text{ cm}^2$$

$$= 256 \text{ cm}^2 - 64\left(\frac{22}{7}\right) \text{ cm}^2$$

$$= 256 \text{ cm}^2 - \frac{1408}{7} \text{ cm}^2$$

$$= 256 \text{ cm}^2 - 201\frac{1}{7} \text{ cm}^2$$

$$= 54\frac{6}{7} \text{ cm}^2$$

So,  $A = 55 \text{ cm}^2$  to the nearest whole number

## Sample Constructed-Response Item 2

Use the information below to complete the exercise that follows.

When sunlight strikes the large oceans covering Earth, some of the energy absorbed by the surface of these large water bodies is reradiated as infrared energy that warms the lower atmosphere. Earth processes distribute the warmth of these low-latitude oceans, helping maintain a range of habitable climates throughout the world.

Using your knowledge of earth science:

- identify and describe an earth process that helps distribute the warmth of the oceans into cooler regions; and
- explain how this transfer of energy is accomplished by that earth process.

**A Strong Response to Sample Constructed-Response Item 2**

The sun is most intense along the earth's equator, where it warms the ocean's surface. The pattern of prevailing winds helps explain how this heat energy is distributed to cooler regions. In the Northern Hemisphere, the trade winds drag along relatively cold surface water toward the equator, where the ocean's surface is warmed by the sun. This warmed water is then dragged along to the west by the easterly winds. The west-moving surface water follows a curve to the right--in this case going northward. The prevailing "westerlies" move these warmer surface waters toward the north, where the stored heat energy is released to the atmosphere, thus warming the air in that area. Continued global wind circulation drags this now cooler water back to the lower latitudes, where it is again heated by the sun. The cycle repeats itself.