AMERICA'S PREMIERE TESTING READINESS PROGRAM

ACT®
(Form Code 1572C)

Cambridge Navigator Plus:
The Complete Explanation Guide
to the ACT, Inc. ACT Practice Exam

5 Ways to Increase Score Gains Using Cambridge's *Navigator Plus*

Navigator Plus is Cambridge's complete explanation guide to a previously administered test. It includes explanations for each item on the test, categorization for each item, an answer key, and more.

The following list provides suggestions for implementing the Navigator into your program to increase score gains.

1. **Simulate test day as much as possible when proctoring tests.** Students will benefit from a testing experience that closely simulates what they will experience on test day. They will feel more confident if they know what to expect.

2. **Follow up when you receive your data.** Use the reports you receive from Cambridge to cover the items your class struggled as a group to answer (see the Error Analysis report). Taking this step within two weeks of administering the test will ensure that your students haven't forgotten the items you cover and will be able to learn from their testing experiences.

3. **Use the Pre-Assessment Item references in the *Victory* lesson to illustrate key points.** Your teacher's guide includes references to items on your pre-assessment that you can use as additional examples. Keep a copy of your pre-assessment test booklet handy so that you can cover these items with your students. Using pre-assessment items as additional examples helps students connect the concepts you are teaching with their test-day experiences.

4. **Don't forget to review the wrong answers.** Many explanations in this Navigator packet include references to each wrong answer choice. Students will benefit from reviewing why each wrong answer is wrong so that they can recognize what makes the right answer correct and use the process of elimination to eliminate similar wrong answers in the future.

5. **Pay attention to item categories.** Each item in this Navigator packet includes a category path that corresponds to the course concept outline in your *Victory* text as well as the categories listed in the Item Index of your *Victory* text. Use the Item Index to identify items students can use for further practice.

Category Paths

Throughout these explanations, each item includes a **Cambridge Category Path** which links the item to the Course Concept Outline in Cambridge's *Victory* series. For example:

> *Mathematics/Geometry/Triangles/Pythagorean Theorem*

An item with this particular category path is found in the Mathematics Test (based on Level 1 of the category path, mathematics) and tests students' knowledge of geometry (Level 2 of the category path), more specifically of triangles (Level 3), and even more specifically of the Pythagorean theorem (Level 4). The *Victory* Mathematics Lesson includes a section on the Pythagorean theorem, which you can find by referencing the Course Concept Outline at the beginning of the mathematics section in the *Victory* book. Additionally, you can find items testing geometry, triangles, or the Pythagorean theorem using the Item Index at the end of the *Victory* Student Text and Teacher's Guide.

ENGLISH TEST EXPLANATIONS

PASSAGE I

1. **(A)** *English/Usage and Mechanics/No Change.* The original is correct because the underlined comma is used properly to set off the dependent clause that describes the behavior of the water droplets ("following a specific process of chemical bonding as they freeze").

2. **(J)** *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* (J) is the correct answer choice because "however" is the only adverb that provides the contrast needed to transition between the first and second sentences of this paragraph. The specific process of chemical bonding to form six-sided snowflakes is known, but the process of chemical bonding involved in the creation of triangular snowflakes remains a mystery.

    TIP Notice right away that all of the answer choices except for "however" indicate an extension of thought. Since "however" is the odd one out, first testing (J) may help expedite the problem-solving process.

3. **(D)** *English/Usage and Mechanics/Sentence Structure/Fragments.* "Forming" seems to function as a noun; and in doing so, the original results in an incomplete sentence: the shape of the snowflakes suggests that forming through a different chemical process ... *does what*? (D) is the correct answer choice because it addresses the issue of the fragment by replacing the seeming noun "forming" with the plural pronoun "they" (which refers to the plural noun "snowflakes") and the plural present tense verb "form."

4. **(H)** *English/Usage and Mechanics/Sentence Structure/Unintended Meanings.* (H) is the correct answer choice because it addresses the issue of unintended meaning (that it was the discovery that re-created snowflake formation); instead, the writer intends to say that scientists Kenneth Libbrecht and Hannah Arnold re-created snowflake formation.

5. **(B)** *English/Usage and Mechanics/Sentence Structure/Run-On Sentences.* (B) is the correct answer choice because it addresses the issue of the run-on sentence by using a comma to set off a dependent clause beginning with a present participle ("causing").

6. **(J)** *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement.* (J) is the correct answer choice because the plural present tense verb "bump" agrees in number and tense with its subject ("molecules").

7. **(B)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* (B) is the correct answer choice because without the underlined portion, it would not be made clear that certain water vapor molecules skip the liquid water phase as a result of bumping into falling snowflakes.

8. **(J)** *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement.* (J) is the correct answer choice because the plural present tense verb "form" agrees in number and tense with its subject ("snowflakes").

9. **(C)** *English/Usage and Mechanics/Punctuation/Colons.* (C) is the correct answer choice because it uses a colon to introduce the phrase "one significant addition to the process" before "dust." A colon is the most appropriate punctuation mark to use here because it expands and clarifies a part of the sentence that comes before, introducing important words or phrases to the sentence.

10. **(J)** *English/Usage and Mechanics/Punctuation/Commas.* (J) is the correct answer choice because it removes the comma that disrupts the logical flow of the sentence by separating the subject ("pressure") from its verb ("causes").

11. **(B)** *English/Usage and Mechanics/Grammar and Usage/Adjectives versus Adverbs.* (B) is the correct answer choice because it uses the comparative "more" in conjunction with the adverb "quickly" to

modify the verb "form." The phrase "form more quickly" sets up a comparison between one edge of the snowflake and the rest of the snowflake.

12. **(G)** *English/Usage and Mechanics/Punctuation/Dashes.* (G) is the correct answer choice because only a comma (not a dash) can be used to join a dependent clause with an independent clause.

13. **(A)** *English/Rhetorical Skills/No Change.* This item deals with recognizing whether the underlined portion provides an effective conclusion. To begin the passage, the writer discusses the process of chemical bonding involved in the formation of snowflakes, indicating that they are hexagonal in shape. The writer goes on to describe how the triangular snowflake formed as a result of interfering impurities is in fact an illusion and is actually hexagonal. So, regardless of whether snowflakes are affected by dust particles, "the basic laws of chemistry still apply."

14. **(H)** *English/Rhetorical Skills/Organization/Paragraph-Level Structure.* The sentence under consideration describes two forms of snowflake growth (branching and faceting). This sentence, therefore, would most logically be placed at the end of the second paragraph, immediately following the sentence explaining that "the flake grows outward into bigger and more complex hexagonal arrangements." So, (H) is the correct answer choice.

> **TIP** Use verbal clues to help locate the context in which the given material would provide support. In this case, the sentence discusses two forms of "growth." Throughout the essay, the only instance of this word (or a form of it) is in the second paragraph ("grow").

15. **(D)** *English/Rhetorical Skills/Strategy/Main Idea.* As already established in the explanation for item #13, it is the case that "the basic laws of chemistry still apply," even when snowflakes are affected by impurities. This means that if the writer's primary purpose is to describe a discovery that *changed* how we understand the basic laws of chemistry, this essay would not accomplish that purpose. So, (D) is the correct answer choice.

> **TIP** Keep an eye out for any item whose correct answer has already been determined by a previous item's correct answer.

PASSAGE II

16. **(H)** *English/Usage and Mechanics/Sentence Structure/Problems of Coordination and Subordination.* (H) is the correct answer choice because it eliminates the coordinating conjunction "and," which results in the correct joining of a dependent clause with an independent clause. Remember that a coordinating conjunction immediately preceded by a comma is used to join two *independent* clauses.

17. **(B)** *English/Usage and Mechanics/Grammar and Usage/Verb Tense.* (B) is the correct answer choice for a couple of reasons. First, the verb "would need" is consistent with the past tense used throughout the essay. Second, "would have needed" not only sets up a conditional that is not completed ("would have needed the warmth . . . altitudes" *if*. . .), but it also incorrectly suggests that the hikers did not have the warmth from their bodies that they needed in the high altitudes.

18. **(J)** *English/Rhetorical Skills/Style/Conciseness.* (J) is the correct answer choice because it eliminates the redundancy of the original. That the hikers were walking on jumbled rocks is already established in the previous sentence. And to say that the hikers slipped because of what they were slipping on is both redundant and circular.

> **TIP** In questions that test concision, the shortest answer is usually the correct answer.

19. **(C)** *English/Usage and Mechanics/Grammar and Usage/Diction.* (C) is the correct answer choice because the preposition "with" expresses the writer's intended meaning. The original incorrectly suggests that the roof is made of something that is piled *on* top of fallen rocks. Instead, the writer intends to say that the roof is made *with* fallen rocks that are piled high.

20. **(H)** *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.* (H) is the correct answer choice because it removes the two pronouns ("which" and "it") that both refer to the same antecedent

("station brand") and as a result make for a confusing construction. (H) simply uses a comma to set off the dependent clause describing the station brand.

> **TIP** Notice that sometimes when the original is wrong, it is constructed in a way that might be acceptable had it been worded and/or punctuated a little differently: ". . . a clerk burned the station brand into our walking sticks, which was proof of. . ." or ". . . a clerk burned the station brand into our walking sticks; it was proof of . . ."

21. **(A)** *English/Usage and Mechanics/No Change.* This item deals with pronoun usage and diction. The original is correct because the pronoun "most" is used properly with the preposition "of" to indicate a distance covered on a particular route.

22. **(F)** *English/Usage and Mechanics/No Change.* This item deals with verb tense. The original is correct because the present participle verb "forming" is used properly to introduce the dependent clause describing the shape taken by the condensed group of hikers: "an illuminated line."

23. **(B)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* (B) is the correct answer choice because it is the only option that supports the idea of a slow ascent ("a few steps at a time") and that such a pace was not of the hikers' choosing ("<u>only</u> a few steps at a time").

24. **(H)** *English/Usage and Mechanics/Punctuation/Commas.* (H) is the correct answer choice because the comma is used properly to join the introductory dependent clause with the independent clause that follows. A colon, used incorrectly here, is typically used to introduce a list, definition, or explanation.

25. **(C)** *English/Usage and Mechanics/Punctuation/Apostrophes.* (C) is the correct answer choice because it retains the singular possessive "crater's" to properly modify the singular noun "edge" while replacing the improperly used plural possessive "cliffs'" with the plural noun "cliffs."

26. **(F)** *English/Rhetorical Skills/No Change.* (F) is the correct answer choice because it is the only option that restates a previously mentioned idea ("[i]n the half-light of the rising sun") in order to emphasize the hikers' anticipation when they reached the summit.

27. **(D)** *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* (D) is the correct answer choice because "finally" is the only adverb that provides the transition needed to introduce the fifth and final paragraph of the essay, which describes the last in a series of events.

28. **(G)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* (G) is the correct answer choice because the phrase "shattered over" is the only option that dramatically emphasizes the ruggedness of the landscape and is at the same time an appropriate word choice in this context.

29. **(A)** *English/Rhetorical Skills/No Change.* The sentence under consideration describes the hikers gearing up for ("[w]e clipped small flashlights onto our coats") and setting out on ("started up the trail") their journey. It also indicates that the time of day is sunset ("as the sun dipped below the trees"). This sentence, therefore, would most logically be placed at the end of the first paragraph, following the sentence situating the time of day ("Sunset at the base, . . .") and preceding the second paragraph that begins with "[a]s we hiked." So, (A) is the correct answer choice.

> **TIP** Just as with item #14, use verbal clues to help locate the context in which the given material would provide support. In this case, the sentence in question provides clues that relate to the sequence of events described.

30. **(F)** *English/Rhetorical Skills/No Change.* This essay describes a group of hikers on Mt. Fuji in Japan who are dealing with a number of challenges: cold temperatures at "high altitudes," darkness, treacherous terrain ("volcanic rocks"), and strong winds. This means that if the writer's primary purpose is to describe the experience of doing something difficult, this essay would accomplish that purpose. So, (F) is the correct answer choice.

PASSAGE III

31. (B) *English/Usage and Mechanics/Punctuation/Commas.* (B) is the correct answer choice because it removes the two commas that disrupt the logical flow of the sentence. The proper name "Juan Quezada" is an essential element of the sentence (object of the verb "named" and subject to the verb "gathered") and therefore should not be set off with punctuation.

32. (H) *English/Usage and Mechanics/Punctuation/Commas.* This item asks for the alternative to the underlined portion that would NOT be acceptable. (H) is the correct answer choice because with parentheses to set off the non-essential information, the one comma separates the subject "pots" from its verb ("painted").

33. (B) *English/Usage and Mechanics/Punctuation/Commas.* The original has two problems, and (B) solves both of them. First, it removes the comma that disrupts the logical flow of the sentence by separating the main clause ("Fascinated . . . Quezada wondered") from the conditional clause ("if he could make pots like these"). Second, it replaces the question mark with a period, which is the appropriate end-stop punctuation in this context, since "if he could make pots like there" is an indirect question, not a direct one.

TIP Do not be distracted by the word "if," which is commonly used to introduce a question.

34. (H) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* The end of the first paragraph mentions how Quezada was curious as to whether he was capable of making pots similar to those of his ancestors, and the beginning of the second paragraph offers a description of him working with clay to shape a pot. So, (H) is the correct answer choice because it us Quezada acquired his clay from the mountains.

35. (A) *English/Usage and Mechanics/No Change.* This item deals with faulty parallelism and sequence of verb tense. The original is correct because the verb "had taught" not only sets up a parallel structure with the verb preceding the conjunction "and" ("was selling"), but its tense also accurately expresses the sequence of events.

36. (F) *English/Rhetorical Skills/No Change.* (F) is the correct answer choice because the idea that the anthropologist thought Quezada's pots were prehistoric illustrates how accurately Quezada was able to replicate pots from the Paquimé tradition, which took place from about 1000 to 1400.

37. (A) *English/Usage and Mechanics/No Change.* This item deals with subject-verb agreement, pronoun usage, and verb tense. The original is correct because the singular verb "led" agrees with its singular subject ("search") and is consistent with the past tense used throughout the passage. Additionally, the pronoun "him" is consistent with the use of the possessive pronoun "his."

38. (F) *English/Rhetorical Skills/No Change.* The original is correct because the adjective "eventual," which means "occurring at a later time," indicates that Quezada and MacCallum did not form a partnership immediately.

39. (C) *English/Rhetorical Skills/Style/Conciseness.* (C) is the correct answer choice because the adverb "where" is the only option that both expresses the writer's intended meaning and is presented in a concise manner.

40. (J) *English/Usage and Mechanics/Grammar and Usage/Diction.* (J) is the correct answer choice because the adverb "more" is the appropriate word choice, modifying the verb "do." The phrase "more so" is inappropriate in this context, incorrectly suggesting that the writer is making some sort of comparison.

41. (C) *English/Rhetorical Skills/Style/Idiomatic Expression.* (C) is the correct answer choice because it provides the prepositional phrase "in Mata Ortiz" to describe specifically where the potters are located. Using the preposition "around" to describe their location is unacceptable in standard written English.

42. (G) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.* (G) is the correct answer choice because the pronoun "whom" should be used as the object of a preposition ("of whom") and to refer to a person or persons ("more than four hundred potters").

43. **(D)** *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.* (D) is the correct answer choice because the singular possessive pronouns in the phrase "his or her" agree with the singular subject to which each refers ("artist").

    TIP Do not be distracted by commonly confused words; "they're" is the contraction of the phrase "they are," and "their" is a plural possessive pronoun.

44. **(J)** *English/Rhetorical Skills/Organization/Paragraph-Level Structure.* The sentence under consideration states that potters brought something unique to their creations. In this paragraph, only the second and third sentences refer to these artists. The sentence in question would most logically be placed after the second sentence, which refers to those people whom Quezada taught to make pots. Notice, too, that both of these sentences situate the events in the past ("taught people" and "brought something"), whereas the third sentence refers to the present ("[t]oday"). So, (J) is the correct answer choice.

45. **(C)** *English/Rhetorical Skills/Strategy/Main Idea.* This essay focuses on the artistic technique of potter Juan Quezada and how he taught this technique to others in his village. This means that if the writer's primary purpose is to write an essay summarizing the history of pottery making in Mexico, this essay would not accomplish that purpose. So, (C) is the correct answer choice.

PASSAGE IV

46. **(J)** *English/Usage and Mechanics/Punctuation/Apostrophes.* (J) is the correct answer choice because the singular possessive pronoun "its" is used properly to modify "height" in referring to the Lyceum Theatre.

    TIP Just as with item #43, do not be distracted by commonly confused words; "it's" is the contraction of the phrase "it is," which does not make sense here: "more than twice it is height" is grammatically incorrect.

47. **(D)** *English/Usage and Mechanics/Sentence Structure/Fragments.* The original is wrong because it results in a construction that lacks a main verb. (D) is the correct answer choice because it addresses the issue of the fragment by replacing the present participle verb "filling" with the present tense verb "fill."

48. **(H)** *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* (H) is the correct answer choice because "however" is the only adverb that provides the necessary contrast between those who go to the theatre to "attend a performance" and those who go simply "admire the stunning building itself."

49. **(B)** *English/Usage and Mechanics/Sentence Structure/Run-On Sentences.* As written, the first part of the sentence preceding the underlined portion is an independent clause, and the second part of the sentence beginning with the underlined portion is also an independent clause. (B) is the correct answer choice because it addresses this issue of the run-on sentence by replacing the phrase "they come" with the pronoun "there," which refers to the Lyceum Theatre.

50. **(F)** *English/Usage and Mechanics/No Change.* This item deals with semicolons. The original is correct because the semicolon is used properly to join together two independent clauses that are related in content.

51. **(D)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* The second paragraph of the essay focuses on describing part of the architecture of the Lyceum Theatre. The last sentence of this paragraph mentions that theatrical masks are carved into the horizontal stone band that extends above the columns standing in the front of the theatre. The sentence under consideration makes reference to theatrical masks but does so in the context of describing classical Greek theater, not architecture. So, (D) is the correct answer choice.

52. **(J)** *English/Rhetorical Skills/Style/Conciseness.* (J) is the correct answer choice because the building was already described as gray in the preceding sentence. Remember that items dealing with conciseness do not always address wordiness; they sometimes deal with redundancy.

53. **(A)** *English/Usage and Mechanics/No Change.* This item deals with commas. The original is correct because the comma is used properly to set off the dependent clause that describes a balustrade ("a stone railing supported by a row of waist-high, vase-shaped pillars").

54. **(F)** *English/Usage and Mechanics/No Change.* This item deals with subject-verb agreement and adjectives versus adverbs. The original is correct because the adjective "elegant" is used properly to modify the plural noun "chandeliers," and the plural present tense verb "illuminate" agrees with its plural subject ("chandeliers").

55. **(B)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* (B) is the correct answer choice because the verb "embellish," which means "to make more attractive," maintains the essay's positive tone; and the adjective "myriad," which means "great in number," mimics the elaborate style of decor at the Lyceum Theatre.

56. **(G)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* The sentence in question describes the "sumptuous" aesthetic demonstrated by the "curved rows of plush purple chairs." (G) is the correct answer choice because such details contribute to the description of the Lyceum Theatre's elaborate interior. In fact, the correct answer is directly supported by the fourth sentence in this paragraph: "The ornate interior of the building is consistent with its elaborate exterior."

57. **(C)** *English/Rhetorical Skills/Organization/Passage-Level Structure.* (C) is the correct answer choice because to divide the paragraph at Point C would effectively separate the description of the theatre's external features from its internal features. The part of the paragraph preceding Point C discusses external features ("windows," "columns," and "balcony"), while the sentence that immediately follows Point C introduces a description of the theatre's interior.

58. **(F)** *English/Rhetorical Skills/No Change.* This item deals with recognizing an effective transitional sentence between two paragraphs. The original is correct because an introductory phrase that makes a logical extension or comparison between ideas is not necessary.

59. **(D)** *English/Rhetorical Skills/Style/Conciseness.* (D) is the correct answer choice because it is the only option that expresses the writer's intended meaning clearly and concisely.

60. **(G)** *English/Rhetorical Skills/Strategy/Main Idea.* This essay describes the Beaux Arts architectural style as it is demonstrated in the exterior and interior of the Lyceum Theatre. This means that if the writer's primary purpose is to explain how a building illustrates a particular architectural style, this essay would accomplish that purpose. So, (G) is the correct answer choice.

PASSAGE V

61. **(C)** *English/Usage and Mechanics/Grammar and Usage/Adjectives versus Adverbs.* (C) is the correct answer choice because it results in a complete sentence, with the adjective "factual" used properly to modify the plural noun "inaccuracies."

62. **(G)** *English/Usage and Mechanics/Sentence Structure/Comma Splices.* (G) is the correct answer choice because it addresses the issue of the comma splice by replacing the comma with a colon. The colon is used properly to introduce the explanation of how Jones "fudges her date of birth."

63. **(D)** *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement.* (D) is the correct answer choice because the plural present tense verb "matter" agrees with its plural subject ("untruths").

    TIP Do not be distracted by the non-essential material that is set off with dashes; the singular noun "memory" is not the subject of the sentence.

64. **(F)** *English/Usage and Mechanics/No Change.* This item deals with commas. The original is correct because the comma is used properly along with the conjunction "for" to introduce the independent clause that immediately follows. The word "for," which typically functions as a preposition, functions here as a conjunction with a meaning similar to those of "since" and "because."

65. **(C)** *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* This item asks for the sentence that would provide the best transition between the first paragraph and the rest of the essay. The first paragraph discusses the factual inaccuracies of Mary Harris Jones's autobiography, and the rest of the essay focuses on her public persona as activist "Mother Jones." So, (C) is the correct answer choice. The adverb "rather" indicates the contrast between Mary Harris Jones's autobiography and a typical autobiography that discusses the author's life.

66. **(H)** *English/Usage and Mechanics/Punctuation/Apostrophes.* (H) is the correct answer choice because the apostrophe is used properly to indicate the singular possessive form of "movement" ("movement's"), which in turn demonstrates ownership of the plural noun "advocates": "the movement's . . . advocates." The phrase "one of" signals that the plural form of "advocate" is required: "one of the movement's . . . advocates."

67. **(D)** *English/Usage and Mechanics/Punctuation/Commas.* (D) is the correct answer choice because it removes the comma that disrupts the logical flow of the sentence. The unnecessary comma separates that subject ("she") from its verb ("adopted").

68. **(G)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* In the sentence preceding this point in the passage, the writer says that Mary Harris Jones's "audiences came to expect 'Mother Jones.'" The sentence under consideration supports this idea by describing what elements of her public persona Mary Harris Jones created in order to meet those expectations. So, (G) is the correct answer choice.

69. **(D)** *English/Usage and Mechanics/Sentence Structure/Comma Splices.* (D) is the correct answer choice because it addresses the issue of the comma splice by replacing the underlined comma with a semicolon. Remember that semicolons (not commas) are used to join together two independent clauses that demonstrate a close relationship to each other.

70. **(J)** *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* (J) is the correct answer choice because the underlined quotation expressing that Jones had no permanent residence (her address travels with her wherever she goes) provides support for the claim that she "redefined the boundaries of home and family."

71. **(A)** *English/Rhetorical Skills/No Change.* (A) is the correct answer choice because the phrase "her family of workers" successfully completes the metaphor describing Jones as having a matriarchal role in relationship to those workers.

72. **(F)** *English/Rhetorical Skills/No Change.* This item deals with conciseness and colons. The original is correct for two reasons. First, it is the only option that expresses the writer's intended meaning clearly and concisely: to introduce an explanation of how Jones protected workers. Second, it is the only option in which the colon is used properly to introduce that explanation.

73. **(B)** *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* (B) is the correct answer choice because the phrase "[b]ecause of," which means "as a result of," provides the cause-and-effect relationship necessary to transition between the idea that Jones made tireless efforts to the idea that workers trusted her.

74. **(H)** *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.* (H) is the correct answer choice because the plural possessive pronoun "their" is used properly to indicate on whose behalf (the workers') Jones fought.

TIP Just as with items #43 and #46, do not be distracted by commonly confused words; the adverb "there" is inappropriate in this context.

75. **(D)** *English/Rhetorical Skills/Strategy/Main Idea.* This essay focuses on Mother Jones and the significant role that she played in the labor movement. This means that if the writer's primary purpose is to summarize the contributions that women, as a whole, made to early-twentieth-century labor law reform, this essay would not accomplish that purpose, since the essay only focuses on one woman. So, (D) is the correct answer choice.

MATHEMATICS TEST EXPLANATIONS

1. **(D)** *Mathematics/Statistics and Probability/Probability.* The probability of an event occurring is equal to the ratio of the number of ways the event can occur to the total number of possible outcomes. According to the graph, of the 150 people surveyed, 67 had Type A blood and 6 had Type AB blood. Therefore, the probability of a randomly selected person from the 150 people surveyed having either Type A or Type AB blood is $\dfrac{67+6}{150} = \dfrac{73}{150}$, (D).

2. **(H)** *Mathematics/Statistics and Probability/Averages.* The mean, or average, of a data set is the sum of the data values divided by the total number of data values in the set. Therefore, the average of the monthly fees at the 5 colleges is $\dfrac{\$370+\$310+\$380+\$340+\$310}{5} = \dfrac{\$1,710}{5} = \$342$, (H).

3. **(E)** *Mathematics/Arithmetic/Common Arithmetic Items/Proportions and Direct-Inverse Variation.* Set up a direct proportion between the measurements (in inches) and the distances (in miles) represented by the measurements, where x represents the unknown distance. Group "like" units on each side of the equality and solve for x: $\dfrac{\frac{1}{2}\text{ inches}}{2\frac{1}{2}\text{ inches}} = \dfrac{18\text{ miles}}{x\text{ miles}} \Rightarrow x = \dfrac{18 \times 2\frac{1}{2}}{\frac{1}{2}} = 18 \times \dfrac{5}{2} \times 2 = 90$. So, $2\frac{1}{2}$ inches on the map represents 90 miles, (E).

4. **(F)** *Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.* First, solve the given equation for c: $f = cd^3 \Rightarrow c = \dfrac{f}{d^3}$. Next, substitute 450 for f, 10 for d, and evaluate: $c = \dfrac{450}{10^3} = \dfrac{450}{1,000} = 0.45$, (F).

5. **(E)** *Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Function Notation*

   Substitute 1 for x in the given function and evaluate: $f(x) = (3x+7)^2 \Rightarrow f(1) = (3(1)+7)^2 = 10^2 = 100$, (E).

6. **(H)** *Mathematics/Arithmetic/Common Arithmetic Items/Percents.* An increase of 6% on a $12 hourly wage is equal to $(1.06)(\$12) = \$12.72$, (H).

7. **(E)** *Mathematics/Algebra/Evaluating Sequences Involving Exponential Growth.* A geometric sequence is a series of terms, with each term multiplied by some number to determine the next term. In this sequence, the terms are all multiplied by –3. Continue multiplying by –3 to find the seventh term:

   $n = 1 : 1$
   $n = 2 : -3$
   $n = 3 : 9$
   $n = 4 : -27$
   $n = 5 : -27(-3) = 81$
   $n = 6 : 81(-3) = -243$
   $n = 7 : -243(-3) = 729$

   The seventh term is 729, (E).

8. **(H)** *Mathematics/Arithmetic/Solving Complicated Arithmetic Application Items* and *Data Representation/Tables (Matrices).* The box weighs 15 pounds, so look to the row of data in the table that corresponds to packages weighing 10 to 25 pounds: the total cost is the $10 base fee, plus $0.65 per pound: $10 + \dfrac{\$0.65}{\text{pound}} \times 15 \ \text{pounds} = \$10 + \$9.75 = \$19.75$, (H).

9. **(A)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions* and *Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.* The total thickness of the chip (0.32 cm) is equal to the sum of the thicknesses of the top layer (0.03 cm), the bottom layer (0.03 cm), and the inner layers (each 0.02 cm). If n is the total number of inner layers, then
$$0.32 = 0.03 + 0.03 + 0.02(n) \Rightarrow n = \frac{0.32 - 0.06}{0.02} = \frac{0.26}{0.02} = 13 \text{, (A).}$$

10. **(K)** *Mathematics/Statistics and Probability/Median* and *Data Representation/Tables (Matrices).* The median of a data set is equal to the middle value when the data are arranged in numerical order. Since there are 12 values in the table, for 12 months, the median will be the average of the two middle values. Arranged in order, the data set is {13, 15, 16, 19, 19, 22, 25, 25, 26, 27, 28, 29}. Therefore, the median is $\dfrac{22 + 25}{2} = 23.5$, (K). Note that for practical purposes on the exam, rather than rewrite the entire list, it's easier to eliminate the least/greatest values in pairs from the table until the two middle values are left (and then averaged).

11. **(C)** *Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Function as Models* and *Data Representation/Table (Matrices).* First, test the easiest data pair given in the table: $t = 0$ and $d = 14$. Eliminate any answer choices that don't equal 14 for $t = 0$:

   A. $t + 14 = 0 + 14 = 14$
   B. $6t + 8 = 6(0) + 8 \neq 14$ ✖
   C. $6t + 14 = 6(0) + 14 = 14$
   D. $34t = 14(0) + 6 \neq 14$ ✖
   E. $34(0) \neq 14$ ✖

   Next, use $t = 1$ and $d = 20$ in (A) and (C). The correct choice will equal 20 for $t = 1$:

   A. $t + 14 = 1 + 14 \neq 20$ ✖
   C. $6t + 14 = 6(1) + 14 = 20$ ✓

12. **(K)** *Mathematics/Geometry/Rectangles and Squares.* From the formula for the area of a rectangle (area is width times length), find the width: $54 = 9w \Rightarrow w = 6$. The perimeter is twice the width plus twice the length: $2(6) + 2(9) = 12 + 18 = 30$, (K).

13. **(B)** *Mathematics/Geometry/Triangles/Working with Triangles.* The sum of the angle measures in a triangle is equal to 180°. And vertical angles (the pairs of opposing angles formed by two intersecting lines) are equal. Therefore, in triangle ABC, $\angle BCA = 45°$ and $\angle BAC + 35° + 45° = 180° \Rightarrow$ $\angle BAC = 180° - 80° = 100°$, (B).

14. **(H)** *Mathematics/Geometry/Circles* and *Arithmetic/Common Arithmetic Items/Proportions and Direct-Inverse Variation.* The sum of the central angle measures for a circle is 360°, so create a proportion

between the hours and the degree measures and solve for the unknown: $\dfrac{4 \text{ hours}}{9 \text{ hours}} = \dfrac{x^\circ}{360^\circ} \Rightarrow$

$x^\circ = \dfrac{4(360^\circ)}{9} = 4(40) = 160^\circ$, (H).

15. (**B**) *Mathematics/Algebra/Solving Simultaneous Equations.* Create a system of simultaneous equations for the given information. The number of large figurines, *l*, and the number of small figures, *s*, total 70, so

$l + s = 70$. The sales of the large figurines, $\dfrac{\$12}{\text{large figurine}} \times l$ ~~large figurines~~ , equals the sales of the

small figurines, $\dfrac{\$8}{\text{small figurine}} \times s$ ~~small figurines~~ , so $12l = 8s$. Solve the second equation for *s*:

$12l = 8s \Rightarrow s = \dfrac{12}{8}l = \dfrac{3}{2}l$. Substitute $\dfrac{3}{2}l$ for *s* in the first equation and solve for *l*:

$70 = l + s = l + \dfrac{3}{2}l = \dfrac{5}{2}l \Rightarrow l = \dfrac{70(2)}{5} = 28$, (B).

16. (**H**) *Mathematics/Arithmetic/Simple Manipulations.* The car's acceleration, in feet per second per second, is the difference in speed divided by the duration of time:

$a = \dfrac{\Delta v}{\Delta t} = \dfrac{220 \text{ feet per second} - 88 \text{ feet per second}}{3 \text{ seconds}} = \dfrac{132}{3} = 44$ feet per second per second, (H).

17. (**D**) *Mathematics/Geometry/Lines and Angles.* The best approach to this item is to draw a figure of the given information:
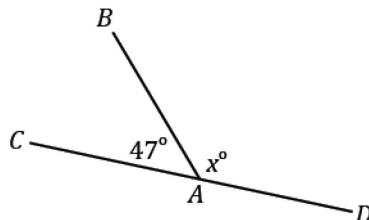
The degree measure of a straight line is 180°, so $47^\circ + x^\circ = 180^\circ \Rightarrow x^\circ = 180^\circ - 47^\circ = 133^\circ$, (D).
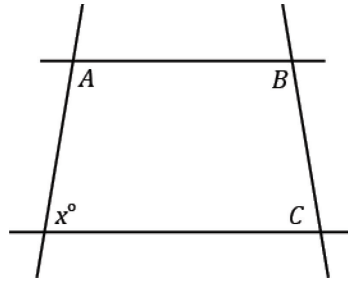
18. (**F**) *Mathematics/Arithmetic/Complicated Manipulations/Decimal-Fraction Equivalents.* To ease

comparison, convert the fractions to their decimal equivalents: $\dfrac{1}{2} = 0.5$, $\dfrac{5}{6} = 0.8\overline{3}$, and $\dfrac{5}{8} = 0.625$.

Arrange the values in ascending order: $0.5 < 0.625 < 0.8\overline{3}$, so the correct choice is $\dfrac{1}{2} < \dfrac{5}{8} < \dfrac{5}{6}$, (F).

19. (**D**) *Mathematics/Arithmetic/Simple Manipulations.* To write a number in scientific notation, first move the decimal place until the number is between 1 and 10. Then, add a power of 10 that tells how many places the decimal was moved: the power is positive for places to the left of the decimal place (and negative for places to the right of the decimal place): $670,000,000 = 6.7 \times 10^8$ and

$700,000,000 = 7.0 \times 10^8$. Therefore, $670,000,000 + 700,000,00 = 6.7 \times 10^8 + 7.0 \times 10^8 = 13.7 \times 10^8 = 1.37 \times 10^9$, (D).

20. **(F)** *Mathematics/Geometry/Lines and Angles.* Trapezoids can be reimagined as comprised of parallel lines intersected by other lines:


The angles on the same side of a leg are supplementary: $x° + \angle A = 180°$ (and $\angle B + \angle C = 180°$). Therefore, $\angle A = (180 - x)°$, (F).

21. **(B)** *Mathematics/Arithmetic/Common Arithmetic Items/Percents.* Of 1,000 applicants, 80% pass the written test, or $(0.8)(1,000) = 800$, and 60% of those pass the driving test, or $(0.6)(800) = 480$, (B).

22. **(H)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents.* Substitute a^b for x and c^b for y in the expression xy: $xy = (a^b)(c^b)$. Both terms are raised to the same exponent, so they can be combined: $xy = (ac)^b$, (H).

23. **(A)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Basic Algebraic Manipulations.* Multiply each term in the parentheses by the outside term and simplify: $\frac{1}{2}y^2(6x + 2y + 12x - 2y) =$

$3xy^2 + y^3 + 6xy^2 - y^3 = 9xy^2$, (A).

24. **(H)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions.* Substitute the answer choices into the given expression ($500p - p^2$) to determine which results in a value of at least 60,000. Start with choice (H) to minimize the number of choices that must be tested:

    H. $500p - p^2 = 500(200) - 200^2 = 100,000 - 40,000 = 60,000$

    Since 200 results in a value of 60,000, this must be the fewest number of paintings that the artist can sell to make a profit of at least $60,000.

25. **(B)** *Mathematics Arithmetic/Common Arithmetic Items/Percents* and *Data Representation/Pie Charts.* According to the pie chart, the category with the greatest expenditures was clothes: $254. Since the total expenditures was $900, the clothes category accounted for $\frac{254}{900} = 0.28\overline{2} \approx 0.28 = 28\%$, (B).

26. **(G)** *Mathematics/Geometry/Lines and Angles.* The combined degree measure of $\angle BAC$ and $\angle CAD$ is 90°, so $(x + 20)° + \angle CAD = 90° \Rightarrow \angle CAD = 90° - x° - 20° = (70 - x)°$, (G).

27. **(E)** *Mathematics/Geometry/Triangles/45°-45°-90° Triangles.* The given triangle is an isosceles triangle, so it is a 45°-45°-90° triangle. As can be determined using the Pythagorean theorem, the length of the sides of a 45°-45°-90° triangle are in the ratio $1:1:\sqrt{2}$. Since the hypotenuse is $8\sqrt{2}$, the ratio is $8:8:8\sqrt{2}$ —each leg of the triangle has a length of 8. Thus, the perimeter of the triangle is $8 + 8 + 8\sqrt{2} = 16 + 8\sqrt{2}$, (E).

28. **(H)** *Mathematics/Coordinate Geometry/Graphs of Quadratic Equations and Relations.* The solution for a quadratic equation is comprised of the x-values for which the y-value equals zero. In this case, the graphed equation crosses the x-axis twice: once for a negative value of x and once for a positive value of x—there is both a negative and a positive real solution, (H).

29. **(C)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Basic Algebraic Manipulations* and *Arithmetic/Common Arithmetic Items/Complex Numbers.* Use the FOIL (First- Outer-Inner-Last) method for multiplying polynomials to find the product of the two complex expressions: $(-3i+4)(3i+4) = -9i^2 - 12i + 12i + 16 = -9i^2 + 16$. Since $i^2 = -1$, this simplifies to $-9(-1) + 16 = 25$, (C).

30. **(G)** *Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions.* Use the SOH-CAH-TOA mnemonic to recall the definitions of the tested ratios: $\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$, $\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$, and $\tan\theta = \dfrac{\text{opp}}{\text{adj}}$. Immediately eliminate (H), (J), and (K) because the values 7 and 5 are for the legs, not the hypotenuse. As for (F) and (G), $\tan\theta = \dfrac{7}{5}$, so (G) is correct.

31. **(D)** *Mathematics/Statistics and Probability/Probability.* With the additional five pieces in the box, the total number of pieces is $750 + 5 = 755$. Therefore, the probability of selecting one of the extra pieces is $\dfrac{5}{755}$, (D).

32. **(K)** *Mathematics/Statistics and Probability/Averages.* Calculate the average of the two fractions:
$$\frac{\frac{2}{3} + \frac{3}{4}}{2} = \frac{\frac{2(4) + 3(3)}{(3)(4)}}{2} = \frac{8 + 9}{2(12)} = \frac{17}{24}, \text{(K)}.$$

33. **(B)** *Mathematics/Arithmetic/Common Arithmetic Items/Proportions and Direct-Inverse Variation.* Set up a direct proportion between the distances measured (in inches) and the distances (in feet) those measurements represent, grouping "like" units on the same side of the equality, and solve for the unknown: $\dfrac{0.25 \text{ inch}}{x \text{ inches}} = \dfrac{2 \text{ feet}}{15 \text{ feet}} \Rightarrow x = \dfrac{0.25(15)}{2} = 1.875$, (B).

34. **(H)** *Mathematics/Geometry/Rectangles and Squares* and *Complex Figures.* The area of the floor not covered by cabinets is equal to the total area of the floor (15 feet by 12 feet) minus the area covered by cabinets. According to the information provided, there are four cabinets, each with a footprint of 2 feet by 2 feet, and another cabinet with a footprint of 12 feet by 2 feet. Therefore, the area not covered by cabinets, in square feet, is $(15)(12) - 4(2)(2) - (12)(2) = 180 - 16 - 24 = 140$, (H).

35. **(D)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions* and *Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.* The estimate for installation is equal to a labor charge of $650 plus a charge per cabinet times the number of cabinets, xn, where x is the charge and n is the number of cabinets. Originally, there were $4 + 1 = 5$ cabinets and the estimate was $2,150, so use this information to find the charge per cabinet: $\$650 + 5x = \$2,150 \Rightarrow 5x = 1,500 \Rightarrow x = \$300$ per cabinet. Now, use this per cabinet charge and double the number of cabinets to determine the new estimate: $\$650 + \dfrac{\$300}{\text{cabinet}}(10 \text{ cabinets}) = \$3,650$, (D).

36. **(J)** *Mathematics/Coordinate Geometry/Graphs of First-Degree Inequalities.* Solve the given inequality for *x*: $1 < x + y < 2 \Rightarrow 1 - y < x < 2 - y$. For $y = 0$, $1 < x < 2$. This is true only for the graphs in (J) and (H). Next, solve the inequality for *y*: $1 < x + y < 2 \Rightarrow 1 - x < y < 2 - x$. For $x = 0$, $1 < y < 2$, which is true for (J) only.

37. **(A)** *Mathematics/Statistics and Probability/Averages* and *Median.* The mean of the set is $\frac{3 + 8 + 10 + 15}{4} = \frac{36}{4} = 9$. The median of the set is $\frac{8 + 10}{2} = 9$. Therefore, the difference between the mean and the median is 0, (A).

38. **(F)** *Mathematics/Coordinate Geometry/Qualitative Behavior of Graphs of Functions.* The graph shows the two functions intersecting twice. Therefore, the two functions are equal ($f(x) = g(x)$) for exactly two values of *x*, (F).

39. **(B)** *Mathematics/Coordinate Geometry/Slope of a Line.* The slope of $\overline{CD}$ is equal to the rise over the run: $\frac{\Delta y}{\Delta x} = \frac{1 - 4}{12 - 9} = \frac{-3}{3} = -1$, (B).

40. **(F)** *Mathematics/Coordinate Geometry/The Coordinate System.* A reflection over the *y*-axis puts the coordinate of *D'* in the second quadrant: the *x*-coordinate for *D'* is the same as that for *D* but negative, and the *y*-coordinate is the same as that for *D*. Therefore, the coordinates of *D'* are $(-12, 1)$, (F).

41. **(E)** *Mathematics/Geometry/Trigonometry/Working with Triangles.* Recall that the area of a trapezoid is equal to $\frac{a + b}{2}(h)$, where *a* and *b* are the lengths of the parallel sides and *h* is the height. The height of the trapezoid is the same for the two smaller trapezoids, so test the answer choices to determine which one results in the sum of the parallel sides lengths being equal for both trapezoids. Only $x = 6.5$, (E), works. For $x = 6.5$, the top length of the left-hand trapezoid is equal to $6.5 - 3 = 3.5$ and the bottom length is equal to $6.5 - 2 = 4.5$, the sum of which is $3.5 + 4.5 = 8$. For the right-hand trapezoid, the top length is $9 - 6.5 = 2.5$ and the bottom length is $12 - 6.5 = 5.5$, the sum of which is $2.5 + 5.5 = 8$.

42. **(K)** *Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Function Notation.* First, substitute $\frac{1}{2}$ for *x* in the given function for *g(x)* and evaluate: $g(x) = \frac{1}{x} = \frac{1}{\frac{1}{2}} = 2$. Next, substitute 2 for *x* in the given function for *f(x)* and evaluate: $f(x) = x - \frac{1}{x} = 2 - \frac{1}{2} = \frac{3}{2}$, (K).

43. **(D)** *Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Functions as Models.* Replace *a* with 2*a* in the expression for *p* and evaluate: $p' = \frac{\frac{1}{2}(2a)(ry) + 2a}{12y} = \frac{2\left(\frac{1}{2}ary + a\right)}{12y} = 2p$. Therefore, *p*, the monthly payment, is multiplied by 2 when *a* is multiplied by 2, (D).

44. **(G)** *Mathematics/Coordinate Geometry/The Coordinate System.* If point *D* lies on $\overline{EF}$ such that the length of $\overline{EF}$ is four times the length of $\overline{DE}$, then the position of *D* is as follows:
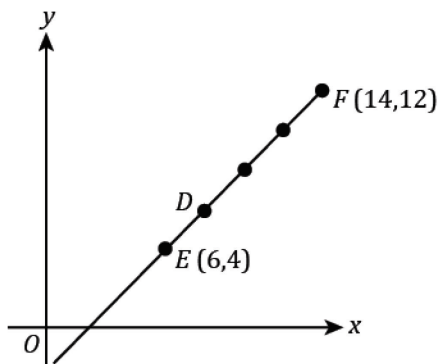
Divide both the rise and the run of the line between points E and F by 4: $\dfrac{12-4}{4}=\dfrac{8}{4}=2$ and

$\dfrac{14-6}{4}=\dfrac{8}{4}=2$. Therefore, both the x- and y-coordinates of D are 2 more than the x- and y-coordinates of

E: $(6+2, 4+2)=(8,6)$, (G).

45. **(D)** *Mathematics/Algebra/Solving Simultaneous Equations* and *Data Representation/Tables (Matrices).*

To multiply a matrix by a real number, a, each term in the matrix is multiplied by a: $a\begin{bmatrix} 2 & 6 \\ 1 & 4 \end{bmatrix}=\begin{bmatrix} 2a & 6a \\ a & 4a \end{bmatrix}$.

Since this matrix is equal to $\begin{bmatrix} x & 27 \\ y & z \end{bmatrix}$, we have four simultaneous equations: $2a=x$, $6a=27$, $a=y$, and

$4a=z$. Therefore, $x+z=2a+4a=6a=27$, (D).

46. **(J)** *Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions* and *Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.* Let V represent the volume of the container, in cups, and translate the given information into an algebraic equation:

$\dfrac{1}{8}V+10=\dfrac{3}{4}V \Rightarrow 10=V\left(\dfrac{6}{8}-\dfrac{1}{8}\right)=\dfrac{5}{8}V \Rightarrow V=\dfrac{10\times8}{5}=16$, (J).

47. **(B)** *Mathematics/Arithmetic/Common Arithmetic Items/Ratios* and *Statistics and Probability/Probability.* Write the given ratios with a common denominator: the ratio of 10th graders to

the total student population is $\dfrac{86}{255}$ and the ratio of 11th-graders to the total student population is

$\dfrac{18}{51}=\dfrac{90}{255}$. From these ratios, determine the number of 12th-graders: $255-86-90=79$, so the ratio of

12th-graders to the total student population is $\dfrac{79}{255}$. Therefore, the greatest proportion of students are in

eleventh grade, so the probability is greatest that a randomly selected student will be in eleventh grade, (B).

48. **(G)** *Mathematics/Arithmetic/Complicated Manipulations/The "Flying-X" Method.* Use the "flying-x"

method to combine the fractions: $\dfrac{4}{\sqrt{2}}+\dfrac{2}{\sqrt{3}}=\dfrac{4\sqrt{3}+2\sqrt{2}}{(\sqrt{2})(\sqrt{3})}=\dfrac{4\sqrt{3}+2\sqrt{2}}{\sqrt{6}}$, (G).

49. **(A)** *Mathematics/Coordinate Geometry/Graphs of Quadratic Equations and Relations* and *Graphs of First-Degree Inequalities.* The shaded region is the area below the line $y=-x+2$, or $y<-x+2$, and

within the circle $(x-1)^2+(y-2)^2=9$, or $(x-1)^2+(y-2)^2<9$. Therefore, the shaded region represents the solution set to the system of inequalities $y<-x+2$ and $(x-1)^2+(y-2)^2<9$, (A).

50. (F) **Mathematics/Geometry/Complex Figures** and **Arithmetic/Solving Complicated Arithmetic Application Items.** According to the item stem, the volume of the submerged object is equal to the volume of water displaced. After the object sinks, the water level rises 0.25 centimeters in the tank, which has a base area of 40 centimeters by 30 centimeters. Therefore, the displaced volume of water, in cubic centimeters, is $\frac{1}{4}\times30\times40=300$, (F).

51. (E) **Mathematics/Arithmetic/Common Arithmetic Items/Ratios.** Solve for x and z in the given ratios: $\frac{x}{y}=\frac{5}{2}\Rightarrow x=\frac{5y}{2}$ and $\frac{y}{z}=\frac{3}{2}\Rightarrow z=\frac{2y}{3}$. Now, create an expression for the ratio of x to z:

$\frac{x}{z}=\frac{\dfrac{5y}{2}}{\dfrac{2y}{3}}=\frac{5y}{2}\times\frac{3}{2y}=\frac{15}{4}$. Therefore, $x:z$ is $15:4$, (E).

52. (H) **Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities.** Solve the given inequality for x: $-5<1-3x<10\Rightarrow-5-1<-3x<10-1\Rightarrow-6<-3x<9$. Remember, if dividing or multiplying an inequality by a negative value, the inequality switches direction. Therefore, the inequality becomes $-6<-3x<9\Rightarrow\frac{-6}{-3}>x>\frac{9}{-3}\Rightarrow2>x>-3$, (H).

53. (B) **Mathematics/Geometry/Complex Figures** and **Algebra/Expressing and Evaluating Algebraic Functions/Functions as Models.** Create an expression for the new surface area by replacing l, w, and h with $2l$, $2w$, and $2h$: $A'=2(2l)(2w)+2(2l)(2h)+2(2w)(2h)=4(2lw+2lh+2wh)=4A$. Therefore, the new surface area is equal to the original surface area multiplied by 4, (B).

54. (K) **Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions.** Translate the given information into an algebraic expression, including units so "like" units cancel leaving the expression in units of "cans": $\frac{7\text{ cans}}{3\text{ days}}\times(3+d)\text{ days}=\frac{7}{3}(3)+\frac{7}{3}(d)=7+\frac{7d}{3}$ cans, (K).

55. (E) **Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations** and **Manipulating Algebraic Expressions/Creating Algebraic Expressions** and **Data Presentation/Tables (Matrices).** A Venn diagram to represent the data in the table for students who had skied helps clarify the situation:

Total, 65

Downhill, 28   Cross-Country, 45

$28-x$ x $45-x$
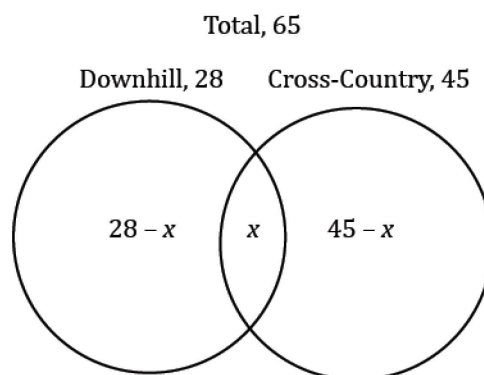
In the diagram, x represents the number of students who had skied both cross-country and downhill. The total, 65, is equal to the sum of the three parts of the diagram: $(28-x)+(45-x)+x=65 \Rightarrow$ $x=28+45-65=8$, (E).

56. (**K**) *Mathematics/Arithmetic/Simple Manipulations* and *Geometry/Rectangles and Squares.* The item stem asks for the fraction of the total square labeled A, so let each side of the total square equal 1, and determine the lengths of the sides of the individual squares labeled A:
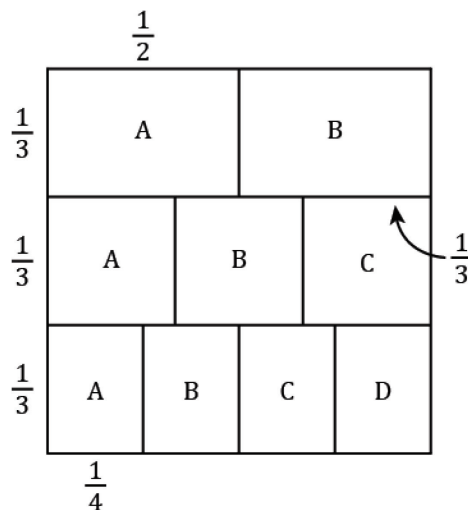
Therefore, the total area in a region labeled A is $\left(\frac{1}{2}\times\frac{1}{3}\right)+\left(\frac{1}{3}\times\frac{1}{3}\right)+\left(\frac{1}{3}\times\frac{1}{4}\right)=\frac{1}{6}+\frac{1}{9}+\frac{1}{12}=\frac{13}{36}$ of the total area of the square, (K).

57. (**A**) *Mathematics/Trigonometry/Trigonometric Relationships* and *Coordinate Geometry/Transformations and Their Effects on Graphs of Functions.* In the figure, $y=\sin x$ is the function that crosses the y-axis at $y=0$, so the other function is $y=\sin(x+a)+b$. Adding a constant value to the argument of a function shifts the function a units left or right (depending on whether the value is positive or negative). Adding a constant value to the function shifts the function b units up ($b>0$) or down ($b<0$). Since the sine function is not shifted vertically, $b=0$, the correct answer must be (A).

58. (**K**) *Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Inequalities Involving Absolute Value.* Before setting off to solve the inequality, notice what it really says: the absolute value of some number is *less than* -1. By definition, absolute value is always positive, so there is no solution set to the given inequality, (K).

59. (**E**) *Mathematics/Statistics and Probability/Probability.* The probability of picking the correct answer for one question is 1 out of 3 and is independent of the other three questions. To find the probability of the four independent events occurring together, multiply the probabilities of the independent events: $\frac{1}{3}\times\frac{1}{3}\times\frac{1}{3}\times\frac{1}{3}=\frac{1}{81}$, (E).

60. (**J**) *Mathematics/Trigonometry/Trigonometric Relationships.* The smallest angle of a triangle is the angle opposite the smallest side. Therefore, the question is asking for the measure of the angle opposite the side measuring 14 cm. According to the item stem, for any triangle with sides a, b, and c, $c^2=a^2+b^2-2ab\cos C$, where C is the angle opposite side c. So, substitute 20 for a, 18 for b, and 14 for c: $14^2=20^2+18^2-2(20)(18)\cos\theta$, (J).

READING TEST EXPLANATIONS

PASSAGE I

1. (A) *Reading/Prose Fiction/Main Idea*. In the very first line of the passage, the narrator mentions that he grew up "in a great city"; the rest of the passage describes the city, Bombay, as well as the narrator and his parents' relationship to the city. So (A) is the correct answer.

2. (J) *Reading/Prose Fiction/Explicit Detail*. The first great photographers of Bombay, as mentioned in the passage, became important influences for the narrator because they "show[ed him] what [he] did not want to do" (lines 64–65). Instead of taking photos of Bombay by air, the narrator wanted to "get back down to ground level" (line 69): in other words the narrator wanted to see the city from the streets instead of the air, (J).

3. (C) *Reading/Prose Fiction/Explicit Detail*. In lines 25–31, the narrator begins by talking about how the frenzied building in Bombay before the narrator's birth was almost as if the city was hurrying to become something fantastic by the time the narrator was old enough to appreciate it. Immediately after this musing, however, the narrator states that no, he doesn't really think along those lines. Thus, (C) is the correct answer.

4. (H) *Reading/Prose Fiction/Voice.* In lines 32–43, the narrator describes Bombay as his rival, refers to the city as "her," and mentions that his parents have a romance with the city. The narrator is giving the city human characteristics, which is the literary device personification, (H).

5. (B) *Reading/Prose Fiction/Explicit Detail.* The third paragraph (lines 32–51) discusses how the narrator's parents balanced parental and work responsibilities. If the narrator's mother was at work, the narrator spent time with his father; when the narrator's father gave the narrator to his mother, then his father would go to work or explore the city. (B) best describes this balance.

6. (J) *Reading/Prose Fiction/Vocabulary.* When "sweep" is used in line 9, the narrator mentions it in the context of describing "Marine Drive," which could probably be assumed to be some sort of road or architectural site. In any event, none of the choices but (J) echo the idea of a physical site that is represented by Marine Drive.

7. (A) *Reading/Prose Fiction/Development.* In lines 6–10, the narrator is comparing various sites in Bombay (Malabar, Cumballa hills, Brabourne Stadium) with sites elsewhere—specifically in Rome (the Capitol, Palatine, Colosseum). That means that (A) is the correct answer.

    TIP Remind students that they don't have to draw on outside knowledge to answer questions. For example, in this item, students might be worried if they are unfamiliar with the sites mentioned; however, everything necessary to answer the question will be found in the passage.

8. (H) *Reading/Prose Fiction/Explicit Detail.* The narrator explicitly mentions how his parents' work with the city made him feel; in lines 33–34, he states that he was "insanely jealous of the city . . . because it was my parents' other love." So (H) is the correct answer.

9. (B) *Reading/Prose Fiction/Vocabulary.* When the narrator uses the term "drew up," he is discussing a list of "shared parental responsibilities" (lines 38–39) that his parents created every week so that they knew who was doing what in regards to the narrator. The correct answer choice will be something like "created" or "formed," and (B), "prepared," fits best.

10. (J) *Reading/Prose Fiction/Implied Idea.* The narrator's father declares in the last paragraph that the photos of storefronts and piers, the places "people lived and worked and shopped" (lines 80–81), make

it obvious what those people were like. In other words, photographs of places can show viewers as much about the people who frequented those places as can photos of the actual people, (J).

PASSAGE II

11. (**A**) *Reading/Social Science/Voice.* The author definitely has a positive attitude toward her subject; in fact, she seems in awe of what lies beneath the ocean floor. She describes the features of the Atlantic Ocean as "grand and sweeping energies" (line 7) and writes about a "great valley [that eclipses] any comparable feature on dry land" (line 62). Her attention to details (such as the height of the mountain range or the length of the valley) speaks to her great interest in the subject; "awe and fascination," (A), are two words that best describe how the author probably feels about the main subject of the passage.

12. (**J**) *Reading/Social Science/Explicit Detail.* In lines 30–34, the author mentions various names in quotation marks and then states that the basin of the Atlantic was "variously called" (line 34) these names. (J) then is the correct answer.

13. (**C**) *Reading/Social Science/Development.* At the beginning of the passage, the author poetically describes the smoothness of the Sargasso Sea, which she says is a "vast, unroughened surface" (lines 5–6). She then states that the "unperturbed surface" (lines 7–8) gives no indication of the "grand and sweeping energies" (line 8) beneath. The smoothness of the sea contrasts with something that is decidedly less smooth (the mountains hidden below). (C) best describes this intentional contrast.

14. (**J**) *Reading/Social Science/Explicit Detail.* The author mentions the valley in the Atlantic at the beginning of the fifth paragraph (lines 62–76). Later in that paragraph, the author also mentions the Grand Canyon, which she says is about 280 miles long. By contrast, the canyon in the Atlantic is about 11,000 miles long—much, much longer than the Grand Canyon, (J).

TIP The correct answer for an Explicit Detail item will, as the name states, be stated explicitly in the passage, so look for specific words or phrases in the item stem or answer choices that are also found in the passage.

15. (**B**) *Reading/Social Science/Main Idea.* Some details about the canyon in the Atlantic are found in lines 71–76. The author uses words that invoke a setting that is unfamiliar or strange: "bleak," "forbidding," "otherworldly," and sites named after "distant, lifeless planets." (B) mentions the canyon as an alien and barren place, and both "alien" and "barren" echo the ideas of "otherworldly" and "lifeless," so (B) is the correct answer.

16. (**H**) *Reading/Social Science/Main Idea.* In the last paragraph (lines 77–86), the author briefly describes the process whereby the seafloor of the Atlantic has come into being. The rift valley, which seems so mysterious and strange, really is a vital part of the Atlantic seafloor's creation. (H) best fits this purpose of the last paragraph.

17. (**B**) *Reading/Social Science/Implied Idea.* At the beginning of the second paragraph, the author states that the *Cramer* has passed over some of the deepest parts of the Atlantic Ocean after only traveling one thousand miles from the shoreline. Then, in the very next sentence, the author continues by saying that "[c]ontrary to what one might guess" (line 11), the deepest water of the Atlantic and other oceans are actually along the edges and that the bottom of the ocean actually rises as one continues toward the middle of the ocean. The author implies, then, that most people think the deepest part of the ocean is in the middle, (B).

18. (**F**) *Reading/Social Science/Vocabulary.* When the author uses the phrase "paid out," she is referencing something a naval officer has done with eight miles of hemp rope to try to measure the depth of the Atlantic seafloor. It doesn't make sense for the officer to "ascertain" or "suggest" hemp rope, so (G) and (H) can be eliminated. "Compensated," (J), is a common meaning of "paid out" and so will probably not

be the correct answer either. That leaves (F), "dispensed," which makes sense in context: the naval officer dispensed eight miles of hemp rope to measure the depth of the Atlantic.

TIP Some Vocabulary items test meanings of words students may be familiar with. If students encounter such items, they can usually eliminate the most common meanings of the word because, more likely than not, those familiar meanings will not be the correct answer.

19. **(D)** *Reading/Social Science/Explicit Detail.* In the fourth paragraph, the author states that the mountain range found at the bottom of the Atlantic "covers almost as much of earth's surface as the dry land of continents" (lines 51–52), which means (D) is the correct answer.

20. **(F)** *Reading/Social Science/Explicit Detail.* The correct answer to this item is (F), and it can be found in lines 55–59 of the passage: the author mentions in these lines that the white covering on top of the mountains is the remains of microscopic animals that used to live at the surface.

PASSAGE III

21. **(A)** *Reading/Humanities/Implied Idea.* At the beginning of Passage A, Ray Bradbury states that he "learn[ed] the nature of surprises" (line 1) early in his career as a writer. He continues with a brief description of how he thought you could beat an idea into being (which he says is the quickest way to make it die) and then, in the second paragraph, states that, to his relief, he then "floundered into a word-association process" (line 8). The rest of the passage gives some details about how this word-association process worked and how it helped him. The finding of this process was accidental, something he stumbled—or fell—into. So it's likely that when he says he "fell into surprise," he is referring to the success he had as a writer using this word-association method, (A).

22. **(G)** *Reading/Humanities/Explicit Detail.* Bradbury states in the first paragraph that, like all beginners, he believed you could "beat, pummel, and thrash an idea into existence" (lines 3–4), or force an idea into creation, (G).

23. **(D)** *Reading/Humanities/Implied Idea.* The phrase "take arms" invokes some kind of struggle—in this case, Bradbury's struggle as he sought to find a particular word's meaning in the context of his life. (D) best echoes this idea.

24. **(J)** *Reading/Humanities/Implied Idea.* In the seventh paragraph, Bradbury mentions that he would "stroll [him]self across a recollection" (lines 31–32) of his grandparents' property. It was not a literal stroll but something that Bradbury undertook in the hopes that he would, in his mind, come across some memory that would remind him more of the boy he used to be. (J) fits this description.

25. **(C)** *Reading/Humanities/Implied Idea.* John Huff is mentioned in the eighth paragraph of Passage A (lines 38–42). Here, Bradbury says that he "borrowed" (lines 39–40) John Huff from where Bradbury had known him in Arizona and "moved" him east to the fictional Green Town to write about him, (C).

26. **(G)** *Reading/Humanities/Development.* It is clear in the first paragraph of Passage B (lines 52–63) that Douglas Spaulding admires John Huff: everything about him presented in this paragraph emphasizes—and perhaps exaggerates—John's positive qualities. One phrase, however, gives some pointed insight into how Douglas Spaulding felt about John Huff: John was the "only god living in the whole of Green Town" (lines 61–62) that Douglas knew of. Describing John as a god clearly shows that Douglas idolized him, which makes (G) the correct answer.

27. **(C)** *Reading/Humanities/Voice.* Since the item stem for #27 specifically states that the image in lines 74–76 is a figurative one, we know then that the cloud didn't literally cover the sun and not move. So what could the author mean by this image? The dialogue in lines 80–82 explains the news that John shared: he and his family were moving away. And a day (whether literally or figuratively) going from bright and

sunny to cloud-covered and dark is a dramatic change that seems to echo what Douglas was feeling prior to and then after John's news. (C) best describes this.

28. **(J)** *Reading/Humanities/Development.* The correct answer to this item is (J), and Bradbury's use of "sensory details and imaginative description" can be seen time and again within both passages. Just a few examples: "any decent idea folds up its paws, turns on its back, fixes its eyes on eternity, and dies" (lines 5–6); "some old half-burnt firecracker, a rusted toy, or a fragment of letter written to myself (lines 33–34); "the only god living in the whole of Green Town, Illinois, during the twentieth century that Douglas Spaulding knew of" (lines 61–63); "warm and marble-round day, the sky blue blown-glass . . . , the creeks bright with mirror water fanning over white stone" (lines 65–67).

> **TIP** Process of elimination is often a very helpful technique in finding the right answer for an item. If students can eliminate *any* answer choice, they should, since elimination drastically improves their chances of guessing the right answer.
>
> For example, in item #28, students could eliminate (F), since Passage B is not written in first person. (G) and (H) could also be eliminated if students are familiar with satire, irony, and allegory since none of those techniques are used in either passage. However, even if students could only definitively eliminate one of those answer choices, encourage them that they should still use process of elimination.

29. **(C)** *Reading/Humanities/Generalization.* What is Bradbury's writing process as described in Passage A? The second and third paragraphs (lines 7–18) detail the process: Bradbury would get up and write down any word or phrase that popped into his head; then he would create characters to help him discover the meaning of that word in his own life through a story. The word would come first, followed by characters and a plot. (C), which follows this order, would be the best example of how Bradbury would probably write.

30. **(G)** *Reading/Humanities/Generalization.* One of the hallmarks of Bradbury's word-association process, as he describes it, is to take the initial words he writes down and use them as "catalysts" (line 27) to spark buried or forgotten memories of his life. One of those memories allowed him to take his childhood friend John Huff and "ship him East to Green Town" (line 41) from Arizona where Bradbury had known him. So John Huff, though fictionalized in Passage B, was still a real person (as mentioned in Passage A and the item stem). Bradbury had drawn on real memories or life experiences to create his fiction, (G).

PASSAGE IV

31. **(A)** *Reading/Natural Science/Main Idea.* The first paragraph gives a quick introduction into the topic of the passage—trap-jaw ants and their trap jaws. Paragraphs two and three mention a little bit of background information about how the trap jaws work, and the rest of the passage details some of the ways the ants utilize their jaws. (A) best reflects this purpose and development.

> **TIP** Many Main Idea items can be answered by utilizing the Goldilocks Rule—the correct answer will be neither too large (greater than the scope of the passage) nor too small (smaller than the scope of the passage, or perhaps a detail mentioned within the passage) but just right.

32. **(G)** *Reading/Natural Science/Voice.* What makes the two sentences mentioned in the item stem different from the rest of the passage? Well, most of the passage is characterized by a fairly no-nonsense discussion of trap-jaw ants. Facts and statements are presented clearly and in a straightforward manner. However, the two sentences in question are a little bit different. They use phrases like "head over heels" (line 75) and "banging one's head against the ground" (line 88)—phrases that are a little more playful than the rest of the passage. They serve, as (G) states, to interject a more lighthearted tone into a passage that is primarily technical.

33. **(A)** *Reading/Natural Science/Vocabulary.* The key to figuring out the correct answer to this item can actually be found earlier in the passage. In the last sentence of paragraph two (lines 18–21), the author states that the unbelievable speed of the trap-jaw ants' jaws has "enough force to crack open the armor of most prey." So "well-defended prey" would probably be prey that, as mentioned in this line, had outer armor, or a hard outer shell, (A).

34. **(J)** *Reading/Natural Science/Explicit Detail.* Lines 22–24 give the correct answer to this item. The source of the speed of the ants' jaws is that "the release comes from stored energy produced" by the muscles in the jaw, (J).

35. **(D)** *Reading/Natural Science/Implied Idea.* The beginning of the fourth paragraph (lines 39–45) is when the ants are described as popping popcorn because they bounce around "in a dizzying frenzy" (line 43) whenever they sense someone approaching. (D), "bounce around frantically," best echoes this thought.

36. **(H)** *Reading/Natural Science/Main Idea.* The author mentions in the last paragraph that the bouncer-defense jump might have been discovered when the ants had attempted to bite intruders but that the escape jump, with the ants aiming their jaws at the ground, "must have arisen from a different, perhaps accidental kind of behavior" (lines 85–86). And (H) mentions this accidental behavior, so it is the correct answer.

37. **(B)** *Reading/Natural Science/Vocabulary.* When the author uses the word "domain" in the line 31, he is mentioning two biomechanics who know something about biomechanics. They are knowledgeable in that particular field—in other words, biomechanics is their domain, or area of expertise, (B).

38. **(J)** *Reading/Natural Science/Explicit Detail.* In lines 49–52, the author discusses the trap-jaw ants' mandibles and their ability to decelerate, which the field biologists observed to be a possible way to avoid damage the ants could inflict on themselves. (J) is the correct answer because deceleration is mentioned.

39. **(A)** *Reading/Natural Science/Explicit Detail.* The escape jump is mentioned in paragraph five (lines 53–64). Though the jump doesn't allow the ant to go in a particular, predetermined direction, it does allow the ant the possibility of getting to a "new vantage point from which to relaunch an attack" (lines 63–64). This fits with (A), which is the correct answer.

40. **(H)** *Reading/Natural Science/Explicit Detail.* The bouncer-defense jump is mentioned in paragraph six (lines 65–75). One of the results of this jump is that it "propels the interloper . . . in one direction, out of the nest, and the ant in the other" (lines 69–70). So both the intruder and the attacking ant will be propelled out of the nest or in another direction, (H).

SCIENCE TEST EXPLANATIONS

PASSAGE I

1. **(C)** *Science/Research Summary/Analysis.* Figure 1 presents the data from Study 1 and Figure 2 presents the data from Study 2. Only Figure 2 has data representing live flies at 75 days: the data point, approximately 5% alive, is a circle, which according to the legend is for flies fed 5% SY medium, (C).

2. **(G)** *Science/Research Summary/Comprehension.* In Studies 1 and 2, the fly populations decreased over the course of the studies because flies died, but no new flies were born—the birthrate was zero. According to the study descriptions, "200 virgin female Strain N fruit flies" were used in Studies 1 and 2, which explains the zero birthrate, (G).

3. **(D)** *Science/Research Summary/Comprehension.* The same number, sex, and type of fruit flies are used in both Studies 1 and 2. The difference is the diet of the flies: the sugar yeast (SY) medium is 15% sugar in Study 1 and 5% sugar in Study 2. Thus, the SY medium tested in Study 1 contained a higher percentage of sugar than did the medium in Study 2, (D).

4. **(G)** *Science/Research Summary/Application.* The item stem specifies the Strain X fruit flies, which corresponds to the bottom row of Table 1. According to the data, flies fed 10% SY medium lived an average of 58.6 days, while those fed 15% SY medium lived an average of 55.6 days. Therefore, the average life span of flies fed 12% SY medium would most likely be between 55.6 days and 58.6 days, (G).

5. **(C)** *Science/Research Summary/Analysis.* In Table 1, the Strain N data correspond to fruit flies able to detect odors and the Strain X data correspond to fruit flies unable to detect many odors. If decreasing a fruit fly's ability to detect odors increases life span, the expectation is that the Strain X flies would live longer than the Strain N flies. Indeed, Table 1 supports this prediction: for each diet, the average life span of the Strain X flies was longer than that of the Strain N flies, (C).

6. **(F)** *Science/Research Summary/Application.* Only Studies 1 and 2 involve adding live yeast and additional odors from live yeast—both variables mentioned by the item stem. Since Study 1 uses the 15% SY medium, this is the correct study. And since the proposed study involves whether a defect in ability to detect odor affects lifespan, Strain X must be used, (F).

7. **(A)** *Science/Research Summary/Comprehension.* The numbered test tubes are in Studies 1 and 2. Tubes 1 and 4 are the only ones that do not include additional live yeast and odors. The only difference between Tubes 1 and 4 is the amount of sugar and yeast in the medium, so these two tubes would be best compared to determine the impact of reduced calorie diet on life span, (A).

PASSAGE II

8. **(F)** *Science/Conflicting Viewpoints/Comprehension.* A quick summary of the three positions in a chart will aid in answering the questions accompanying this passage:

	Before Migration	During Migration	Before Overwintering	During Overwintering
Hypothesis 1	Store lipids (lipids increase)	Use lipids (lipids decrease)	Store lipids (lipids increase)	Use lipids (lipids decrease)
Hypothesis 2	Store lipids	Use lipids	X	X
Hypothesis 3	X	Store lipids	X	Use lipids

According to the chart, Hypothesis 1, (F), asserts that the butterflies store lipids during two distinct periods: before migration and before overwintering.

9. **(D)** *Science/Conflicting Viewpoints/Comprehension.* The item stem asks which hypothesis does not use lipids (require energy from stored lipids) either during migration or during overwintering? Rather, each

hypothesis asserts that the butterflies use lipids during either migration (#2), overwintering (#3), or during both (#1). Thus, (D) is the correct choice.

10. (J) *Science/Conflicting Viewpoints/Analysis.* According to Hypothesis 3, the butterflies store lipids during migration and do not require energy from stored lipids during migration, so (J) is correct: the lipid mass increases constantly during migration.

11. (C) *Science/Conflicting Viewpoints/Analysis.* If the body mass is connected only with changes in stored lipids, a butterfly's body mass will be greater at the beginning of migration than at the end of migration if it uses lipids during migration. According to the passage and summarized in the chart above (explanation #8), both Hypotheses 1 and 2 assert that the butterflies use lipids during migration, (C).

12. (F) *Science/Conflicting Viewpoints/Application.* Essentially, the item stem asks which hypothesis asserts that monarch butterflies must store lipids before overwintering (for use during overwintering) at the overwintering site (after migration). According to the passage and summarized in the chart above (explanation #8), only Hypothesis 1, (F), asserts that the butterflies store lipids at the overwintering site after migration for use during overwintering.

13. (B) *Science/Conflicting Viewpoints/Comprehension.* Check each of the answer choices against the information given in the passage (and summarized in the chart above)—the correct choice will be supported by all three hypothesis. Only (B) is true: both Hypotheses 1 and 2 state that the butterflies use lipids during migration and Hypothesis 3 states that they store lipids during migration, so the statement that the butterflies' lipid masses change during migration is supported by all three hypotheses, (B).

14. (F) *Science/Conflicting Viewpoints/Application.* This item requires basic biology knowledge: which of the answer choices is associated with energy metabolism in carbon-based life forms? Specifically, which of the answer choices could possibly be an energy-rich molecule? Only ATP, or adenosine triphosphate, (F), is considered to be the energy currency of life—it's the biochemical way to store and use energy. Starch, (G), is also a storage mechanism for energy, but it stores energy for long periods. Conversely, ATP molecules store energy for short-term use, as specified in the stem: energy-rich molecules that can be readily used.

PASSAGE III

15. (C) *Science/Data Representation/Comprehension.* According to Figure 2, the solar radiation intensity (left-side axis) eight thousand years ago was approximately 500 watts/m^2, (C).

16. (F) *Science/Data Representation/Analysis.* If the CH_4 concentration data, represented by the solid line, were to continue to match the solar radiation data, represented by the dotted line, at present (right-side axis) it would be close to 450 ppb, which is less than 550 ppb, (F).

17. (B) *Science/Data Representation/Analysis.* If, as according to the item stem, the average global temperatures follow the trend in CH_4 concentration, the correct graph will mimic the data in Figure 2 for the CH_4 concentration (solid line). The graph that best matches the data represented by the solid line in Figure 2 is (B).

18. (H) *Science/Data Representation/Analysis.* Figure 1 shows the levels of solar radiation and CH_4 concentration over the 250 thousand years (Figure 2 focuses on the last 11 thousand years). The item stem asks about the average solar radiation intensity (dotted line) shown in Figure 1: the midpoint of the data cycle is at approximately 480 watts/m^2, (H).

19. (B) *Science/Data Representation/Analysis.* Identify an easily determinable maximum for the solar radiation intensity (dotted line): say, 80 thousand years ago. The next maximum occurs approximately 60 thousand years later. The only range given in the answer choices, in which a cycle of $80 - 60 = 20$ thousand years falls, is (B): between 15,000 and 35,000 years ago.

20. (J) *Science/Data Representation/Application.* According to the first paragraph, the given figures are consistent with the hypothesis that human activities have caused greenhouse gases that may have begun

warming Earth's climate (thousands of years earlier than before thought). That greenhouse gases, including CH_4, are responsible for warming Earth's climate eliminates (F) and (H). Now, the choice is between whether CH_4 gives off ultraviolet radiation in space, (G), or absorbs heat from Earth's surface, (J). Even the most basic of scientific background and familiarity with current global issues and challenges is enough to inform an educated guess: the CH_4 absorbs heat from the Earth's surface, contributing to a warming of Earth's climate.

PASSAGE IV

Note: Cambridge has classified this passage as a Data Representation passage because all the questions have to do with the data gathered. If you are spending time explaining the different passage types to your students, you can use this passage to illustrate the difference in question types associated with a Data Representation passage compared to those associated with a Research Summary passage. Both passage types will ask students to find and interpret data and predict the results of additional data collection, but only Research Summary passages will ask about the experiment design and the intentions of the researchers.

21. (D) *Science/Data Representation/Application.* A frictional force acting on the block acts in the direction opposite to the force acting on the block to move it. Common intuition tells you this: friction tends to slow things down. Therefore, if the block is pulled to the east, the frictional force exerted on the block by the surface is directed in the opposite direction—opposite east is west, (D).

22. (F) *Science/Data Representation/Analysis.* Figure 2 represents the velocity of the blocks as a function of time. The block that requires the shortest time to reach 15 m/s will have the greatest slope. The 2.00 kg block has the greatest slope (largest increase in velocity per unit of time), followed by the 2.50 kg block, and then the 3.00 kg block, (F). Alternatively, the graph shows that the 3.00 kg block takes 3 seconds to reach 15 m/s, the 2.50 kg block takes about 2 seconds, and the 2.00 kg block takes about 1.5 seconds.

23. (B) *Science/Data Representation/Analysis.* Acceleration is the change in velocity per unit time, or in Figure 2 for the 3.00 kg block, $\frac{\Delta y}{\Delta x} = \frac{15 \text{ m/s}}{3 \text{ s}} = 5 \text{ m/s}^2$, (B).

24. (J) *Science/Data Representation/Analysis.* The data in Figure 1 fall along a linear line, so the line can be represented by the slope-intercept form of the equation: $y = mx + b$, where m is the slope of the line and b is the y-intercept ($x = 0$). In Figure 1, the y-intercept is 0. As for the slope, $\frac{\Delta y}{\Delta x} = \frac{20 \text{ N}}{4 \text{ kg}} = 5 \text{ N/kg}$.

    Therefore, the data in Figure 1 is best modeled by the following equation:
    pulling force (N) $= 5 \times$ block mass (kg), (J).

25. (B) *Science/Data Representation/Analysis.* According to Figure 2, for a given time, as the block mass increases, the corresponding velocity decreases, (B).

26. (H) *Science/Data Representation/Analysis.* In item #24, we determined the equation for the results of Experiment 1: pulling force (N) $= 5 \times$ block mass (kg). Solve the equation for the block mass that corresponds to a pulling force of 30 N: block mass (kg) $= \frac{\text{pulling force (N)}}{5 \text{ N/kg}} = \frac{30}{5} = 6 \text{ kg}$, (H). Note that this same result is obtained by extrapolating the data in Figure 1 to a pulling force of 30 N.

PASSAGE V

27. (A) *Science/Research Summary/Comprehension.* Experiments 1 and 2 were performed to investigate how the indicators performed in solutions of known pH (pH 0-7 in Experiment 1 and pH 8-14 in

Experiment 2). In Experiment 3, four solutions of unknown pH were tested. Therefore, Experiment 2 differed from Experiment 3 in that the solutions were of known pH, (A).

28. **(J)** *Science/Research Summary/Analysis.* The solutions and indicators were placed in the wells of the well plate and any changes in color noted. If the plate were any color besides white, it would be difficult to distinguish the color changes. Therefore, the well plate must have been white, (J).

29. **(C)** *Science/Research Summary/Analysis.* The first paragraph of the passage defines the transition range of an indicator: the small range over which the indictor changes from one color to another color. In Experiment 1, the curcumin remains yellow for pH of 0 through pH of 7. In Experiment 2, the curcumin is orange for a pH of 8 and then red for the remaining pHs. This implies that the transition range for curcumin is between a pH of 7 and a pH of 9. Only (C) (pH = 7.4 to pH = 8.6) falls within this range.

30. **(F)** *Science/Research Summary/Analysis.* According to the results of Experiments 1 and 2, indigo carmine is blue for a pH of 0 through 11, so it cannot be used to distinguish between a pH of 1 and a pH of 6, as it'd be blue for both, (F).

31. **(B)** *Science/Research Summary/Analysis.* A transition range of pH = 4.6 to pH = 6.8 means that propyl red will be one color for a pH of less than 4 and a different color for a pH of more than 7. According to Table 1, the indicator that has a transition range closest to that of propyl red is resorcin blue, (B), which is red for a pH of 0 through 4 and blue for a pH of 7 through 14.

32. **(G)** *Science/Research Summary/Application.* Compare the results in Table 3 for Solution III with the indicated pH values from Tables 1 and 2. Solution III was yellow with the addition of metanil yellow, which is yellow for a pH of 3 through 14. It was red with resorcin blue, which is red for a pH of 0 through 4. These two indicators alone narrow the pH range for Solution III to between 3 and 4. Thus, the resorcin blue narrowed the possible pH range for Solution III, and excludes the possibility that Solution III has a pH of 7.3, (G).

33. **(D)** *Science/Research Summary/Analysis.* According to Table 1, metanil yellow has the lowest pH transition range, so start there. Solutions I, II, and III are all yellow with the addition of metanil yellow, indicating a pH of at least 3. However, Solution IV is orange with the addition of metanil yellow, indicating a pH of 2. Therefore, of the four tested solutions, Solution IV has the lowest pH, (D).

PASSAGE VI

34. **(J)** *Science/Research Summary/Comprehension.* This item tests general comprehension and understanding of the conducted studies described in the passage. In the first study (Figure 1), measurements of the proportion of total incoming solar radiation reflected from the surface, or albedo, was measured each day that was not cloudy. This item asks why the measurements were taken at noon. The data shows that the albedo was neither 100% reflected nor 100% absorbed, so eliminate (F) and (G). As for (H) and (J), since the purpose was to measure albedo, these measurements would be taken when the albedo is most intense, (J). Indeed, incoming solar radiation is most intense at noon, when the sun is directly overhead.

35. **(A)** *Science/Research Summary/Comprehension.* The difference between the three plots is the amount of DM sprayed on each plot. The reason for this was so that the albedo could be studied as a function of the amount of DM sprayed, (A).

36. **(H)** *Science/Research Summary/Analysis.* Look to Figure 1 to determine which day had albedo measurements that were lower than the previous measurements: on July 27th, all three measurements

were less than the previous measurement on July 25th. Therefore, it can be inferred that it must have rained on July 26th, (H).

37. (**B**) *Science/Research Summary/Comprehension.* According to the last paragraph of the passage, "the sensor recorded the soil temperature every 5 sec over the study period." Therefore, in one minute, the sensor makes $\dfrac{60 \text{ seconds}}{5 \text{ measurements/second}} = 12 \text{ measurements}$, (B).

38. (**F**) *Science/Research Summary/Comprehension.* As per the description of the albedo study, measurements were only taken on cloudless days. According to Figure 1, there is no data point for July 20th, so albedo data were not taken that day because it was not cloudless, (F).

39. (**D**) *Science/Research Summary/Analysis.* According to Figure 1, every data point (fraction of reflected radiation) for Plot 1 (no DM sprayed) is greater than either Plot 2 (40 m³/ha DM sprayed) or Plot 3(80 m³/ha DM sprayed). This implies that an increase in the amount of DM sprayed on a plot results in a decrease in albedo. As for Figure 2, the soil temperatures for Plot 1 were each less than the corresponding measurements for Plots 2 and 3. This implies that an increase in the amount of DM sprayed on a plot results in an increase in soil temperatures. Therefore, the correct choice is (D).

40. (**J**) *Science/Research Summary/Comprehension* and *Analysis.* This item tests understanding of what the data in Figure 1 actually show: the albedo is the fraction of the total incoming solar radiation that is reflected back from the surface. On August 3, the Plot 2 albedo measurement was 0.2, or 20%. Therefore, the amount that was NOT reflected back was $100 - 20 = 80\%$, (J).