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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.

English Test

1. **(C)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: BSC.PU.1.* "Since 1972" is an adverbial phrase that specifies when Cynthia Moss has been studying elephants; the inclusion of a comma in (A) incorrectly separates this adverbial phrase from the verb it is intended to modify. (C) moves the comma to the correct place—between "1972" and "when," where the comma separates the independent clause from the dependent relative clause. (B) includes the same comma error as (A), and (D) uses the plural possessive "elephants'," which is not correct in this context.

2. **(F)** *English/Conventions of Standard English/No Change. CCRS: BSC.GU.1.* For this item, the original is correct. "Amboseli Elephant Research Project" is a noun and requires an adjective, not an adverb, to modify it. Both (H) and (J) incorrectly supply adverbs, and (G) simply doesn't make sense.

3. **(B)** *English/Conventions of Standard English/Punctuation/Dashes. CCRS: AVG+.PU.3.* The material from "which" to "encroachment" is parenthetical material meant to modify the noun "elephants." The author chose to begin this parenthetical material with a dash, so another dash is required to end it. (B) is the only choice that supplies the necessary pair of dashes.

4. **(J)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: EXP. WC.1.* The sentence the author wishes to add tells us that humans are a threat to elephants. However, one of the "daunting . . . threats" the author mentions earlier in this paragraph is "human encroachment." To add another sentence here about the threat of humans would be unnecessarily redundant.

5. **(B)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: BSC.PU.1.* It could be tempting to put commas between "intensive," "field," and "studies," as (A) does, since you may think that "intensive" and "field" both modify "studies." However, "field studies" is actually a compound noun (like "swimming pool"), so a comma between "field" and studies" makes (A) incorrect. Commas are also not placed between a noun and a single adjective (in this case, "intensive"), so that makes (D) incorrect as well. Finally, a comma after "field studies" would separate the subject ("key finding") from the verb ("is"), which makes (C) incorrect as well. That leaves (B) as the correct answer.

6. **(G)** *English/Production of Writing/Strategy/Effective Transitional Sentence. CCRS: EXP. ORG.1.* In the original sentence, "however" denotes a contrast between the material presented and that which came before. However, there is no contrast; the author is instead supplying an example of the learned behavior mentioned in the previous paragraph. "For instance," (G), provides the best transition word.

7. **(C)** *English/Conventions of Standard English/Sentence Structure/Faulty Parallelism. CCRS: AVG.SEN.1.* The original sentence suffers from a lack of parallelism. The gerund phrases that are the objects of the preposition "by" should be parallel, but "kneeling" and "it sipped" are not. "It sipped" should be changed to "sipping," and (C) makes that change. The other choices fail to provide the necessary parallelism.

8. **(G)** *English/Conventions of Standard English/Sentence Structure/Fragments. CCRS: ADV. SEN.1.* The original sentences from "The habit" to "trunk" and "Then" to "doing so" are both fragments. All of the other answer choices combine the two sentences, so you must choose the most grammatically correct option. (J) can be eliminated since the resulting option creates a run-on sentence. (H) creates a problematic preposition situation. When the two sentences are combined, the "of" in the first part of the sentence modifies both "pulling" and "releasing"; "by" should not be added. Only (G) combines the two sentences logically and grammatically with the conjunction "and."

9. **(C)** *English/Conventions of Standard English/Sentence Structure/Problems of Coordination and Subordination. CCRS: AVG+.SEN.1.* The phrase "as if witnessing" in the original sentence implies that the baby elephant is not actually witnessing other elephants pull and release water into their mouths. However, in order for that behavior to be learned, the baby elephant would have to witness it. So (A) is incorrect. As for the other choices, (B) implies erroneously that the baby elephant *only* practices the behavior when it sees other elephants doing it. (D) makes it unclear what the elephant is witnessing and when it is doing so. (C) correctly describes when and what the baby elephant is witnessing.

10. **(G)** *English/Knowledge of Language/Style/Conciseness. CCRS: BSC.WC.1.* The original sentence is too wordy. "In this regard," (G), is clear, concise, and does not include the unnecessary "which."

11. **(B)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: ADV.TD.3.* In the original sentence, the descriptive details given are that Enid is a ten-year-old female and that Ely is named by Moss. Since it's safe to assume that the elephants did not name themselves, the original description is unnecessary. As for the other choices, both (C), an elephant, and (D), the third, are mentioned in the preceding sentence. Only (B) provides new, relevant information that also parallels the description given to Enid: ten-year-old female vs. baby male.

12. **(F)** *English/Conventions of Standard English/No Change. CCRS: AVG+.SEN.2.* The verb tense in the original sentence is correct. All of the other choices provide verb tenses that are incorrect within the context and timeline of the given sentence.

13. **(D)** *English/Production of Writing/Organization/Paragraph-Level Structure. CCRS: BSC.ORG.1.* In Sentence 6 of the paragraph in question, the author mentions Ely overcoming "early limitations." However, nothing prior to that sentence indicates what those limitations might be. Sentence 7 describes Ely's early limitation (deformed feet), so it should go somewhere before Sentence 6, which makes (A) incorrect. As for the other choices, Ely is not mentioned until Sentence 4, and it makes sense for any description of him to come after the initial mention. That rules out (B) and (C) and leaves (D) as the correct answer choice.

14. **(J)** *English/Conventions of Standard English/Sentence Structure/Problems of Coordinate and Subordination. CCRS: AVG.GU.3.* The sentence here already includes a verb: "has brought." The use of an additional verb ("is provided") in the underlined portion without a verbal signal that another clause has begun is incorrect. (G) and (H) create similar errors; only (J) removes the verb and creates a grammatically correct prepositional phrase instead.

15. **(B)** *English/Production of Writing/Strategy/Main Idea. CCRS: EXP.TD.2.* You should be able to immediately eliminate the two negative answers, (C) and (D), as soon as you finish reading the item stem. The author's essay does indeed focus on an aspect of animal behavior in the wild; in fact, the author provides three examples of elephant behavior in the wild (calves learning to use their trunks and identify safe vegetation to eat, and senior females teaching younger females to care for calves). That description most closely aligns with the description provided by (B), which is the correct answer.

16. **(J)** *English/Conventions of Standard English/Sentence Structure/Misplaced Modifiers. CCRS: AVG.SEN.1.* This item suffers from a misplaced modifier. As written, the sentence asserts that "they" (the ghost signs) see remnants of outdoor advertisements, an assertion that doesn't make sense. (G) and (H) provide similarly illogical modifiers; only (J) replaces the gerund phrase "Seeing remnants" with the noun "Remnants," a switch that changes the clause into an appositive that modifies "ghost signs."

17. **(A)** *English/Production of Writing/No Change. CCRS: BSC.WC.1.* The phrase "bygone era" in the original sentence implies times that are past. All of the other choices repeat this idea unnecessarily, so (A) is the correct answer.

18. **(G)** *English/Conventions of Standard English/Punctuation/Dashes. CCRS: AVG+.PU.3.* Like #3, this item tests the appropriate way to punctuate parenthetical material. The dash between "*Coffee*" and "are" is the big clue; since the parenthetical material ends with a dash, it must begin with a dash as well, making (G) the correct answer.

19. **(B)** *English/Conventions of Standard English/Grammar and Usage/Nouns and Noun Clauses. CCRS: AVG.SEN.1.* The specific type of dependent clause that begins with the underlined "should" is called a relative clause, and to be grammatically correct, it requires a subject (specifically, a relative pronoun) and a verb. "Should" is the verb, but in the original sentence, there is no subject. Only (B) supplies the appropriate, grammatical relative pronoun to complete the clause.

20. **(F)** *English/Conventions of Standard English/No Change. CCRS: AVG+.PU.1.* The original sentence is correctly punctuated. Adding a comma after "businesses," like (G) does, incorrectly separates "products and businesses" from a restrictive relative clause. As for (H), commas are never added between two nouns separated by "and." And (J) is incorrect because adding a colon there incorrectly implies that the products are, in fact, businesses.

21. **(B)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: ADV.PU.2.* This item is tricky. The correct answer is (B), but it would be easy to look at that answer and think that commas between every word must be wrong. So we'll break it down for you so you can see why each comma is needed.

    Comma #1: There are two main parts in this sentence—the main clause ("Yet . . . apology") and a prepositional phrase ("with . . . colors"). A comma is needed to correctly separate the two.

    Commas #2 and 3: "Instead" is an aside—an interruption that is not essential to the meaning of the sentence. As such, it requires a pair of commas to set it off from the rest of the sentence.

    None of the other choices include all of the punctuation.

22. **(H)** *English/Conventions of Standard English/Sentence Structure/Misplaced Modifiers. CCRS: AVG.SEN.1.* This item addresses the misplaced modifier. As written, the sentence makes it sound like the collection itself is driving home from school. (H) rewrites the sentence to clarify that the narrator is the one who drove home from school.

23. **(D)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: EXP. TD.3.* In discussing ghost signs thus far, the author has used phrases like "weather-beaten," "bygone," "faded," and "barely legible." Which answer choice best echoes these ideas? "Disappearing," (D), best seems to reflect the point the writer is trying to make about the nature of the ghost signs.

24. **(J)** *English/Knowledge of Language/Style/Clarity of Meaning. CCRS: PRE.WC.1.* In the original sentence, "the setting sun's illumination of the yellowing plastic" functions as a clause and, as such, needs a subject and a verb. "The setting sun" is the subject, but there is no verb. Only (J) supplies the needed verb to make the clause complete: "the setting sun illuminated."

25. **(B)** *English/Knowledge of Language/Style/Idiomatic Expression. CCRS: AVG+.WC.1.* The underlined portion of the sentence suffers from two errors: the use of the contextually unidiomatic "clue" and the lack of parallelism between the prepositions "to" and "of." (B) corrects both problems by replacing "clue" with the idiomatic "evidence" and "to" with "of." (C) incorrectly changes the meaning of the sentence by asserting that the hole was definitely caused by vandalism or a hailstorm, and to simply delete the underlined portion, as (D) suggests, changes the portion of the sentence from an appositive that describes the hole to a list in which "small hole," "vandalism," and "hailstorm" are all on equal grounds.

26. **(J)** *English/Production of Writing/Strategy/Effective Transitional Sentence. CCRS: EXP.ORG.1.* "Instead," (F), and "on the other hand," (G), both signal a contrast between the information that came before and the information that will come after. However, the structure of the paragraph doesn't lend itself to that contrast. The writer describes various aspects of the sign that drew his or her attention and then states that, whatever the reason, "the sign touched me." As for (H), "meanwhile" implies that the sentence to come is not connected directly to the idea before, which is incorrect. Since the ideas of these sentences are so closely connected, (J) simply does away with any transitional phrase without losing any meaning or significance of the sentences.

27. **(D)** *English/Conventions of Standard English/Grammar and Usage/Diction. CCRS: BSC. GU.1.* All of the answer choices mean, in some way, "alone," but only one choice provides a grammatically correct option. "Solitude," (A), and "solitaire," (C), are both nouns—and nouns cannot modify other nouns ("trips"). "Solitarily," (B), is an adverb, and adverbs do not modify nouns. "Solo," (D), is an adjective in this context, and since adjectives modify nouns, (D) is the correct answer.

28. **(H)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: ADV.PU.2.* In the original sentence, there appear to be two verbs in the dependent clause beginning with "when"—namely, "like" and "am." Instead of being a verb, however, "like" begins a nonrestrictive phrase that compares the writer to the signs. And nonrestrictive phrases are set off from the rest of a sentence by, in this case, pairs of commas, as in (H).

29. **(A)** *English/Production of Writing/Organization/Passage-Level Structure. CCRS: AVG+. ORG.5.* The current order of the paragraphs flows logically: in the first paragraph, the author gives an introduction to and description of ghost signs; in the second paragraph, the author mentions how he or she collects the ghost signs and when the collection began; in the third paragraph, the author describes the very first sign that began the collection; and, finally, in the fourth paragraph, the author discusses some more of his or her current hunt for ghost signs. Each paragraph transitions easily to the next, so Paragraph 2 should not be moved, (A).

30. **(F)** *English/Production of Writing/Strategy/Main Idea. CCRS: EXP.TD.2.* Does the writer's essay describe starting and enjoying a new hobby? Yes—the writer describes starting the hunt for ghost signs and, from the language used in the essay, clearly enjoys this hobby. Since the answer is yes, that immediately eliminates (H) and (J). As for (G), though the author does mention in Paragraph 4 taking friends on searches and having people "point [the narrator] to where they think they have seen a ghost sign," that is only one part of the essay and not the purpose of the essay as a whole. That leaves (F) as the correct answer.

31. **(B)** *English/Conventions of Standard English/Sentence Structure/Fragments. CCRS: ADV. SEN.1.* The original sentence is a fragment: "The Bahamas . . . which are home to some of the most unusual geological formations in the world." The sentence needs a verb, which both (B) and (C) supply. However, (C) contains another error. The phrase "a series . . . United States" is nonrestrictive and, as such, needs to be set off with a pair of commas. (C) omits the closing comma, which leaves (B) as the correct answer.

32. **(F)** *English/Production of Writing/Strategy/Effective Opening Sentence. CCRS: EXP.ORG.2.* This item asks you to find a sentence that best transitions between the first paragraph, which brings up the topic of blue holes in the Bahamas, and the second paragraph, which details how blue holes are formed with calcium carbonate. Only (F) echoes that order, with a mention of the Bahamas followed by an introduction to calcium carbonate.

33. **(A)** *English/Conventions of Standard English/No Change. CCRS: ADV.SEN.2.* The original sentence supplies the correct past verb tense. All of the other choices destroy the logical order of the action of the grains described in the sentence. The grains formed the Bahamas in the past, not in the present, (B) and (D), or in the future, (C).

34. **(F)** *English/Production of Writing/No Change. CCRS: BSC.WC.1.* As currently written, the original sentence provides the most concise and clearest way of expressing the sentence. (G) is not only too wordy but also implies incorrectly that the sea level is being buoyed by seawater, (H) introduces an additional error with the informal "it being," and (J) is not only wordy but confusing and illogical.

35. **(D)** *English/Conventions of Standard English/Punctuation/Dashes. CCRS: EXP.PU.1.* This item provides a slightly different twist on the traditional item testing the punctuation of nonrestrictive phrases. At first glance, "or seawater" seems like it is a correctly punctuated nonrestrictive phrase set off by dashes. However, there are two clues that show it is not. The first is actually in (B). Nonrestrictive phrases are set off from the rest of the sentence by pairs of punctuation marks—commas, dashes, or parentheses. (A) provides dashes, and (B) provides commas. If "or seawater" was a nonrestrictive phrase, both (A) and (B) would be correct—and the test-writers would not give you two correct answers. So both (A) and (B) can be eliminated.

    The second clue is in the essay itself. The word "either" before "rainwater" indicates that two items (rainwater and seawater) in an either/or construction will be compared to the brackish water. They should not be separated from each other by a comma, so that eliminates (C) as well and leaves (D) as the correct answer.

36. **(H)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: AVG.PU.3.* There are two clauses in the original sentence: "As the limestone eroded," a dependent clause, and "caves formed," an independent clause. For clarity, an introductory dependent clause should be separated from an independent clause by a comma. Only (H) provides the proper punctuation in the appropriate part of the sentence.

37. **(B)** *English/Conventions of Standard English/Grammar and Usage/Diction. CCRS: AVG+. WC.5.* This item asks for you to pick an answer choice that uses the most specific language to illustrate how long it took to create the caves. While all the answer choices deal with the passage of time, the phrases "ice ages" and "temperate eras" in (B) provide the most specificity about the length of time the cave-creating process took.

38. **(J)** *English/Knowledge of Language/Style/Conciseness. CCRS: BSC.WC.1.* Most of the information contained in the original sentence is redundant. "Process" is already mentioned earlier in the sentence, and the idea of repetition "at different depths hundreds of feet apart" was referenced in the sentence before ("sea levels rose and fell by hundreds of feet"). All of the ideas in the original sentence that took twelve words can be reduced down to the four in (J) and still lose none of the meaning.

39. **(C)** *English/Conventions of Standard English/Punctuation/Semicolons* and *Sentence Structure/Run-On Sentence. CCRS: ADV.PU.4.* The original sentence is a run-on of two independent clauses. There are a number of ways to correct this error (period, semicolon, or comma + conjunction), but only one is given as an answer choice: adding a semicolon, as (C) does.

40. **(H)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: ADV. ORG.3.* Question of the day: should the writer add that sentence? The rest of the paragraph deals with the general mechanics of blue-hole cave formation. While the sentence in question references a specific blue hole, it really has nothing to do with the cave-creating process. It should be deleted because the detail is unrelated to the paragraph as a whole, (H).

41. **(B)** *English/Conventions of Standard English/Grammar and Usage/Adjectives versus Adverbs. CCRS: BSC.GU.1.* "Darker" in this sentence is a comparative adjective that modifies "water." "Striking" then modifies "darker," but it is in the incorrect form. Adverbs modify adjectives, and the adverbial form of "striking" is "strikingly." (B) has the necessary adverb + adjective.

42. **(J)** *English/Conventions of Standard English/Grammar and Usage/Pronoun Usage. CCRS: BSC.GU.3.* This item tests pronoun usage, and in order to see if the proper pronoun is used, you first need to determine the pronoun's antecedent. In this case, the antecedent is "patch," a singular noun, so the pronoun must also be singular. Both (H) and (J) are singular, but (H) confusingly implies that the writer is indicating a specific patch of water instead of a general feature of blue holes. That makes (J) the correct answer.

43. **(C)** *English/Conventions of Standard English/Sentence Structure/Fragments. CCRS: ADV. SEN.1.* The underlined punctuation creates a fragment of the second sentence. (B) and (D) only move the period and do nothing to fix the fragment. Only (C) remedies the problem by combining the two sentences and creating a cohesive list describing what the divers found: remains of animals now extinct, stalactites and stalagmites, and human artifacts.

44. **(G)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: ADV.TD.3.* In Paragraph 4, the writer describes a striking visual that indicates the presence of a blue hole: a circle of water that's darker than the surrounding water. (H) uses the word "darken," so it could be a good choice, but the image presented in (G)—that of dots (or dark circles) in the waters of the Bahamas—provides a much better visual.

45. **(C)** *English/Production of Writing/Organization/Paragraph-Level Structure. CCRS: ADV.ORG.2.* (C) provides the only choice in which the inserted sentence really makes sense: prior to Point (C), the writer mentions the depths of the blue hole's water; after Point (C), the writer lists some fossils and rock formations within the blue holes. Inserting the sentence at Point (C) follows the logical progression of that part of the passage .

46. **(J)** *English/Knowledge of Language/Style/Conciseness. CCRS: AVG.WC.1.* The original underlined part is not very concise. "Protectively" and "defend" are similar ideas, and it has already been mentioned earlier in the paragraph that the walls surround the city, so "city" doesn't need to be repeated. (D) cuts through the extraneous verbiage to get to the core of what the author wants to say: "defensive walls."

47. **(C)** *English/Conventions of Standard English/Sentence Structure/Run-On Sentences and Punctuation/Commas. CCRS: AVG.PU.3.* As in #39, there are two clauses here: an introductory dependent clause and the following independent clause. Since the introductory clause beginning with "Although" is so long, it really needs a comma to separate it from the independent clause. (C) provides the appropriate comma. Both (B) and (D) attempt to add punctuation, but in doing so, they create fragments of the introductory dependent clause.

48. **(F)** *English/Conventions of Standard English/No Change. CCRS: AVG+.PU.4.* "It's" is a contraction that means "it is," "its" is a possessive pronoun, and "its'" is not grammatical English (which means (H) can be eliminated). Both (G) and (J) use the possessive "its," which doesn't make sense in context. Replacing "It's thought" with "It is thought" makes it clear that (F) is the correct answer.

49. **(A)** *English/Conventions of Standard English/No Change. CCRS: ADV.PU.2.* The nonrestrictive phrase "built in . . . Aurelian" describes in further detail the Aurelian Wall and is correctly set apart from the rest of the sentence by commas. Since there is already a main verb later in the sentence ("was"), to remove a comma and add another verb, as (B) does, is grammatically incorrect. (D) has a similar problem, although it adds the additional error of separating the subject from the apparent verb with a comma. Finally, (C) adds the relative pronoun "which," which signals a relative clause, not an appositive, and is also incorrect.

50. **(G)** *English/Conventions of Standard English/Sentence Structure/Problems of Coordination and Subordination. CCRS: PRE.GU.2.* There are two ways to create a comparative adjective: either adding the suffix *–er* or using the word "more." It is not grammatical to use both, as both (F) and (H) do. That leaves (G) and (J), and the only difference between these two is the use of "than" vs. "then." And "than" is the correct word to use when making comparisons, which means that (G) is the correct choice.

51. **(B)** *English/Conventions of Standard English/Sentence Structure/Unintended Meanings. CCRS: ADV.SEN.1.* As mentioned earlier, the best place for modifiers to be is as close to the word they are meant to modify as possible. If the writer intends to say that it is Rome that has greatly expanded, then that phrase needs to be close to "Rome." Both (B) and (C) shorten the distance, but (C) doesn't make sense: "surrounded the city of Rome greatly expanded." (B), however, does make sense: "surrounded the greatly expanded city of Rome."

52. **(J)** *English/Production of Writing/Strategy/Effective Transitional Sentence. CCRS: EXP. ORG.1.* In the original sentence, the phrase "in other words" signals that an idea is going to be expressed in a different way. The ideas before and after the underlined portion are not, however, the same idea; they are different details about the Aurelian Wall. That makes (F) incorrect. In (G), "therefore" means "as a result of," but that does not make sense in context. As for (H), "instead" signals a contrast or reversal, but no reversal is meant. The paragraph simply lists some features of the Aurelian Wall, and removing a transitional word or phrase altogether, as (J) does, provides the simplest and clearest way of connecting the two sentences.

53. **(A)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: AVG+.PU.1.* "The posterns" and "the towers" are two parts of a compound subject linked by the conjunction "both." The two parts of the subject should not be separated with a comma from each other, as (B) and (C) do, nor from the verb, as (D) does. Only the original sentence is punctuated correctly.

54. **(G)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: AVG. TD.3.* The phrase "defensive positions" in the original sentences makes it clear the purpose of the posterns and towers. (F), (H), and (J) really add nothing more to the idea of defense; (G), however, details how the posterns and towers were used in defense and is a much more specific choice.

55. **(B)** *English/Production of Writing/Strategy/Effective Transitional Sentence. CCRS: EXP. ORG.1.* Paragraph 4 discusses some of the details and designs of the Aurelian Wall in Roman times. Paragraph 5 focuses more on the present, with references to a restaurant and a train station, and particularly contrasts the Servian Wall with something. (B) provides the best transition between a discussion of the Aurelian Wall in the past and a discussion of the Aurelian Wall in the present (and how it differs from what remains of the Servian Wall).

56. **(J)** *English/Conventions of Standard English/Grammar and Usage/Subject-Verb Agreement. CCRS: AVG.GU.2.* Paragraph 5 deals with the Servian and Aurelian Walls as they are in the present, so the present tense is correct here. However, since the subject of the sentences is the plural "portions," the verb needs to be the plural "remain," not the singular "remains." (J) makes the appropriate change.

57. **(C)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: ADV. TD.3.* Features of the Aurelian Wall were addressed in the fourth paragraph of the essay. The sentence the writer wishes to add brings up more details about the Aurelian Wall that would be appropriate in Paragraph 4—not in Paragraph 5, and especially not amidst a discussion of the present-day Servian Wall. (C) best echoes this idea.

58. **(F)** *English/Knowledge of Language/Style/Clarity of Meaning and Conciseness. CCRS: BSC. WC.1.* This item tests concision, and a quick reading of (G), (H), and (J) shows that they are

all trying, with unnecessary wordiness, to restate the idea presented concisely in the original sentence: "the future capital."

59. **(C)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: ADV.TD.3.* What could be ironic about a wall that once protected one of the most powerful cities in one of the world's most famous empires? Well, that some of the remains of a wall of such obvious significance are now found in a location as ubiquitous as a fast food restaurant, (C). None of the other choices present such a ironic contrast.

60. **(F)** *English/Production of Writing/Organization/Paragraph-Level Structure. CCRS: ADV.ORG.2.* The verbal clue to finding the right place for this sentence is "two walls." At Point B, the writer is talking only of the Servian Wall, and at Points C and D, the writer mentions only the Aurelian Wall. Only at Point A does the writer address "two ancient walls," and the sentence fits best here.

61. **(C)** *English/Conventions of Standard English/Punctuation/Commas. CCRS: AVG.PU.3.* This item has two comma errors. Since this sentence begins with a long introductory phrase ("Before . . . Revolution"), it should be set apart from the main clause with a comma. A comma needs to come after "Revolution," which makes both (A) and (D) incorrect. As for (B), the comma after "Forten" separates the subject of the sentence ("prisoner of war James Forten") from the verb ("said"), which is also incorrect. That leaves (C) as the correct answer.

62. **(G)** *English/Production of Writing/Strategy/Effective Transitional Structure. CCRS: AVG+. ORG.2.* The last idea presented in the first paragraph is that of Forten's rejection of an offer to be freed and educated in England. Both (G) and (H) mention that idea, but the risk mentioned in (G) provides a better transition since the remainder of the second paragraph details why the rejection was risky and not why the offer was unusual.

63. **(C)** *English/Conventions of Standard English/Grammar and Usage/Subject-Verb Agreement. CCRS: BSC.GU.2.* The verb of the underlined subject is the plural "were"; however, "chance" is singular. So the plural subject "chances" is needed, which eliminates (A) and (D). (B) uses the nonidiomatic "to surviving," and that leaves (C) as the correct answer.

64. **(F)** *English/Conventions of Standard English/No Change. CCRS: ADV.PU.2.* In the original sentence, "if released . . . exchange" is a dependent clause. As such, it needs to be separated from the independent clause ("he . . . Philadelphia") by a comma. (F) is the only answer choice that does that, but you may wonder if the second comma in the underlined part is needed as well. And the answer is yes. "A free black man" functions as a nonrestrictive appositive describing "he," so it needs to be set off by a pair of commas. As for the other choices, the punctuation added in both (G) and (J) creates a fragment, and the dash added in (H) is an improper way to punctuate the combining of dependent and independent clauses.

65. **(B)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: EXP. TD.1.* In the first two sentences of Paragraph 2, the writer describes some of the immediate ramifications Forten faced from rejecting his British captor's offer to free him—including the possibility or capture and slavery. In Paragraph 3, the writer begins to detail Forten's rise to success. The sentence in question transitions nicely between the two by first mentioning that, despite the risk Forten took by rejecting the offer, he actually survived and then by stating that he actually became very successful—and then Paragraph 3 opens with the story of how his success began. (C) best echoes this idea.

66. **(F)** *English/Conventions of Standard English/No Change. CCRS: ADV.SEN.2.* The original sentence stays consistent with the rest of the passage and uses the past tense correctly. As for the other choices, (G) and (H) both use the incorrect past perfect tense ("had arisen" and "had risen") and do not make grammatical sense in context. As for (J), the verb "raised" is transitive and requires an object to complete the thought ("He raised the flag"), which the sentence does not provide.

67. **(A)** *English/Conventions of Standard English/No Change. CCRS: ADV.PU.2.* The phrase "white and black" is an appositive that describes the workers. Since it is nonrestrictive (not essential to the meaning of the sentence), it must be set apart by commas, which the original sentence does correctly.

68. **(H)** *English/Production of Writing/Strategy/Appropriate Supporting Material. CCRS: BSC. TD.1.* Like the questions that ask whether you should include a particular sentence, you can quickly increase your odds of finding the right answer by eliminating two of the answer choices: either the two "keep" options or the two "delete" ones. Paragraph 4 discusses the rising success of Forten's business and his later status as one of the premier sailmakers in Philadelphia. The sentence about his business records does not follow the logical (and chronological) progression of the paragraph, so it should be deleted, which means (F) and (G) can be eliminated. As for (J), though the paragraph does mention that Forten had high standards, that is not the primary focus of the paragraph, so (J) can also be eliminated. That leaves (H) as the correct answer.

69. **(D)** *English/Knowledge of Language/Style/Conciseness. CCRS: BSC.WC.1.* The original sentence includes a redundancy: "in Philadelphia" is already implied by describing Forten as "the city's" best sailmaker. (D) eliminates this redundancy; the other two choices do nothing to eliminate it or, as in the case of (B), add more ("foremost leading").

70. **(J)** *English/Production of Writing/Strategy/Effective Opening Sentence. CCRS: EXP.ORG.1.* Paragraph 5 details some of the ways Forten successfully adapted his business as needs arose. Though (F), (G), and (H) all are true points mentioned somewhere in the passage, they do not provide good opening sentences for this paragraph specifically. Only (J) provides a general statement that segues nicely into the specifics of the paragraph.

71. **(A)** *English/Conventions of Standard English/No Change. CCRS: AVG.GU.1.* The way to create a comparative adjective is by either using the suffix *–er* or adding the word "more." Both (B) and (C) create the grammatically incorrect "more quicker." As for the other two choices, a comma is required between two adjectives that modify the same noun—in this case, "smaller" and "quicker" modifying "vessels." (D) doesn't supply this comma, which makes (A) the correct answer.

72. **(J)** *English/Knowledge of Language/Style/Conciseness. CCRS: BSC.WC.1.* "Over greater" in the original sentence is redundant. (J) eliminates the "greater" to create a simple, concise phrase that loses none of the meaning.

73. **(D)** *English/Knowledge of Language/Style/Conciseness. CCRS: BSC.WC.1.* A war veteran is, by definition, someone who has served in a war. (D) correctly eliminates the redundant phrase "who served in this war."

74. **(J)** *English/Production of Writing/Organization/Paragraph-Level Structure. CCRS: ADV. ORG.2.* One of the keys to the sentence in question is the mention of ending slavery. Neither Paragraph 1, (A), nor Paragraph 3, (B), mention slavery or abolition at all, so those choices can be eliminated. That leaves Paragraph 6, which *does* talk about abolition. The second key, then, is the mention of writing and the verbal clue "Forten himself." Prior to Point (D), the author mentions Forten financing the *Liberator*, "a powerful abolitionist newspaper," which links back to both writing and Forten. (D), then, is the correct answer.

75. **(C)** *English/Production of Writing/Strategy/Main Idea. CCRS: EXP.TD.2.* Though the passage does mention Forten's business as a sailmaker, it doesn't go into any great detail about the daily operations of that business. So the answer to whether the essay accomplished this purpose is no, and that leaves (C) and (D) as possible correct answers. And as for (D), the passage mentions sailmaking and supporting abolition as parts of Forten's life; there is no intention to contrast the two. (C) best encapsulates the purpose of the passage.

Mathematics Test

1. **(C)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Basic Algebraic Manipulations. CCRS: PRE.A.2.*

   To simplify the given expression, apply the distributive property and combine like terms:
   $a(4-a) - 5(a+7) = 4a - a^2 - 5a - 35 = -a^2 - a - 35$, (C).

2. **(G)** *Mathematics/Number and Quantity/Basic Arithmetic Manipulations. CCRS: AVG+.NS.1.*

   First, write an inequality between the two decimal numbers. Three-hundredths is less than two-tenths, so $0.03 < 0.2$. Convert $\frac{1}{4}$ to a decimal: $\frac{1}{4} = 0.25$, which is larger than 0.2. Therefore, the three numbers arranged from least to greatest is $0.03 < 0.2 < \frac{1}{4}$, (G).

3. **(C)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Basic Algebraic Manipulations. CCRS: BSC.A.2.*

   To determine the value of $x^2 - 4$, subtract 8 from both sides of the given equation:
   $x^2 + 4 = 29 \Rightarrow x^2 + 4 - 8 = 29 - 8 \Rightarrow x^2 - 4 = 21$, (C).

4. **(F)** *Mathematics/Geometry/Coordinate Geometry/The Coordinate System, Rectangles and Squares*, and *Number and Quantity/Percentages. CCRS: AVG+.G.6.*

   Graph the four sets of (x, y) coordinate pairs in the xy-coordinate plane:
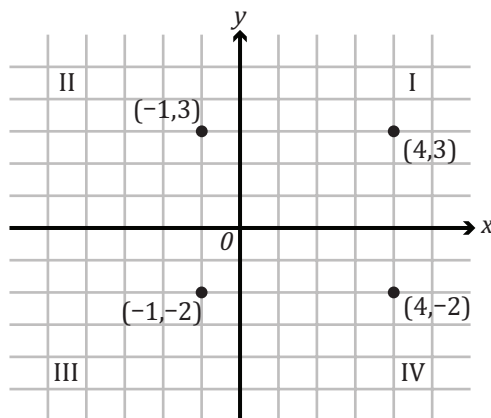
   The width of the rectangle extends from $x = -1$ to $x = 4$: a distance of 5 units. The height extends from $y = -2$ to $y = 3$: a distance of 5 units. The area of the entire rectangle is the product of width and height: $5(5) = 25$. The portion of the rectangle in Quadrant III is 1 unit by 2 units, so the area is $1(2) = 2$. The percentage of the total area of the rectangle that is in Quadrant III is $\frac{2}{25} = \frac{2(4)}{25(4)} = \frac{8}{100} = 8\%$, (F).

5. **(B)** *Mathematics/Number and Quantity/Rates and Proportions. CCRS: AVG.AF.1.*

   The item stem gives the cost of clothes in 1985 and 10 years later, and asks for the cost in 1991 if the cost continues to increase linearly. Determine the unit rate of cost increase per year: $\frac{\$1,000 - \$620}{10 \text{ years}} = \frac{\$380}{10 \text{ years}} = \frac{\$38}{\text{year}}$. There are 6 years between 1985 and 1991, which

equals an increase of $\dfrac{\$38}{\text{year}}(6 \text{ years}) = \$228$. The original cost is $620, so the final cost is

$\$620 + \$228 = \$848$, (B).

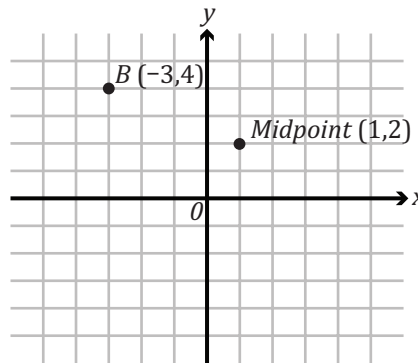6. **(K) *Mathematics/Number and Quantity/Basic Arithmetic Manipulations. CCRS: AVG+.A.9.***

Let the unknown number equal x. According to the item stem, $\sqrt{x} \approx 9.2371$, so $x \approx (9.2371)^2$. Since $9^2 = 81$ and $10^2 = 100$, x must be between 81 and 100. The only possible matching choice is (K), between 81 and 99.

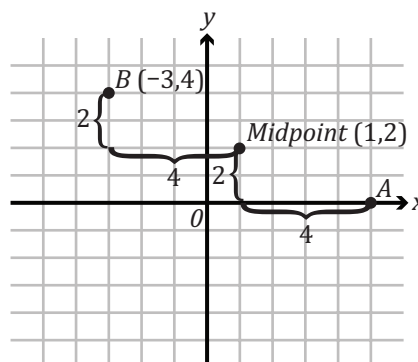7. **(E) *Mathematics/Statistics and Probability/Probability. CCRS: AVG+.SP.3.***

The total number of pieces of candy is 10 and all but 2 are grape. Therefore, the probability that a candy picked at random is NOT grape is $\dfrac{10-2}{10} = \dfrac{8}{10} = \dfrac{4}{5}$, (E).

8. **(K) *Mathematics/Geometry/Coordinate Geometry/The Coordinate System* and *Distance and Midpoint Formulas. CCRS: AVG+.G.11.***

Graph the given (x,y) coordinate pairs for point B and the midpoint of $\overline{AB}$ in the xy-coordinate plane:

Since the midpoint is 2 units down and 4 units to the right of point B, point A must be another 2 units down and 4 units to the right of the midpoint:

The coordinates corresponding to point A are $(5,0)$, (K).

9. **(B)** *Mathematics/Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations* and *Evaluating, Interpreting, and Creating Algebraic Functions. CCRS: AVG+.A.2.*

If C represents the number of customers 1 year ago, and there are 116 customers now, then $2C + 8 = 116$. Solve the equation for C: $2C + 8 = 116 \Rightarrow 2C = 108 \Rightarrow C = 54$, (B).

10. **(H)** *Mathematics/Number and Quantity/Rates and Proportions. CCRS: AVG.AF.1.*

The item stem asks for the unit rate of cost per foot of fence. The amount spent on the fence is the difference between the total and the \$500 fee: $\$2,200 - \$500 = \$1,700$. The total length of fence is 200 feet, so the cost per foot is $\dfrac{\$1,700}{200} = \dfrac{\$17}{2} = \$8.50$, (H).

11. **(C)** *Mathematics/Algebra and Functions/Solving Quadratic Equations and Relations*, *Solving Simultaneous Equations*, and *Geometry/Rectangles and Squares. CCRS: ADV.A.5.*

The easiest approach to this item is to test the answer choices. Evaluate the area (the product of length and width) of each answer choice. Eliminate any choice not equal to 180:

A. $A = 9(20) = 180$
B. $A = 10(18) = 180$
C. $A = 12(15) = 180$
D. $A = 14(13) = 182$ **✗**
E. $A = 16(11) = 176$ **✗**

Test (A), (B), and (C) for perimeter (twice the length plus twice the width). Eliminate the choices not equal to 54:

A. $P = 2(9) + 2(20) = 58$ **✗**
B. $P = 2(10) + 2(18) = 56$ **✗**

So, the correct choice must be (C). Indeed, $P = 2(12) + 2(15) = 54$.

The algebra approach to this item involves solving the system of simultaneous equations $lw = 180$ and $2(l + w) = 54 \Rightarrow l + w = 27$. Substitute $27 - l$ for w in the first equation: $l(27 - l) = 180 \Rightarrow l^2 - 27l + 180 = 0$. The two solutions to this quadratic equation correspond to the dimensions of the room. To factor, find the two factors of 180 that sum to 27 : 12 and 15. Therefore, $l^2 - 27w + 180 = (l - 12)(l - 15) = 0$. So, l must be 12 (and w is 15) or l must be 15 (and w is 12). If you didn't see how to factor the quadratic equation, you can use the quadratic formula (for $ax^2 + bx + c = 0$ to be true, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$):

$$l = \frac{27 \pm \sqrt{(-27)^2 - 4(180)}}{2} = \frac{27 \pm \sqrt{9}}{2} = \frac{27 \pm 3}{2} = 12 \text{ or } 15, \text{ (C)}.$$

12. **(J)** *Mathematics/Number and Quantity/Basic Arithmetic Manipulations* and *Statistics and Probability/Data Representation/Tables. CCRS: PRE.SP.2.*

According to the table, a box of 25 candies at Tamika's costs \$4.25. Therefore, the change from \$10 is $\$10 - \$4.25 = \$5.75$. Since there are 4 quarters per dollar, \$5.75 is equal to $4(5) + 3 = 23$ quarters, (J).

Test-the-Test

Test-the-test is a useful strategy both for items that you can solve algebraically and those that you can't. Often, the test-the-test method is the fastest solution method. The ACT doesn't care how you solve an item—pick the solution method that is fastest and least-error prone for you.

Use POE

Don't test more choices than you have to. Once you've eliminated the wrong choices, the remaining choice must be correct. If you've eliminated four choices, pick the remaining choice and move on! Don't bother double-checking.

13. (B) *Mathematics/Statistics and Probability/Measures of Center* and *Data Representation/ Tables. CCRS: BSC.SP.2.*

According to the table, the price for a box of 20 candies at Tamika's Treat Shop is $3.75. The average price per candy is $\dfrac{\$3.75}{20 \text{ candies}} = \$0.1875$ per candy. Round to the nearest $0.01: $0.19, (B).

14. (F) *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions, Geometry/Coordinate Geometry/Slope-Intercept Form of Linear Equations*, and *Statistics and Probability/Data Representation/Tables. CCRS: ADV.AF.2.*

The introductory information states that the relationship between the price of a box of candies, *c*, and the number of candies in a box is linear, so $c = mn + b$, where *m* is the slope and *b* is the *y*-intercept. A quick glance at the answer choices shows that each equation has a different slope, so first calculate the slope. The slope of the data is the difference in cost per corresponding change in the number of candies per box. Any two sets of values from the table for Carrie's Chocolate Shop work: $m = \dfrac{\Delta c}{\Delta n} = \dfrac{\$2.50 - \$1.50}{10 - 5} = \dfrac{1}{5} = 0.2$. Therefore, the answer must be (F), because $c = 0.2n + 0.5$ is the only given equation that has a slope of 0.2.

15. (B) *Mathematics/Algebra and Functions/Solving Quadratic Equations and Relations* and *Manipulating Algebraic Expressions/Factoring Expressions. CCRS: AVG+.A.6.*

Factor an *x* from each of the terms on the left side of the equality: $x^2 - 36x = 0 \Rightarrow x(x - 36) = 0$. This equation is true for $x = 0$ or $x = 36$, (B).

16. (J) *Mathematics/Geometry/Lines and Angles* and *Triangles/Properties of Triangles. CCRS: AVG+.G.1.*

The sum of the interior angle measures of a triangle is $180°$. To determine the measure of $\angle DEF$, first determine the measures of $\angle EDF$ and $\angle EFD$. The angle measure of a straight line is $180°$, so $\angle EDF + 148° = 180° \Rightarrow \angle EDF = 32°$ and $\angle EFD + 140° = 180° \Rightarrow \angle EFD = 40°$. Therefore, $\angle DEF + 32° + 40° = 180° \Rightarrow \angle DEF = 180° - 72° = 108°$, (J).

17. (E) *Mathematics/Geometry/Solids. CCRS: ADV.G.1.*

Each notepad is $3 \text{ in.} \times 3\text{in.} \times 3\text{in.}$. Divide each dimension of the rectangular shipping box by 3 inches to determine how many notepads can fit in the box: $\dfrac{9 \text{ in.}}{3 \text{ in.}} = 3$, $\dfrac{9 \text{ in.}}{3 \text{ in.}} = 3$, and $\dfrac{12 \text{ in.}}{3 \text{ in.}} = 4$. Therefore, the total number of notepads that will fit in the box is , $(3)(3)(4) = 36$ (E).

Alternatively, draw a sketch of the box with the appropriate dimensions and count the number of $3 \text{ in.} \times 3 \text{ in.} \times 3 \text{ in.}$ notepads that can fit in the box:
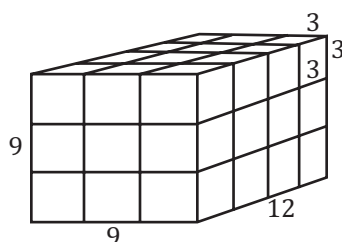
Four layers of notepads fit in the box, with $3(3) = 9$ notepads in each layer, for a total of $4(9) = 36$ notepads.

18. (J) *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Function Notation. CCRS: AVG.F.1.*

To simplify the evaluation of the function, first factor: $f(x) = -4x^3 - 4x^2 = -4x^2(x+1)$. Substitute -4 for x and evaluate: $f(-4) = -4(-4)^2(-4+1) = -4(16)(-3) = 192$, (J).

19. (A) *Mathematics/Algebra and Functions/Solving Simultaneous Equations. CCRS: ADV.A.4.*

A quick glance at the answer choices shows they each have a unique value for y, so solve the simultaneous equations for y. To eliminate the x-variable, multiply the first equation by 2 and add it to the second equation:

$$2(x + 2y = 4)$$
$$+(-2x + y = 7)$$
$$4y + y = 8 + 7 \Rightarrow 5y = 15 \Rightarrow y = \frac{15}{5} = 3$$

(A) is the only choice with $y = 3$.

20. (G) *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Logarithmic Expressions. CCRS: EXP.F.7.*
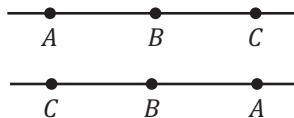
A logarithm represents the power to which the base must be raised to produce a given number. In other words, logarithms are the inverse of exponentials: $y = b^x$ is equivalent to $\log_b y = x$. The logarithm $\log_x 36 = 2$ translates to "there is a value x that when raised to power 2 equals 36." In other words, $x^2 = 36$. Therefore, $x = \pm 6$. Only 6 is given as an answer choice, (G).

21. (C) *Mathematics/Geometry/Complex Figures* and *Rectangles and Squares. CCRS: EXP.G.2.*
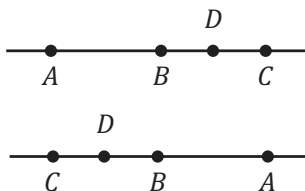
The area of the 5-inch-by-7-inch photograph is $5(7) = 35$ square inches. The area of the 4-inch-by-6-inch frame is $4(6) = 24$ square inches. The difference between the two areas is $35 - 24 = 11$ square inches, (C).

22. (K) *Mathematics/Geometry/Lines and Angles. CCRS: AVG.NS.3.*

This item asks about the relative lengths of line segments on a line. No figure is given, so sketch the given information. First, draw a line with B between A and C; note that there are two possible layouts:

Add point D between points C and B:

The Cambridge Edge

Preview the choices to help you determine the quickest solution method. In the case of #19, you don't want to waste time solving for x when only y is required, as the answer choices all have different values for y.

Nothing can be said about the distances between the points on the line; only the relative positions of the points is determinate. For this reason, (F), (G), (H), and (J) are not necessarily true. Only (K) must be true: the length of $\overline{CD}$ is less than the length of $\overline{BC}$ for both scenarios above because D is between B and C.

23. **(E)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Factoring Expressions. CCRS: AVG.NS.1.*

Write each expression as the product of its factors: $x^2 y^2 = (x)(x)(y)(y)$ and $xy^3 = (x)(y)(y)(y)$. The greatest factor common to both expressions is $(x)(y)(y)$. Since $xy^3 = 45$, $xy^2 = 45 \Rightarrow y = \sqrt{\dfrac{45}{x}} = 3\sqrt{\dfrac{5}{x}}$. The answer choices are all integer values for y, so the only possible value for x is 5, for which $y = 3$, (E).

24. **(G)** *Mathematics/Statistics and Probability/Data Collection Methods. CCRS: EXP.SP.3.*

This item tests understanding of the vocabulary associated with data collection methods. The scenario describes testing a new medication on 150 volunteers chosen without bias, or randomly, from a group of 300, the remainder of whom received the placebo. Since there is a randomly selected treatment group (medication) and control group (placebo), the testing is a randomized experiment, (G). A census, (F), is a survey of a population and doesn't include any type of testing. A survey, (J) and (K), of a group would represent a population that either received the medication or didn't, but not both groups as in an experiment.

25. **(D)** *Mathematics/Number and Quantity/Properties of Numbers. CCRS: ADV.NS.2.*

The first caution sign flashes at a rate of $\dfrac{4 \text{ seconds}}{\text{flash}}$ and the second flashes at a rate of $\dfrac{10 \text{ seconds}}{\text{flash}}$. If x is the number of flashes of the first sign and y is the number of flashes of the second sign when the two signs flash at the same time, $4x = 10y$, where x and y are integers. In other words, what are the common multiples of 4 and 10?

Multiples of 4: ⓪, 4, 8, 12, 16, ㉔, 24, 28, 32, 36, ㊵, …
Multiples of 10: ⓪, 10, ㉔, 30, ㊵, …

The minimum amount of time that passes between the flashes corresponds to the smallest common multiples of 4 and 10: 20 seconds, (D).

26. **(K)** *Mathematics/Number and Quantity/Properties of Numbers. CCRS: ADV.NS.3.*

Check each answer choice until you find one that is always negative. Eliminate (F) because $a - b$ is negative only if $b > a$. Eliminate (G) because $-a - b = -(a + b)$ is negative only if $a + b$ is negative, which is not always true. Eliminate (H) because the sum of two absolute values is always positive. Eliminate (J) because $|a| - |b|$ is negative only if $|b| > |a|$. Therefore, by the process of elimination, (K) must be correct. Indeed, $-|a| - |b| = -(|a| + |b|)$ is always negative because $|a| + |b|$ is always positive.

Use POE

In the case of item #26, the solution to the item depends on the answer choices. The best solution is to eliminate the non-answers. At the most, you'll have to test four choices, but don't bother testing the fifth choice. If you've eliminated four choices, the remaining choice must be correct. Make your selection and move on!
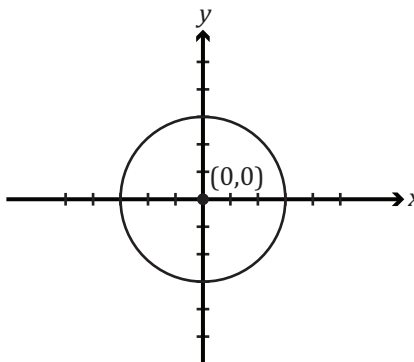
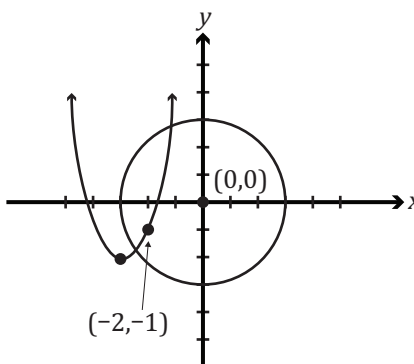**27.** **(C)** *Mathematics/Geometry/Coordinate Geometry/Graphs of Quadratic Equations and Relations. CCRS: ADV.G.9.*

The quickest approach to this item is to draw a sketch of the given information. First, draw a circle with the center at $(0,0)$ and radius 3:

The parabola has a vertex, meaning minimum or maximum, at $(-3,-2)$; since it also goes through point $(-2,-1)$, the parabola must open upward:

Now, this is just a sketch. While we know the parabola crosses the circle in the third quadrant, we don't know where it exits the circle. However, it must exit the circle. Whether it exits in the first or second quadrant doesn't matter: the parabola crosses the circle at two points, (C).

28. **(H)** *Mathematics/Number and Quantity/Percentages. CCRS: PRE.AF.1.*

If 40% of 250 equals 60% of some number x, $0.4(250) = 0.6x \Rightarrow x = \dfrac{0.4(250)}{0.6} = 166\dfrac{2}{3}$, (H).

29. **(A)** *Mathematics/Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities. CCRS: ADV.A.2.*

A quick glance at the answer choices tells you that you need to solve the given inequality for x. Solving inequalities is exactly like solving equations—you can do whatever you want to the equation as long as you do the same thing to both sides—but there is one exception. If you multiply or divide by a negative, you must flip the inequality sign:

$$-2x - 6y > 2y - 4 \Rightarrow -2x > 2y - 4 + 6y \Rightarrow x < \frac{8y - 4}{-2} \Rightarrow x < -4y + 2 \text{ , (A).}$$

30. (F) *Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions. CCRS: ADV.G.4.*

The tangent of an angle in a right triangle is equal to the ratio of the sine of the angle to the cosine of the angle: $\tan\alpha = \dfrac{\sin\alpha}{\cos\alpha} \Rightarrow \cos\alpha = \dfrac{\sin\alpha}{\tan\alpha}$. Therefore, $\cos\alpha = \dfrac{\frac{40}{41}}{\frac{40}{9}} = \dfrac{9}{41}$, (F).

31. (B) *Mathematics/Algebra and Functions/Solving Simultaneous Equations, Evaluating, Interpreting, and Creating Algebraic Functions, Geometry/Rectangles and Squares,* and *Number and Quantity/Rates and Proportions. CCRS: EXP.G.5.*

The perimeter of the rectangle is $96 = 2\,(\overline{AB} + \overline{BC})$. The ratio of the side lengths is 3:5, so $\dfrac{\overline{AB}}{\overline{BC}} = \dfrac{3}{5} \Rightarrow \overline{BC} = \dfrac{5}{3}\overline{AB}$. Substitute $\dfrac{5}{3}\overline{AB}$ for $\overline{BC}$ in the perimeter equation and solve for $\overline{AB}$:
$96 = 2\,(\overline{AB} + \dfrac{5}{3}\overline{AB}) = 2\,(\dfrac{8}{3}\overline{AB}) \Rightarrow \overline{AB} = \dfrac{96\,(3)}{16} = 18$, (B).

32. (G) *Mathematics/Geometry/Triangles/Properties of Triangles* and *Rectangles and Squares. CCRS: AVG+.G.6.*

The area of $\triangle ABC$ is half the product of the length of the base and the length of the altitude: $\dfrac{1}{2}(\overline{AC})(\overline{BD}) = \dfrac{1}{2}(16)(8) = 8\,(8) = 64$ square inches. The area of a square is the square of a side, so a square with an area of 64 has a side length of $\sqrt{64} = 8$ inches, (G).

33. (B) *Mathematics/Number and Quantity/Percentages* and *Geometry/Rectangles and Squares. CCRS: AVG.AF.1.*

EFGH is a square, so the length of $\overline{EH}$ is equal to the length of $\overline{HG}$, 3.6. The length of $\overline{AD}$ is equal to the length of $\overline{BC}$, 12. Therefore, $\dfrac{\overline{EH}}{\overline{AD}} = \dfrac{3.6}{12} = 0.3 = 30\,\%$, (B).

34. (F) *Mathematics/Geometry/Triangles/Pythagorean Theorem. CCRS: ADV.G.2.*

The length of $\overline{JD}$ is the hypotenuse of a triangle with legs $\overline{AJ}$ and $\overline{AD}$:
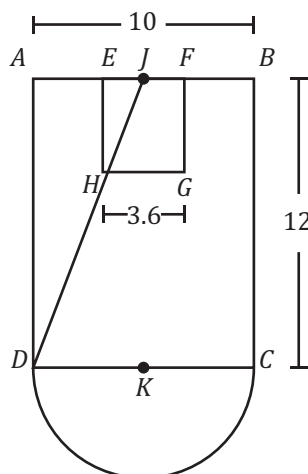
The length of $\overline{AJ}$ is half the length of $\overline{AB}$: $\dfrac{10}{2} = 5$. The length of $\overline{AD}$ is the same as the

length of $\overline{BC}$, which is 12. Therefore, $JD^2 = 12^2 + 5^2 = 144 + 25 = 169 \Rightarrow JD = \sqrt{169} = 13$, (F).

35. (B) *Mathematics/Geometry/Circles. CCRS: EXP.G.1.*

Since $\overline{CD}$ is the diameter of a semicircle, the length of arc $\overparen{CD}$ is half the circumference of a

circle of diameter 10: $\overparen{CD} = \dfrac{1}{2}(\pi d) = \dfrac{\pi}{2}(10) = 5\pi$, (B).

36. (H) *Mathematics/Geometry/Coordinate Geometry/The Coordinate System. CCRS: ADV.G.6.*

Add the coordinate axes to the figure with point K at the origin and $\overline{AB}$ parallel to the x-axis:
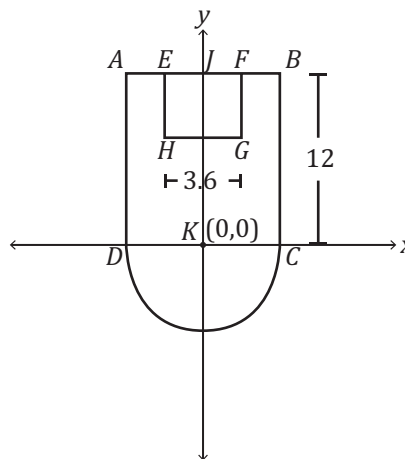
According to the stem, 1 meter equals 1 coordinate unit, so the y-coordinate of H corresponds to the difference between the length of $\overline{BC}$, 12, and the length of $\overline{EH}$. Since $EFGH$ is a square, $EH = HG = 3.6$. Therefore, the y-coordinate of H is $12 - 3.6 = 8.4$, (H).

37. (A) *Mathematics/Geometry/Coordinate Geometry/The Coordinate System. CCRS: AVG.G.6.*

The point where an altitude from C to $\overline{AB}$ intersects $\overline{AB}$ has the same x-coordinate as point C, 2, and the same y-coordinate as A and B, 1. Therefore, the length of the altitude is the difference between the y-coordinates of C and A: $4 - 1 = 3$, (A).

38. (J) *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Functions as Models. CCRS: AVG+.F.1.*

The real world scenario in this item makes the item seem complicated, though all it tests is your ability to evaluate the given function for a particular value. According to the stem, the

function for the probability that n customers are in line is $P = \dfrac{3^n e^{-3}}{n!}$, where $e^{-3} \approx 0.05$.

The expression in the denominator is the factorial of n, which is the product of n and all the positive integers less than n. The question asks about the probability of 2 customers being in

line, so evaluate P for $n = 2$: $P(2) = \dfrac{3^2(0.05)}{2!} = \dfrac{9(0.05)}{2(1)} = \dfrac{0.45}{2} \approx 0.23$, (J).

Throwback to Math Class

Know the meaning of factorial. Factorial, symbolized by "!", is the product of the integer preceding the ! symbol and all the integers below it. For example, $5! = 5(4)(3)(2)(1) = 120$.

39. (B) *Mathematics/Trigonometry/Graphs of Trigonometric Functions. CCRS: EXP.F.5.*

The general form for the equation of a trigonometry function is $y = Af[B(x + C)] + D$, where f is the trigonometry function, A is the amplitude, B helps determine the period, C is the shift left or right, and D is the shift up or down. The graph of the function $f(x) = \frac{1}{2}\cos(3x + \pi)$ has an amplitude of $\frac{1}{2}$, (B).

40. (F) *Mathematics/Statistics and Probability/Counting Methods. CCRS: ADV.SP.3.*

Each of the letters and numbers chosen for the license plate are independent of each other, so the total number of combinations is equal to the product of the individual possibilities for each. The 3 letters are each chosen from 26 letters and the 3 digits are each chosen from 10 digits, so the total number of combinations is $(26)(26)(26)(10)(10)(10) = 26^3 \cdot 10^3 = 10^3 \cdot 26^3$, (F).

41. (D) *Mathematics/Statistics and Probability/Measures of Center* and *Data Representation/ Tables. CCRS: EXP.SP.1.*

The median of a data set is the middle value when the numbers are arranged in order. The table gives the frequency of each score in the corresponding interval, so count off equal numbers of scores from each end of the score intervals. Since the bottom score interval has a frequency of 9, count off 9 scores from the top of the score intervals: $3 + 1 + 3 = 7$. Therefore, counting off 2 more scores puts you into the score interval 81-85, (D).

42. (J) *Mathematics/Number and Quantity/Complex Numbers* and *Algebra and Functions/ Manipulating Algebraic Expressions/Evaluating Expressions. CCRS: ADV.NS.6.*

Multiply the numerators and the denominators of the two fractions, treating i as a variable: $\frac{1}{1+i} \cdot \frac{1-i}{1-i} = \frac{1-i}{1-i+i-i^2} = \frac{1-i}{1-i^2}$. Substitute -1 for i^2 and simplify: $\frac{1-i}{1-(-1)} = \frac{1-i}{2}$, (J).

43. (B) *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Functions as Models. CCRS: BSC.A.2.*

The item stem gives the function for F as a function of C, and asks for the value of F when $F = C$: $F = \frac{9}{5}F + 32 \Rightarrow \frac{9}{5}F - F = -32 \Rightarrow \frac{4}{5}F = -32 \Rightarrow F = \frac{-32(5)}{4} = -8(5) = -40$, (B).

44. (G) *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Evaluating Expressions. CCRS: AVG.A.1.*

At first glance, this item seems difficult, given the descriptions and the data table, but it's really just a function evaluation item. The item stem states that the y data in the table varies linearly with the x data, such that $y = kx$. Therefore, $k = \frac{y}{x}$. Use any two corresponding values for x and y from the table and evaluate: $k = \frac{y}{x} = \frac{0.140}{2.75} \approx 0.05$, (G).

45. (A) *Mathematics/Geometry/Coordinate Geometry/Graphs of Linear Equations* and *Slope-Intercept Form of Linear Equation. CCRS: AVG+.AF.3.*

Rewrite the given equation in slope-intercept form, $y = mx + b$, where m is the slope and b is the y-intercept: $2x - 5y = -5 \Rightarrow -5y = -5 - 2x \Rightarrow y = \dfrac{5 + 2x}{5} = \dfrac{2}{5}x + 1$. The y-intercept of the line ($x = 0$) is 1, so eliminate (C), (D), and (E). To choose between (A) and (B), you'll need to look at the slopes. The slope in (B) is more than 1, since the line is above $x = y$, so eliminate (B). Therefore, by the process of elimination, (A) is the correct graph. Indeed, the rise shown in (A) is $3 - 1 = 2$ and the run is $5 - 0 = 5$, so the slope is $\dfrac{2}{5}$.

46. (J) *Mathematics/Number and Quantity/Rates and Proportions. CCRS: AVG.AF.1.*

Create a direct proportion between the measurements of yeast and the corresponding measurements of flour, where x represents the unknown quantity. Convert the values to their decimal equivalents, so it's easy to use a calculator, and solve for x:

$$\frac{1.5 \text{ tsp. yeast}}{2.25 \text{ tsp. yeast}} = \frac{2.5 \text{ cu. flour}}{x \text{ cu. flour}} \Rightarrow x = \frac{2.5(2.25)}{1.5} = 3.75 = 3\frac{3}{4} \text{, (J)}.$$

47. (E) *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents. CCRS: ADV.A.1.*

This item tests your ability to apply the distributive property and the rule for dividing exponents, $\dfrac{x^m}{x^n} = x^{m-n}$: $\dfrac{12x^6 - 9x^2}{3x^2} = \dfrac{12x^6}{3x^2} - \dfrac{9x^2}{3x^2} = 4x^4 - 3$, (E).

48. (K) *Mathematics/Number and Quantity/Matrices and Vectors. CCRS: EXP.NS.6.*

To multiply matrices together, the number of columns in the first matrix must equal the number of rows in the second matrix; otherwise, the product is undefined. Check each answer choice. (F) and (G) are both defined because W has 2 columns and X and Y each have 2 rows. (H) is defined because Y has 3 columns and Z has 3 rows. (J) is defined because X has two columns and W has two rows. Therefore, (K) must be the correct choice. Indeed, X has 2 columns and Z has 3 rows, so the two matrices cannot be multiplied.

49. (A) *Mathematics/Geometry/Coordinate Geometry/Graphs of Quadratic Equations and Relations. CCRS: ADV.G.9.*

You can answer this item by using the characteristics of the parabolas to eliminate answer choices. The quadratic equations in the answer choices are in standard form, $ax^2 + bx + c$. The sign of a determines whether the parabola opens upward (a is positive) or downward (a is negative). Since the group of parabolas open upward, eliminate (D) and (E). The c term is the y-intercept, which according to the graph is 1 regardless of n, so eliminate (C). To decide between (A) and (B), look to the coefficient of the x^2 term. For (A), as n is increased (for the same value of x), the corresponding y-value increases, so the parabolas become more narrow. This matches the behavior of the parabolas in the graph, so (A) is correct. Indeed, the parabolas in (B) get wider as n increases.

You can also solve this item by testing the answer choices. The given figure is a coordinate graph with units, so you can see that it is drawn to scale. In the graph, the y-intercept for $x = 0$ is 1, so immediately eliminate (C). To choose between the remaining choices, test a point readable from the graph. The $n = 2$ parabola appears to pass through the

point $(1,3)$, so test $x = 1$ and $n = 2$ in the choices. Only (A) returns a value of 3 for y: $y = nx^2 + 1 = (2)(1)^2 + 1 = 3$.

50. (F) *Mathematics/Statistics and Probability/Sets. CCRS: ADV.SP.5.*

According to the item stem, out of 20 students, 8 play piano and 9 play guitar. Some students may not play either instrument, some may play one, and some may play both. Of the 8 that play piano, 8 could also play guitar; or, none could also play guitar, because $9 + 8 < 20$. It is not necessary for there to be overlap between the two sets, so the minimum number of students who play both guitar and piano is 0, (F).

51. (B) *Mathematics/Number and Quantity/Basic Arithmetic Manipulations. CCRS: EXP.AF.1.*

There are 18 different numbers assigned to 18 different students; and combinations of student numbers must add to a perfect square, i.e., 4, 9, 16, 25, 36, etc. If the two greatest numbers, 17 and 18, are added together, the total is 35, and if the two smallest numbers, 1 and 2, are added together, the sum is 3. So, the possible perfect squares are 4, 9, 16, and 25. Since no number can be added to 16, 17, and 18 to make 16, the perfect squares must combine to 25: $16 + 9 = 25$, $17 + 8 = 25$, and $18 + 7 = 25$. These combinations eliminate (A), (C), and (D) as possibilities for combining with 1. The remaining numbers are 1 through 6 and 10 through 15. Now, you are left with 15, (B), and 3, (E). as possible combinations with 1. The only way to choose between (B) and (E) is to test one. If it works, it's correct; if it doesn't, the other choice is correct. Test (B):

$15 + 1 = 16$
$14 + 2 = 16$
$13 + 3 = 16$
$12 + 4 = 16$
$11 + 5 = 16$
$10 + 6 = 16$

(B) works, so it must be the correct choice. Indeed, as for (E), combining 3 with 1 doesn't work: 3 paired with 1, means 15 must be paired with 10, 14 must be paired with 2, 13 must be paired with 12, and 11 must be paired with 5. This leaves 4 and 6, which don't sum to a perfect square. Or, if 12 is paired with 4 (instead of 13) and 11 is paired with 5, 13 and 6 are left, which don't sum to a perfect square.

52. (J) *Mathematics/Algebra and Functions/Solving Simultaneous Equations* and *Evaluating, Interpreting, and Creating Algebraic Functions. CCRS: ADV.A.4.*

Translate the given information into a system of simultaneous equations, with p, n, d, and q representing the number of pennies, nickels, dimes, and quarters, respectively. There are twice as many nickels as pennies, so $n = 2p$; there is 1 fewer dime than nickels, so $d = n - 1$; and there is 1 more quarter than nickels, so $q = n + 1$. The total amount is $8.25 = 0.01p + 0.05n + 0.1d + 0.25q$. The item stem asks for the number of quarters so rewrite the equations in terms of q: $q = n + 1 \Rightarrow n = q - 1$;

$n = 2p \Rightarrow p = \dfrac{n}{2} = \dfrac{q-1}{2}$; and $d = n - 1 = (q - 1) - 1 = q - 2$, so

$8.25 = 0.01p + 0.05n + 0.1d + 0.25q = 0.01\left(\dfrac{q-1}{2}\right) + 0.05(q-1) + 0.1(q-2) + 0.25q$.

Get rid of the fraction by multiplying every term by 2:
$16.5 = 0.01(q-1) + 0.1(q-1) + 0.2(q-2) + 0.5q$. Apply the distributive property:
$16.5 = 0.01q + 0.1q + 0.2q + 0.5q - 0.01 - 0.1 - 0.4$. Combine like terms and solve for q:

$16.5 = 0.81q - 0.51 \Rightarrow q = \dfrac{16.5 + 0.51}{0.81} = 21$, (J).

53. (C) *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents* and *Number and Quantity/Properties of Numbers. CCRS: ADV.A.1.*

The equation states that 10 raised to some value $\frac{2x-1}{x}$ is equal to 1. Ask yourself, what power of 10 is equal to 1? Any number raised to 0 is equal to 1, so $\frac{2x-1}{x}$ must equal 0:

$\frac{2x-1}{x} = 0 \Rightarrow 2x - 1 = 0 \Rightarrow x = \frac{1}{2}$, (C).

54. (G) *Mathematics/Statistics and Probability/Probability* and *Data Representation/Tables. CCRS: EXP.SP.4.*

The item stem asks for the probability that "a randomly selected person who was surveyed likes to read, <u>given that the person plays a musical instrument</u>." According to the table, the number of people surveyed who played musical instruments is 90. Of these 90 people, 50 like to read. Therefore, the probability that a person surveyed who plays a musical instrument also likes to read is $\frac{50}{90} = \frac{5}{9}$, (G).

55. (A) *Mathematics/Number and Quantity/Rates and Proportions* and *Geometry/Circles. CCRS: ADV.AF.1.*

The circumference of the circle is $2\pi r = 2\pi\left(\frac{d}{2}\right) = \pi d = 26\pi$ inches, so the tire covers this distance per revolution. Create an expression for the total distance per total time in units of feet per second: $\dfrac{200 \text{ rev.} \cdot \frac{26\pi \text{ in.}}{\text{rev.}} \cdot \frac{1 \text{ ft.}}{12 \text{ in.}}}{1 \text{ min.} \cdot \frac{60 \text{ sec.}}{1 \text{ min.}}} = \frac{200(26\pi)}{60(12)} = \frac{20(13\pi)}{6(6)} = \frac{10(13\pi)}{3(6)} = \frac{5(13\pi)}{3(3)} = \frac{65\pi}{9}$, (A).

56. (K) *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents. CCRS: AVG+.A.12.*

You can solve this item by applying the rules for working with exponents: $(\sqrt{3})^j = 27^k \Rightarrow \left(3^{\frac{1}{2}}\right)^j = (3^3)^k \Rightarrow 3^{\frac{j}{2}} = 3^{3k}$. Therefore, $\frac{j}{2} = 3k \Rightarrow \frac{j}{k} = 6$, (K).

You can also solve this item using the test-the-test strategy. Only (K), for which $j = 6$ and $k = 1$, works in the given equation.

57. (A) *Mathematics/Statistics and Probability/Measures of Center* and *Algebra and Functions/ Evaluating Sequences. CCRS: EXP.SP.1.*

An arithmetic sequence has a constant term difference between each successive term. The mean, or average, of an odd numbered data set that differ from each successive term by a

constant value is equal to the middle value. The median of an odd numbered data set is also equal to the middle value when the set is arranged in order. Therefore, the mean and the median are the same, so the difference is 0, (A).

58. **(F)** *Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions, Geometry/ Circles,* and *Number and Quantity/Rates and Proportions. CCRS: EXP.G.5.*

To determine the length of $\overset{\frown}{AC}$, create a proportion between the ratio of the length of $\overset{\frown}{AC}$ to the circle circumference and the ratio of the central angle $\angle ADC$ to $360°$, the full measure of a circle: $\frac{\overset{\frown}{AC}}{2\pi r} = \frac{\angle ADC}{360°}$. Since the radius of the circle is 4, $\overset{\frown}{AC} = \frac{2\pi(4)\angle ADC}{360°} = \frac{\pi\angle ADC}{45°}$, where r is the radius of the circle. Determine the measure of $\angle ADC$ by applying the inverse of the sine of $\angle ADC$: $\sin\angle ADC = \frac{\text{side opposite } \angle ADC}{\text{hypotenuse}} \Rightarrow$

$\angle ADC = \sin^{-1}\left(\frac{\text{side opposite } \angle ADC}{\text{hypotenuse}}\right) = \sin^{-1}\left(\frac{1}{4}\right)$ degrees. Therefore, $\overset{\frown}{AC} = \frac{\pi}{45}\left(\sin^{-1}\left(\frac{1}{4}\right)\right)$, (F).

59. **(C)** *Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions. CCRS: EXP.G.2.*

The item stem provides the formula for the area of a triangle, so plug in the provided values. Only one angle value is given, so use that value for C. That means the side with length 5.0 cm must be c and the other two sides with lengths 4.0 cm and 8.0 cm must be a and b. Now plug these values into the formula and solve: $\frac{1}{2}ab\sin C = \frac{1}{2}(8)(4)\sin(30) = 16\sin 30 = 16\left(\frac{1}{2}\right) = 8$, (C).

If you remember the value of sin30, this problem is easily solved using mental math. If not, it's a simple calculation on the calculator.

60. **(K)** *Mathematics/Statistics and Probability/Probability* and *Data Representation/Tables. CCRS: ADV.SP.4.*

The left column of the table gives the expected value of X, labeled "x." The right column of the table gives the probability of X being the corresponding value x, labeled $P(X=x)$. The expected value of X is equal to the sum of the products of each probability and the corresponding value x: $0\left(\frac{1}{6}\right) + 1\left(\frac{1}{12}\right) + 2\left(\frac{1}{4}\right) + 3\left(\frac{1}{12}\right) + 4\left(\frac{1}{12}\right) + 5(0) + 6\left(\frac{1}{3}\right) = \frac{1}{12} + \frac{2}{4} + \frac{3}{12} + \frac{4}{12} + \frac{6}{3} =$

$\frac{1}{12} + \frac{6}{12} + \frac{3}{12} + \frac{4}{12} + \frac{24}{12} = \frac{38}{12} = 3\frac{2}{12} = 3\frac{1}{6}$, (K).

Reading Test

1. **(B)** *Reading/Craft and Structure/Voice. CCRS: AVG.PRT.4.* The best answer is (B). The use of "I" throughout shows that this is a narrative or first-person account, eliminating both (C) and (D). (A) is also incorrect while the narrator is recreating a story, the events are not about *before* she was born, but about the narrator herself being born—a time she was too young to remember, making (B) the correct answer.

2. **(J)** *Reading/Craft and Structure/Development. CCRS: AVG.PRT.4.* The narrator describes the lint and flake as something her father "brushed off his then solid shoulders unceremoniously" (lines 19–21), implying that he made the decision with little care. (H) can be eliminated because the actions show a lack of importance, not an emphasis. (F) is also incorrect as the narrator describes her father making the action, not her grandfather. (G) is incorrect because the narrator refers to the actions as "analogies," (line 21), showing that they are not meant to be taken literally. (J) is the only answer that places the emphasis on the narrator's father ignoring a tradition.

3. **(A)** *Reading/Key Ideas and Details/Implied Idea. CCRS: AVG.DEV.2.* (A) is the correct answer, because her mother gets out of bed, very shortly after having a baby when she should be resting, (lines 48–53), but does not succeed in changing her name, (lines 67–68). There is no textual evidence to support Mama eventually feeling "amused," (B); "outraged," (C); or "resentful," (D).

4. **(G)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: BSC.DET.2.* The narrator says Mama "must not have fought long," about Nadali's name, or "who knows," (line 54) indicating that the explanation that follows is only a possibility of what could have happened, (G).

5. **(D)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: BSC.DET.1.* The answer to this question can be found at the end of the proposed scenario: "...she must've further imagined that going on such a trip...would surely bring about my death—because I still have my name," (D). While the narrator does mention her mother's superstition, it's mentioned as a reasoning why she wouldn't go to the city clerk, making (A) incorrect. (B) is incorrect because the narrator mentions hot weather (line 63), not a storm, and (C) is incorrect because there is no textual evidence to support the idea that Mama changes her mind often.

6. **(H)** *Reading/Craft and Structure/Vocabulary. CCRS: AVG.VO.2.* The best answer is (H) because of the previous reference to these stories earlier in this paragraph: "Baba liked to do that: tell stories that were impossible, but true all at once, especially if those stories made him look like a rock star" (lines 71–74). (F) is wrong because there are no conflicting stories about the narrator's name; while notebooks and poetry are mentioned, no evidence from text can support whether what filled them was sad, so (G) is incorrect; and the narrator's stories about her family's time in Boston are not necessarily sad—the sadness was added by her father in his embellished stories, so (J) is incorrect.

7. **(C)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: BSC.DET.1.* Lines 77–78 show that Baba wanted to be a writer, not an architect, and in lines 85–86 her mother, a musician, is filled with "sadness" that their home has no piano, making (C) the correct answer.

8. **(F)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG.DET.1.* The narrator, in lines 60–61, says that Mama is the "most superstitious of all humans," making (F) the correct answer.

9. **(D)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG.DET.3.* The best answer is (D). The text says that Mama liked to "expose" Baba when he told stories; she was his "story-cop" (lines 79–80). A "cop" regulates or corrects, in this case in terms of the accuracy of Baba's stories, (D).

10. **(F)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG.DET.3.* In the last lines of the passage the narrator states that embellishment happened at home, whereas at school she learned facts based on reality, showing the contrast depicted in (F). (G) is incorrect because Baba was a writer, not a musician; (H) is incorrect because being an architect made Baba sad that he wasn't able to pursue his real passion, writing; and there is no evidence in the text to support (J).

11. **(D)** *Reading/Key Ideas and Details/Application. CCRS: BSC.DET.2.* In the first paragraph, automobiles are referred to as "devilish contraptions" that consumers were steering clear of (lines 4–5), and the second paragraph provides detail on the laws passed to limit automobile use, making (D) the best answer. (A) is incorrect because Passage A says that the cars cost twice the average salary of the average citizen (lines 25–27), there is no evidence in the text to support (B), and (C) is an answer that is provided by Passage B, not A.

12. **(G)** *Reading/Craft and Structure/Vocabulary. CCRS: AVG+.VO.3.* The best answer to the question is (G), monuments. (F) is incorrect because "puddles" refer to heaps of dust from the exhaust that accumulate in actual puddles. Automobiles were actually asked to have bells to notify people they were coming, so (H) is wrong, and cars had so little power that they couldn't make it up an actual ascent or "hill," so (J) is incorrect. "Monuments," are used to indicate laws that were made against automobiles, not buildings or statues dedicated to something or someone, making (G) the best answer.

13. **(A)** *Reading/Craft and Structure/Development. CCRS: AVG.PRT.4.* In the first two paragraphs, the author of Passage A has detailed the grievances toward the automobile, and in the third paragraph, the author refers to "accessories," like "bumpers, carburetors, and headlights" (lines 29–30)—all necessary items to drive safely—to air yet another grievance, so (A) is the correct answer.

14. **(H)** *Reading/Key Ideas and Details/Application. CCRS: BSC.DET.2.* Many of the details of Passage B focus on the publicity associated with the Edsel: 18 varieties were built (line 46), nearly 3 million "flocked to the showrooms" to see it (lines 71–72). The last paragraph also shows how drastically—and quickly—the Edsel failed: Ford "pulled the plug" after the second year, so (H) is the correct answer.

15. **(D)** *Reading/Craft and Structure/Explicit Detail. CCRS: AVG.PRT.1.* The start of this passage sets a tone toward Ford and the efforts taken in the design and selling of the Elder: that of grandiosity. The company didn't make one or two models; they made 18. Comparing 18 to one or two shows that Ford's efforts were over-the-top, making (D) the correct answer.

16. **(G)** *Reading/Craft and Structure/Development. CCRS: PRE.DEV.1.* The answer to this question is explicitly stated in lines 84–85: "The Edsel was an upscale car launched a couple months after a stock market plunge caused a recession." So, chronologically, the market crashed before the car was launched, eliminating answers (F), (H), and (J), and making (G) the correct answer.

17. **(C)** *Reading/Craft and Structure/Vocabulary. CCRS: AVG.VO.2.* This question tests your application of vocabulary. "Premium," in this instance is used to mean "luxury" or "upscale," as it is called in line 84. "Premium" or "upscale" vehicles are a class above the typical vehicle—a class or "category" the makers of the car wanted it to belong, (C).

18. **(F)** *Reading/Integration of Knowledge and Ideas/Explicit Detail. CCRS: PRE.PP.1.* This item asks you to compare both passages. (G) is incorrect because no mention of the author's background is given in either passage. While both passages offer some kind of critique about automobiles or a specific automobile, neither state that they aren't worthwhile to society, so (H) can be eliminated. (J) is also incorrect because Passage B doesn't discuss traffic or road conditions. Only (F) describes both passages: Passage A covers the beginning of the 20th century, and Passage (B) describes the Edsel that was discontinued in 1960—both time periods from long ago.

19. (A) *Reading/Integration of Knowledge and Ideas/Explicit Detail. CCRS: BSC.PP.1.* Both Passage A and B discuss public opinion (in Passage A consumers were staying away from the 'devilish contraptions' [line 5], and in Passage B over 3 million went to see the car) and economics (in Passage A the cars at their most basic level were too expensive; in Passage B the recession didn't help sales of the Edsel), so both (B) and (C) can be eliminated. (D) can also be eliminated because neither passage includes quotes from industry experts. Only Passage A includes information not found in Passage B: legislation against the automobile, (A).

20. (G) *Reading/Integration of Knowledge and Ideas/Application. CCRS: AVG+.PP.1.* This question tests your ability to apply information found in the passages to another scenario. In Passage B, lines 65–69 indicate that PR teams of automobiles "touted the glories" of cars, but released photos of only small details, like a hooded ornament. A comparable example would be another small detail, like a headlight, (G).

21. (C) *Reading/Craft and Structure/Main Idea. CCRS: ADV.MI.1.* This question tests your understanding of the passage as a whole. The author takes you through many phases of Homer's career as indicated by the chronological sequence of his work: The second paragraph discusses the 1860s and the influence of Japanese art on Homer's work during his time in Paris; the third paragraph covers the 1870s to the earlier 1880s to show how the Jersey coast—and the lifestyle that went with living by the ocean—influenced his art; and the last couple of paragraphs explain Homer's move to Maine to focus on life on or near the ocean. The answer that best captures the environments and influence to Homer's career is (C). While the last paragraph does describe Homer's most famous painting, it is not the main point of the passage, so (A) can be eliminated. There is clearly a connection between the natural world—like the ocean—and art, but that also is not the focus of the passage, so (B) is wrong. (D) can be eliminated because there is only one artist discussed in the passage: Homer.

22. (G) *Reading/Key Ideas and Details/Implied Idea. CCRS: AVG.DET.2.* The best answer to this question is (G) and is found in the third paragraph. The author states that Homer became "enthralled with the dramas of people who make their living from the ocean" (lines 39–40), such as "the agonizingly fragile fishing boats being tossed on angry waves" (lines 43–44). A close parallel to that example is (G), a fishing boat being violently pitched about on a stormy ocean.

23. (A) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG+.DET.2.* The author compares Homer's earlier work to his later work in the second paragraph: "The weakness of earlier compositions is replaced by a boldness and lucidity in which simple shapes are massed into powerful designs" (lines 20–22). The author here compares his early work as "weak" and his later work as "powerful", (A).

24. (J) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG+.DET.3.* This is an explicit detail question that asks about Tynemouth's influence on Homer's work. The author discusses Tynemouth in the third paragraph and says Homer became "enthralled" with the people there (line 39) and the dynamic there "occup[ied]" Homer for many years to come" (lines 46–47). (F) and (G) refer to a short time, not "many years" and can be eliminated, and (H) is incorrect because Homer didn't come back to the city, he moved to Maine, so (J) is the best answer.

25. (B) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG+.DET.2.* This question also asks a specific detail about Homer's time in Tynemouth, and the answer can likewise be found in the third paragraph. The author provides examples of what about life there "enthralled" Homer: "the fisherman's wives staring out to sea as they wait for their men, the launch of the lifeboat to rescue sailors from a foundering ship, the agonizingly fragile fishing boats being tossed on angry waves" (lines 41–44). The examples most closely resemble the relationship between the sea and the lives of people who live and work by it, (B). (A) and (C) can be eliminated because farmers, sunbathers, and tourists are not mentioned as important to

Homer's art, and (D) is incorrect because the "drama" of the tumultuous sea cannot be described as "soothing."

26. (F) *Reading/Key Ideas and Details/Implied Idea. CCRS: ADV.DET.3.* The best answer to this question is (F). While the author does state that Homer's paintings were displayed at the Great Exposition, no information about how Homer felt about that accomplishment is provided, so (G) can be eliminated. (H) is incorrect because where he spent his winters is not what was important to his career, but the inspiration he drew from the sea, and (J) is incorrect because Homer didn't reject the belief the world was stark and melancholy—he accepted it (lines 8–9). (F) is the only answer that capture the essence of Homer's turning point: his discovery of subject matter—the sea—that inspired him.

27. (B) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG.DET.4.* The answer to the Explicit Detail item can be found in the second paragraph: the Japanese prints that were on display in the same building as his own made a "deep impression" (line 17) on the artist that replaced the "weakness of his earlier compositions" (line 20) with bold and "powerful designs" (line 21), (B).

28. (F) *Reading/Key Ideas and Details/Main Idea. CCRS: AVG.MI.2.* This item specifically asks about the main idea of the last paragraph, which focuses on the impact of Homer's paintings. His works while living on the Maine coast came to be known as his "greatest paintings" (lines 69–70), and they remain "haunting evocations of the eternal power of the ocean" (lines 85–86). (F) best captures this impact: these paintings best show Homer's artistic skills. While there is a connection between people and the natural work, this paragraph details the unpredictable waters on the Maine coast that Homer captured, not their connection to the human spirit, so (G) can be eliminated. The author never mentions the best artistic methods to capture these images, so (H) is wrong, and (J) is incorrect because the author's personal feelings and opinions are not included in the passage.

29. (D) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG+.DET.4.* The answer to this question can be found in the third paragraph when the author chronicles Homer's time in Tynemouth. While it is unclear why he went, it's possible that he was "searching for a town filled with the type of tourists and bathers that made his paintings of the Jersey Shore successful back home" (lines 30–33). (D) best captures this possibility.

30. (J) *Reading/Key Ideas and Details/Explicit Detail. CCRS: AVG+.DET.2.* This is an Explicit Detail item that asks about a specific place that caused Homer to be irritable. Details about Homer's time in Prouts Neck can be found in the fourth paragraph where "when he was working" he could be "extremely short tempered when interrupted" (lines 65–67). (D) best captures this reason: his work being interrupted.

31. (B) *Reading/Craft and Structure/Development. CCRS: EXP.PRT.3.* This question asks about the overall development of the passage as a whole. The first paragraph details the search—and the finding—of planets, and the remaining paragraphs explore the ways these planets like Earth and the ways scientists can research them, making (B) the best answer. (A) is incorrect because the focus is on the methods in how other planets like Earth can be found, not whether they exist at all. (C) is incorrect because planets are never defined, and (D) is incorrect because the author doesn't provide technical descriptions of exoplanets, but details ways in which these exoplanets can be researched.

32. (G) *Reading/Craft and Structure/Development. CCRS: PRE.PRT.1.* The best answer to this question is (G), figurative language as the passage is rife with metaphors and similes: "To see a planet as small and dim as ours amid the glare of its star is like trying to see a firefly in a fireworks display; to detect its gravitational influence on the star is like listening for a cricket in a tornado" (lines 23–27). (F), (H), and (J) can all be eliminated because no writings from astronauts or astronomers are included in the passage, nor are rhetorical questions.

33. **(D)** *Reading/Craft and Structure/Vocabulary. CCRS: EXP.VO.2.* The answer to this question lies in the description of the exotica: "Amid such exotica, scientists are eager for a hint of the familiar: planets resembling Earth" (lines 18–19). "Such exotica" then means something unfamiliar, or different than Earth, (D).

34. **(J)** *Reading/Key Ideas and Details/Main Idea. CCRS: EXP.MI.1.* This question asks about the overall idea of the second paragraph. The author says that scientists are searching for planets like Earth that could support life, but none have been found yet, presumably because they are "inconspicuous" (line 23). The figurative language in lines 23–27 further demonstrates how difficult it is to detect these types of planets, so (J) is the best answer. (F), (G), and (H) are incorrect because these are not ideas covered in the second paragraph.

35. **(B)** *Reading/Key Ideas and Details/Implied Idea. CCRS: EXP.DET.1.* The answer to this question can be found in lines 33–37, which state the Doppler technique is used to analyze starlight to determine the "gravitational pull of its planets," (B).

36. **(J)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: ADV.DET.2.* In lines 74–76, the author states that Kepler scientists won't identify or announce the presence of a planet until "they have seen it in transit at least three times," (J).

37. **(C)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: ADV.DET.2.* The answer to this question can be found in lines 31–33: "Only 11 exoplanets, all of them big and bright and conveniently far away from their stars, have as yet had their pictures taken," (C).

38. **(F)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: ADV.DET.2.* This question is an Explicit Detail item that asks about a specific capability of the Kepler. The answer can be found in lines 64–66: "It makes wide-field pictures every 30 minutes, capturing the light of more than 100,000 stars," (F). (G), (H), and (J) are incorrect because these capabilities are not attributed to the Kepler.

39. **(A)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: ADV.DET.2.* The answer to this question can also be found in the description of the Kepler: it makes "wide-field pictures every 30 minutes, capturing the light of more than 100,000 stars in a single patch of sky between the bright stars Deneb and Vega" (lines 64–67). Deneb and Vega then, are used as poles, or edges, to examine the stars, (A).

40. **(H)** *Reading/Key Ideas and Details/Explicit Detail. CCRS: ADV.DET.2.* In lines 78–80, the author states scientists expect to determine "the diameters and masses of transiting planets" by "combining Kepler results with Doppler observations," (H).

The Cambridge Edge

On Explicit Detail answers that use numerals, you can skim the passage until you find that numeral and then determine if it fits the question. For example, in item #37, if you skim the passage for "100,000 stars," you can quickly find the numeral, and see that the Kepler captures the "light of 100,000 stars." Scanning for numerals can help you find the correct answer quickly.

Science Test

Passage I: Figure 1 presents data representing the average relative brightness of mouse fur as a function of distance from the coast in four graphs corresponding to four different regions of fur (Figure 1). Figure 2 presents data representing the soil brightness (relative to 100% reflectance) as a function of distance from the coast.

1. **(A)** *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.2.*

    The item stem directs you to Figure 2 and asks for the inland distance (*x*-axis) that corresponds to the brightest surface soil, which in turn corresponds to percent reflectance relative to 100% (*y*-axis). The highest value for percent reflectance corresponds to the coastal site (0 km inland distance), (A).

2. **(H)** *Science/Interpretation of Data/Comprehension. CCRS: BSC.DA.4.*

    The item stem directs you to the dorsal stripe graph (upper right) in Figure 1 and asks for the inland distance (*x*-axis) that corresponds to a relative brightness of 0.25 (*y*-axis). According to the graph, the *x*-value corresponding to a *y*-value of 0.25 is slightly more than 50 km. The answer choice that best matches is 60 km, (H).

3. **(C)** *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.2.*

    The item stem directs you to the rostrum graph (upper left) in Figure 1 and asks for the greatest change in relative brightness over the ranges of inland distance given in the answer choices. Before even bothering with the choices, look at the graph—the greatest change will correspond to the greatest slope. It's easy to see in the graph that the greatest (negative) slope corresponds to the range of approximately 50 km to 70 km. The answer that matches best is 50 km to 75 km, (C).

4. **(J)** *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.2.*

    The item stem directs you to the ventrum graph (lower right) in Figure 1 and asks whether the fur is lighter (brighter) or darker 150 km inland as compared with at the coastal site. According to the graph, a distance of 150 km inland, the brightness is 0; at the coastal site, it's 1. So, it's darker inland, which eliminates (F) and (G). (J) is correct because the brightness is less inland than at the coast.

5. **(B)** *Science/Evaluation of Models/Application. CCRS: ADV.EXP.1.*

    The data in Figure 1 generally show that the further inland the mouse is, the darker its fur; the data in Figure 2 generally show that the further inland the mouse is, the darker the soil surface. This item asks for the most likely hypothesis as to why this is the case. Before going any further, quickly preview the answer choices. The trend in the answer choices is whether or not a mouse is caught by predators and whether or not it is able to pass on its fur pigmentation traits. A mouse that blends in with its background is less likely to be caught by predators, so eliminate (C) and (D). A mouse that survives is more likely to pass on its traits, so (B) is the correct choice.

6. **(J)** *Science/Interpretation of Data/Analysis. CCRS: PRE.DA.3.*

    The data in Figure 2 is relative to 100% reflectance, or brightness. According to Figure 2, the soil at the coastal site has less than 100% reflectance (approximately 75%), so the soil at the coastal site is less bright than the standard assigned 100% reflectance. In other words, the coastal soil is darker than the standard and has less than 100% reflectance, (J).

Passage II: This passage summarizes research on two methods for removing solid monohydrate from solutions following three different reaction times using two methods: standard filtration (Experiment 1) and vacuum filtration (Experiment 2). The concentration of CNF in the filtrates is determined for both experiments (three reaction times each) and reported in Table 1.

7. (B) *Science/Scientific Investigation/Analysis. CCRS: AVG.DA.4.*

    This item asks you to interpolate between the given data points in Experiment 1 for a reaction time of 2 days. According to Table 1, a CNF concentration data point for 2 days reaction time would be between Trial 1 (10 minutes, 6 mg/kg) and Trial 2 (3 days, 39 mg/kg). Therefore, the correct answer is between 6 mg/kg and 39 mg/kg, (B).

8. (F) *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.2.*

    This item asks you to compare the data in Table 1 to find the lowest value of CNF concentration. The lowest level, 6 mg/kg, corresponds to Experiment 1, Trial 1: standard filtration and 10-minute reaction time, (F).

9. (C) *Science/Scientific Investigation/Comprehension. CCRS: BSC.EXD.2.*

    This item tests your understanding of the experimental design: Experiment 1 uses standard filtration in which gravity draws the solution liquid through the filter; Experiment 2 uses a vacuum pump to draw the liquid through the filter. According to Table 1, for the same reaction time, the concentration of CNF is always greater for the vacuum pump than for standard filtration, so the net force on the mixture is greater with the vacuum pump, Trial 6, than with standard filtration, Trial 3, (C).

10. (G) *Science/Scientific Investigation/Comprehension. CCRS: AVG.EXD.2.*

    This item tests your understanding of the chronological sequence of steps in each trial of the experiment. The answer depends on the answer choices, so preview the choices . Measuring the CNF is the last step of each trial, so eliminate (F) and (H). Compare the remaining choices: (G) is correct because mixing the solutions occurs before recovery of the solids.

11. (D) *Science/Interpretation of Data/Analysis. CCRS: AVG+.DA.5.*

    This item asks you to find the evidence to support or negate the given prediction: vacuum filtration will recover greater CNF concentration for a 3-day reaction time than for a 10-minute reaction time. First, identify the corresponding trials in Table 1: Trial 4 (10 minutes, vacuum) and Trial 5 (3 days, vacuum). Next, compare the results: the CNF concentration for Trial 5 (3 days) is greater than it is for Trial 4 (10 minutes). This supports the prediction because Trial 5 had greater CNF than Trial 4, (D).

12. (G) *Science/Scientific Investigation/Comprehension. CCRS: AVG.EXD.1.*

    According to Table 1, reaction times of at least 3 days were tested using standard filtration in Trials 2 and 3—two trials total, (G).

13. (A) *Science/Evaluation of Models/Application. CCRS: AVG+.EXD.3.*

    The balanced chemical equation tells how many ions of $Ni^{2+,}$ OH^-, and H_2O are consumed for every formula unit of $Ni(OH)_2 \bullet H_2O$ produced: 1, 2, and 1, respectively. To consume 6 OH^- ions in the reaction, multiply all parts of the balanced equation by 3: 3 Ni^{2+} + 6 OH^- + 3 H_2O → 3 $Ni(OH)_2 \bullet H_2O$. Therefore, 3 formula units of $Ni(OH)_2 \bullet H_2O$ are produced for every 6 OH^- ions consumed in the reaction, (A).

Passage III: Preview the introductory material to get a general idea of what is presented: three viewpoints on whether the maximum mass of the most massive stars observed can be accounted for by accretion alone. Quickly preview each viewpoint, but don't dwell on the details. Scientist 1 says no, accretion alone accounts for stars less than 20 Ms only; Scientist 2 says no, accretion alone accounts for stars less than 40 M_s only; and Scientist 3 says yes, accretion alone can account for stars of any size.

14. (G) *Science/Evaluation of Models/Comprehension. CCRS: BSC.MOD.1.*

This item tests your comprehension of the introductory material: gravity causes a protostar to accrete (accumulate) gas and radiation pressure causes the protostar to push gas away. Therefore, relative to the center of the protostar, gravity causes gas to accelerate inward and radiation pressure causes gas to accelerate outward, (G).

15. (B) *Science/Evaluation of Models/Comprehension. CCRS: PRE.MOD.1.*

According to Scientist 2, gas accumulates in a disk around the protostar's equator (due to the protostar's rotation), which reduces the effect of RP in that plane, further increasing the gas accumulation near the equator, (B).

16. (H) *Science/Evaluation of Models/Application. CCRS: AVG+.MOD.4.*

The arguments of both Scientists 1 and 2 are based on stellar mergers accounting for massive stars, while Scientist 3 doesn't believe stellar mergers are likely. The item stem states that no evidence of stellar mergers has been found. Therefore, the additional information undermines the arguments of Scientists 1 and 2 only, (H).

17. (C) *Science/Evaluation of Models/Application. CCRS: ADV.MOD.3.*

Since Scientist 3 believes stellar mergers are unlikely and that any size star can be accounted for by gas accretion alone, start with the last column. According to the argument of Scientist 3, only one star would be required to form a star of mass 120 M_S, which eliminates (B) and (D). To choose between (A) and (C), check the first column. Scientist 1 states that any star with a mass of more than 20 M_S forms from a stellar merger. According to the argument of Scientist 1, a star of mass 120 M_S would require at least $\dfrac{120\,M_S}{20\,M_S} = 6$ stars to merge, (C).

18. (H) *Science/Evaluation of Models/Analysis. CCRS: AVG+.MOD.3.*

The star emerges from its envelope when the effect of RP overcomes gravity. This same point corresponds to the most massive star that can result from accretion alone in the arguments of Scientists 1 and 2: 20 M_S and 40 M_S, respectively. To strengthen the argument of Scientist 2 but weaken the argument of Scientist 1, a star with a mass of more than 20 M_S, but less than 40 M_S, would need to be observed. The only answer choice in this range is 30 M_S, (H).

19. (A) *Science/Evaluation of Models/Comprehension. CCRS: AVG.MOD.2.*

This item test your understanding of a key assumption in the arguments. Both Scientists 2 and 3 agree that gas accumulates around the equator of a protostar due to its rotation, or motion, (A). (Scientist 1 believes the gas accumulates uniformly in all directions.)

20. (H) *Science/Evaluation of Models/Comprehension. CCRS: AVG.MOD.1.*

The mass of the Sun (1 M_S) is below the thresholds given by both Scientists 1 (20 M_S) and 2 (40 M_S); Scientist 3 believes any size star can be accounted for by accretion alone. Therefore, all three scientists would agree that the Sun could have formed entirely by accretion, (H).

Passage IV: The studies measure the yield of two types of plants—tomatoes and peppers—as a function of the amount of vermicompost in the potting soil. Figure 1 is the yield of tomato plants from Study 1; Figure 2 is the yield of pepper plants from Study 2.

21. (D) *Science/Interpretation of Data/Analysis. CCRS: AVG+.DA.3.*

The item tests your understanding of the relationships presented in Table 1 and Figures 1 and 2. The percent by volume of vermicompost in the potting soil increases as the mixture number increases from 1 through 6 (Table 1). Both Figures 1 and 2 show the yields first increasing with increasing mixture number and then decreasing, (D).

22. (F) *Science/Scientific Investigation/Analysis. CCRS: AVG.EXD.3.*

The control in an experiment is designed to minimize the effects of the variables studied—in this case, the amount of vermicompost in the potting soil. Therefore, the control in Study 1 would be the mixture without any vermicompost: Mixture 1, (F).

23. (B) *Science/Interpretation of Data/Analysis. CCRS: PRE.DA.1.*

According to Figure 1, the average yield for Mixture 5, in g/plant, is 3,500. Recall that 1,000 grams equals 1 kilogram, so $\dfrac{3,500 \text{ g}}{\text{plant}} \cdot \dfrac{1 \text{ kg}}{1,000 \text{ g}} = 3.50$ kg/plant, (B).

24. (G) *Science/Scientific Investigation/Comprehension. CCRS: AVG.EXD.4.*

The only differences between the studies are the type of plant studied and the length of growing period, which is statement II. Statements I and III are the same in both studies, (G).

25. (A) *Science/Interpretation of Data/Analysis. CCRS: AVG+.DA.1.*

If tomato plants require less vermicompost than do pepper plants for the same yield, than the greatest yield in Figure 1 will occur for a lower mixture number than for the greatest yield in Figure 2. A comparison of Figure 1 with Figure 2 shows that the greatest yield was for the tomato plant grown in Mixture 2, whereas in Figure 2 the greatest yield was for the pepper plant grown in Mixture 3, (A).

26. (J) *Science/Scientific Investigation/Comprehension. CCRS: BSC.EXD.1.*

In both studies, "all seedlings that had emerged were removed from the pots with the exception of a single seedling in each pot," (J). The item stem explains why this was done: to prevent competition among the plants, which affects growth.

27. (D) *Science/Evaluation of Models/Application. CCRS: AVG+.MOD.5.*

This item tests your basic understanding of photosynthesis. Plants absorb carbon dioxide, water, and sunlight to produce glucose and oxygen. Just knowing that plants use carbon dioxide (that we breathe out as waste) and produce oxygen (that we breathe in to survive) is enough to eliminate all the choices except (D).

Outside Knowledge Alert!
You will be expected to know common measurement equivalents, such as 1,000 grams equals 1 kilogram, 12 inches equals 1 foot, 100 centimeters equals 1 meter, etc.

Outside Knowledge Alert!
This item requires the application of biology knowledge that is not presented in the passage itself. However, the scope of the knowledge tested is very basic, and when applied with common sense and elimination of wrong answers, you can easily answer the question.

Passage V: The passage describes the basic design and function of a cathode ray tube and presents the results of three studies. Study 1 measures the deflection of the CRT beam as a function of the electric field direction and magnitude (Table 1). Study 2 measures the deflection as a function of the electric potential, *V*, (Table 2). Study 3 measures the deflection as a function of the conducting plate length, *L,* (Table 3).

28. **(H)** *Science/Scientific Investigation/Comprehension. CCRS: AVG.EXD.4.*

    As described in the passage summary above, Study 1 measures the deflection of the beam (as measured from the location of the bright spot) as a function of the magnitude and direction of the electric field, which eliminates every choice except (H). Indeed, Study 2 measures the deflection of the beam as a function of the electric potential.

29. **(B)** *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.4.*

    This item asks you to interpolate between the data points given in Table 2. If *y* is 2.6 cm, which falls between $y = 3.2$ cm (Trial 8) and $y = 2.1$ cm (Trial 9), the corresponding electrical potential, *V*, would be between 1.0 kV (Trial 8) and 1.5 kV (Trial 9), (B).

30. **(J)** *Science/Interpretation of Data/Comprehension. CCRS: AVG.DA.3.*

    This item requires you to estimate the deflection of the bright spot as shown in Figure 2: it's slightly more than 3 cm, in the positive direction. The closest value in Tables 1 through 3 is 3.2 cm, which occurs for Trials 4 and 8 only, (J).

31. **(C)** *Science/Interpretation of Data/Analysis. CCRS: AVG+.DA.1.*

    The deflections in Study 2 are in the positive direction (the *y*-values in Table 2 are positive) and the deflections in Study 3 are in the negative direction (the *y*-values in Table 3 are negative). According to Table 1, the positive deflections correspond to a downward electric field and the negative deflections correspond to an upward electric field, (C).

32. **(G)** *Science/Scientific Investigation/Analysis. CCRS: BSC.EXD.2.*

    Since *E* and *V* are varied in Studies 1 and 2, respectively, the same CRT with $L = 2.5$ cm can be used in Studies 1 and 2. It can also be used for Trial 14. Since a change in *L* requires a change in CRT, Trials 12, 13, 15, and 16 require additional CRTs. Therefore, the total minimum number of CRTs is $1 + 4 = 5$, (G).

33. **(B)** *Science/Scientific Investigation/Analysis. CCRS: AVG+.EXD.3.*

    According to the introductory information, the electrical potential is what accelerates the cathode rays until they hit the screen; in other words, without the electrical potential, there would be no bright spot on the screen. This eliminates (A) and (C). Furthermore, deflection of the spot occurs for any non-zero electric field magnitude. If $y = 0$ cm, there is no deflection, so the magnitude of the electrical field must be zero, (B).

34. **(J)** *Science/Scientific Investigation/Application. CCRS: EXP.EXD.2.*

    This item requires basic outside knowledge of how charged particles interact: like charges repel and opposite charges attract. This eliminates (F) and (H). According to Table 1, the deflection is in the positive direction (upward) for a downward electrical field. For negatively charged cathode rays to be deflected upward, they are attracted to the upper plate, which means it must be positively charged. Therefore, the bottom plate is the negatively charged plate, (J).

Passage I: There isn't much to read in this passage other than the introduction, which describes the contents of the two graphs. Figure 1 is a graph of the average distance a gas atom travels between collisions with other gas atoms (mean free path) as a function of the volume of the gas, V (Figure 1), for a constant number of atoms in each of four gases. Figure 2 is a graph of the mean free path as a function of the number of atoms in each of four gases, N, for a constant volume.

35. **(D)** *Science/Interpretation of Data/Comprehension. CCRS: AVG+.DA.2.*

    This item requires that you order the gases in Figure 2 according to mean free path from shortest to longest for 15×10^{23} atoms. Notice in Figure 2 that the order of the gases is the same regardless of the N value: Xe < Cr < Ar < Ne, (D).

36. **(G)** *Science/Interpretation of Data/Analysis. CCRS: BSC.DA.4.*

    According to Figure 2, for $N = 6 \times 10^{23}$ Ne atoms (top data set), $\lambda = 1{,}600$ nm, and for $N = 12 \times 10^{23}$ Ne atoms, $\lambda = 800$ nm. Therefore, a doubling of the Ne sample size effectively multiplies λ by $\frac{1}{2}$, (G).

37. **(C)** *Science/Interpretation of Data/Analysis. CCRS: AVG.DA.4.*

    According to Figure 1, the λ for a 25-L Kr sample is approximately double that for a 12.5-L Kr sample: 300 nm and 150 nm, respectively. Since the data demonstrate a linear relationship, extrapolation to a 50-L Kr sample will correspond to another doubling of λ as compared with the λ for a 25-L Kr sample, (C).

38. **(J)** *Science/Interpretation of Data/Analysis. CCRS: AVG+.DA.2.*

    According to Figure 1, the λ for a 20-L Xe sample is approximately 150 nm; the λ for a 20-L Ar sample is approximately 350 nm. The difference between the two mean free paths is approximately $350 - 150 = 200$ nm, (J).

39. **(A)** *Science/Interpretation of Data/Application. CCRS: AVG+.DA.5.*

    According to Figure 1, the mean free path, which corresponds to the distance between collisions, is longer for the 25-L Xe sample than for the 5 L Xe sample. Therefore, the collision frequency will be higher in the 5-L Xe sample, due to the shorter distances between collisions, (A).

40. **(F)** *Science/Interpretation of Data/Application. CCRS: ADV.DA.3.*

    A comparison of Table 1 with Figures 1 and 2 shows that as the diameter of the gas atom, d, increases, the mean free path decreases (this makes logical sense—the bigger the atom, the less the distance between collisions). One would expect the λ value for a 25-L Rn sample of 6×10^{23} atoms to be less than the λ value for a 25-L Xe sample of 6×10^{23} atoms, which according to Figures 1 and 2 is 200 nm. Since 320 nm is longer than 200 nm, there must be less than 6×10^{23} atoms in the sample, (F).