AMERICA'S PREMIERE TESTING READINESS PROGRAM

ACT®
(Form Code 16MC3)

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

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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.

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1. **(C)** *English/Conventions of Standard English/Punctuation/Commas.* "A Native American people . . . Illinois" should be a nonrestrictive appositive phrase that describes in further detail what the Miami tribe is. The placement of the commas in (A) and (B), however, separate the appositive phrase into parts that don't make sense. And the use of a semicolon in (D) creates a fragment of the appositive phrase. Only (C) correctly place the comma between "tribe" and "a" to set apart the appositive phrase.

2. **(F)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* If the writer wishes to help us glimpse some of the grandmother's interests, (G) and (H) don't really cut it—they are too vague to give us any sort of key as to what the grandmother enjoys doing. (J) is perhaps the second-best answer since it provides slightly more detail than (G) and (H) do, but the original sentence gives the best idea into what the grandmother enjoys doing.

3. **(D)** *English/Knowledge of Language/Style/Conciseness.* "Rushed" and "hurry" have the same meaning. One or the other should be deleted to avoid redundancy; (D) deletes the second for a more concise sentence.

4. **(J)** *English/Conventions of Standard English/Sentence Structure/Fragments and Punctuation/Commas.* The original sentence contains a fragment. Dependent clauses, such as the one from "Conversely" to "appointment," cannot stand on their own as a complete sentence. They need to be connected to an independent clause, and (J) does this correctly with a comma. (G) and (H) attempt to fix the problem but still result in fragments.

5. **(A)** *English/Production of Writing/Strategy/Effective Opening Sentence.* The purpose of the paragraph is to describe the concept of "Miami time." The original sentence is the only one that has any link to that idea; the other choices relate to other parts of the passage but not specifically to the idea discussed in this paragraph.

6. **(G)** *English/Conventions of Standard English/Punctuation/Commas.* "When time . . stand still" is a dependent clause linked to the main independent clause. Since the dependent clause is essential to the meaning of the sentence, providing crucial insight into what "those moments" mean to the writer, the clause should not be separated by a comma, (B). (H) and (J) also use commas improperly as well as adding conjunctions that illogically link the two clauses together.

7. **(A)** *English/Knowledge of Language/Style/Conciseness.* (B), (C), and (D) are all verbose descriptions that could be shortened down to a single word: "words," (A).

8. **(J)** *English/Conventions of Standard English/Grammar and Usage/Verb Tense.* The example the writer describes through the rest of the passage is written in past tense. It follows logically that here the writer would use past tense as well, (J), not future tense, (F), or present tense, (G) and (H).

9. **(C)** *English/Conventions of Standard English/Grammar and Usage/Subject-Verb Agreement.* The sentence here has a compound predicate with two verbs joined by the same subject, "I": "was pushing" and "were thinking." The plural "were," however, does not agree with the singular "I." "Was thinking" would be appropriate—or, as (C) does correctly, "was" can simply be eliminated since it is part of the implied elliptical construction "I was" from earlier in the sentence.

10. **(F)** *English/Conventions of Standard English/Punctuation/Commas.* The original sentence is correct. No punctuation is needed between the two parts of the compound subject "two does and three fawns." (G) and (J) add commas that incorrectly split the parts of the subject, and (H) adds a comma that incorrectly separates the compound subject from the verb.

11. **(A)** *English/Production of Writing/Organization/Paragraph-Level Structure.* The best place for Sentence 3 is where it is now. It provides a clear link between the cause of Jeremy's sudden squealing (Sentence 2) and the owners of the five pairs of ears (Sentence 4). Moving the sentence would disrupt the logical order of the paragraph.

12. **(G)** *English/Conventions of Standard English/Sentence Structure/Faulty Parallelism.* In this sentence, the subject consists of two parts that should be—but are not—parallel: "lizards lazing" and "quail rustled." "Rustled" needs to be a participle to correctly parallel "lazing," and both (G) and (H) provide that participle. However, adding "were," as (H) does, gives the sentence two verbs that are illogically joined. The participle by itself is the only word needed, as (G) correctly provides.

13. **(D)** *English/Production of Writing/Strategy/Effective Transitional Sentence.* The phrase "for example" sets us up to expect an example of something, but the previous sentence doesn't set up a logical transition where an example would be appropriate. (B) suggests a contrast, but the rest of the sentence isn't a contrast to the taste of the wild blackberries. (C) simply doesn't make sense in context. Omitting a transitional phrase entirely, as (D) does, provides the best option: the sentence about the aroma of leaves is another description of a sensory experience of the writer and Jeremy.

14. **(J)** *English/Conventions of Standard English/Grammar and Usage/Diction.* The word "shorter" implies a contrast, and "than," not "then," is the word used in English for comparison. That eliminates (F) and (G) as possible right answers. As for (H), the superlative form "shortest" doesn't make sense here since only two things were being compared: the actual time the hike took and the time the writer felt it took. So (J) is the correct answer.

15. **(A)** *English/Production of Writing/Strategy/Main Idea.* Does the essay discuss a personal experience the author had with Miami time? Yes, definitely. The writer describes the experience he or she had in the woods with Jeremy. Since the answer is yes, both (C) and (D) can be eliminated. (B) can also be eliminated since the writer never decided to live in Miami time; Miami time is something that happens to you at unexpected moments, not an actual time that can be chosen to be lived in. That leaves (A) as the correct answer.

16. **(H)** *English/Conventions of Standard English/Punctuation/End-Stop Punctuation.* The pronoun "that" in the original sentence seems to initially and illogically assert that the women sit simultaneously in and around the flowers, but that doesn't make sense. (G) is also incorrect since the use of the conjunction "and" without a comma creates a run-on sentence. (J) creates a comma splice. Only (H) correctly splits the sentence into two logical sentences.

17. **(D)** *English/Production of Writing/Strategy/Effective Transitional Sentence.* The previous paragraph asks some questions that the second paragraph intends to answer. (A) illogically asserts that the answers to those questions can be "found in the artwork itself." (B) suggests a contrast between the questions and the answers that is also illogical. (C) seems to suggest that a continuation of questions will follow, when answers are what will follow. No transition, as (D) uses, is the best way to transition between the two paragraphs.

18. **(F)** *English/Production of Writing/Organization/Sentence-Level Structure.* The original sentence is correct. The first part of the sentence gives clues as to the order of the parts of the sentence. What has Ringgold told? "The story." She hasn't told "of this gathering," (G), or "on two horizontal panels," (H). And (J) is incorrect because "of this gathering" is a prepositional phrase that describes the story, so the prepositional phrase needs to be placed as close to "the story" as possible. (J) keeps them far apart and so confuses the meaning of the sentence.

19. **(C)** *English/Conventions of Standard English/Grammar and Usage/Diction* and *Pronoun Usage.* "It's" is a contraction that means "it is," and that meaning doesn't make sense in the original sentence: "the other into it is bottom border." Instead, the singular possessive "its," (C), is needed to correctly match with the singular antecedent "piece" and to identify what

Tip

Items that have two yes and two no answers should be some of the easier English items to answer. If you can determine whether or not something is added appropriately (see #55) or if it accomplishes a goal (see #15), you can eliminate two answer choices and leave yourself with a 50/50 chance of getting the answer right, even if you have to guess. And we like those odds.

has the bottom border. (B) is not a grammatical English word, and (D) incorrectly uses a plural pronoun with a singular antecedent.

20. **(J)** *English/Conventions of Standard English/Punctuation/Commas.* "The story explains" is a nonrestrictive interrupting phrase, and as a nonrestrictive phrase, it needs to be set apart from the rest of the sentence by a pair of punctuation marks—commas, dashes, even parentheses. It doesn't matter which punctuation marks are used, only that they match and there are two of them. (J) is the only answer choice to satisfy both criteria.

21. **(C)** *English/Production of Writing/Organization/Sentence-Level Structure.* The best way to find the correct answer to this item is simply to insert the phrase at each of the points in the sentence:

    (B): the women strove to support in their various ways the cause of justice in the world (makes sense)
    (C): the women strove to support the cause in their various ways of justice in the world (doesn't make sense)
    (D): the women strove to support the cause of justice in the world in their various ways (makes sense)

    (C) is the only choice that doesn't make sense, and that's because it incorrectly splits the noun "the cause" from its following prepositional phrase "of justice."

22. **(F)** *English/Production of Writing/Strategy/Effective Transitional Sentence.* The previous paragraph describes in some detail the story depicted on *The Sunflowers Quilting Bee at Arles* of eight African American women who supported "the cause of justice in the world." However, the next paragraph begins with a bit of a kicker: the eight women gathered around the quilt never actually met. So the reality of the situation isn't the same as the art, and the original transition best reflects this. The next paragraph does not provide a summary, (G), or add anything further to the description of the quilt, (H). And though there is a contrast between the art and reality, the use of "in contrast," (J), seems to say that there is a contrast between the way the eight women supported justice and how some other people supported justice, and that is not a reading supported by the passage.

23. **(B)** *English/Conventions of Standard English/Grammar and Usage/Nouns and Noun Clauses.* The original sentence incorrectly uses the plural "artists" instead of the possessive "artist's" to describe from whose imagination the scene came. (B) is the only choice that uses the correct singular possessive form.

24. **(J)** *English/Conventions of Standard English/Grammar and Usage/Subject-Verb Agreement.* This sentence has a compound subject with two parts: "Sojourner Truth" and "Harriet Tubman." Compound subjects joined by the conjunction "and" take a plural verb, and the only choice here that offers a plural verb is (D), "were."

25. **(A)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The paragraph names each of the women depicted on the quilt and then offers a brief description of how they, in different ways, "support[ed] the cause of justice in the world." The best choice for this item would be one that describes how Ida B. Wells fought for justice, and the original fits. All of the other choices offer details of Wells' life that, while interesting, don't show how she courageously supported the cause of justice.

26. **(J)** *English/Knowledge of Language/Style/Conciseness* and *Usage and Mechanics/ Punctuation/Commas.* The word "herself" unnecessarily repeats the idea present in the phrase "her own" in the original sentence. (G) and (H) both use similar redundancies; only (J) presents a clear, concise option that contains no excess verbiage.

27. **(B)** *English/Conventions of Standard English/Sentence Structure/Misplaced Modifiers.* The original sentence suffers from a misplaced modifier. As written, the sentence asserts that

millions of dollars by themselves established a hair products business. However, Madam C. J. Walker established the business, so she should be placed as close as possible to the modifying phrase. (B) does this correctly as well as eliminating the wordy use of the passive verb.

28. **(H)** *English/Conventions of Standard English/Punctuation/Commas.* This item is a bit tricky. "Among the schools . . . generosity" is an introductory adverbial phrase and, under normal circumstances, would be set apart from the main clause by a comma, as (A) does. However, the original sentence has an inverted subject and verb—"were those," not "those were." The adverbial phrase in this case should not be separated from the verb it is meant to modify, so no punctuation is needed, (H).

29. **(D)** *English/Conventions of Standard English/Sentence Structure/Comma Splices.* Two independent clauses joined only by a comma? Comma splice! (D) fixes the comma splice by changing "it happened in the 1950s and 1960s" into a prepositional phrase that describes "movement": "the civil rights movement of the 1950s and 1960s." (B) and (C) both suffer from the same error as the original.

30. **(F)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The preceding sentence doesn't compare the women depicted to Ringgold, (G); describe a brushwork technique, (H); or evaluate Ringgold's artistic talent, (J). The best description of the purpose of the last sentence is given in (F): it summarizes the essay through interpretation of the artwork.

31. **(B)** *English/Conventions of Standard English/Grammar and Usage/Subject-Verb Agreement.* The plural noun "times" in this sentence requires a plural verb. (B), "have allowed," is the only choice that offers the necessary subject-verb agreement.

32. **(F)** *English/Conventions of Standard English/Sentence Structure/Problems of Coordination and Subordination.* "When" introduces a dependent clause that is essential to the meaning of the main clause. As such, it should not be separated from the main clause by a comma, as the original does correctly. (B) creates a sentence fragment of the dependent clause, and (H) and (J), in addition to incorrectly using a comma to separate the two clauses, use pronouns that don't make sense when referring to a time.

33. **(C)** *English/Conventions of Standard English/Grammar and Usage/Pronoun Usage.* The original sentence illogically asserts that the camera had potential to expand its own spectacular magical productions. But Méliès was the one who had spectacular magical productions, so the pronoun should be "his," (C). (B) has a similar error to the original, except that (B) suggests that the stage illusions (the only plural antecedent possible) can expand their own productions. And (D) uses the contract form of "it is" that doesn't make sense here: "to expand it is spectacular magical productions."

34. **(F)** *English/Conventions of Standard English/Punctuation/Commas.* "However" is an adverb that, when used in the middle of a sentence, is set apart from the sentence using commas. Since two commas are needed, one before and one after "however," the original sentence is the only correct choice.

35. **(D)** *English/Production of Writing/Organization/Paragraph-Level Structure.* There are a couple of verbal clues that signal Sentence 1 should be moved from its original position. The first is the word "undaunted." Since Sentence 1 begins the second paragraph, something should have been related in the first paragraph, a trial of some sort from which Méliès could emerge "undaunted." But there is no such story. The second verbal clue is the word "instead," which implies some sort of alternative to an existing situation. Once again, however, the first paragraph offers no existing situation. In fact, the only sentence in the second paragraph that provides such a situation (and one about which Méliès was undaunted) is Sentence 5: despite the public preferring live magic to filmed shows, Méliès continued to use photographs to tell stories.

36. **(H)** *English/Production of Writing/Strategy/Appropriate Supporting Material* and *Effective Transitional Sentence.* The preceding paragraph talks about Méliès as a magician and how the camera captured his attention. The paragraph in question details some of the experimental effects Méliès used with his camera. Without Méliès's interest and training in magical illusions, he might not have been able to become a renowned filmmaker, and (H) echoes that idea. As for the other choices, the sentence does not describe specifically Méliès's abilities as a magician, (F); explain the techniques Méliès used, (G); or indicate any interest Méliès might have had in trick photography before he became a magician, (J).

37. **(D)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The original sentence is rather bland and lacks vivid description. (B) and (C) attempt to provide better descriptions, but they too fall rather short when compared with the more colorful and specific example used in (D).

38. **(J)** *English/Conventions of Standard English/Grammar and Usage/Adjectives versus Adverbs.* The phrase "highly excessively" is meant to modify "costs," but it does so incorrectly. Adverbs can modify verbs, adjectives, and other adverbs but not nouns. As currently written, two adverbs modify one noun. (J) correctly provides an adverb ("exceedingly") and an adjective ("high") to modify the noun as well as placing the two in the right order: "exceedingly" modifies "high," which in turn modifies "cost."

39. **(B)** *English/Knowledge of Language/Style/Conciseness.* "Fired," "launched," "projected," and even "propelled" all have the same meaning. (B) gets rid of any redundancies and cleans up the sentence with a clear, concise word: "fired."

40. **(F)** *English/Conventions of Standard English/Grammar and Usage/Adjectives versus Adverbs.* The original sentence is correct. It is safe to assume that the hostile creatures whom the travelers meet live there, so it is unnecessary to mention so, as (G) does. (H) and (J) suffer from similar errors; by virtue of the sentence stating that the space travelers experience adventures in a terrain filled with hostile creatures, we know that the space travelers encountered such creatures and that those creatures can be found on the terrain. There is no need to add that information.

41. **(C)** *English/Conventions of Standard English/Sentence Structure/Comma Splices.* The original sentence contains a comma splice. The two independent clauses ("they escape . . . they bob") are joined incorrectly with only a comma. Simply adding the word "after," as (B) and (D) do, doesn't fix the problem since "after" is a preposition and cannot be used to join two independent clauses. (C) fixes the problem by separating the clauses with a period.

42. **(J)** *English/Conventions of Standard English/Grammar and Usage/Verb Tense.* The use of past perfect is appropriate here (the production of the films took place in the past before explorations took place in the past), but the original sentence incorrectly uses the past tense "began" instead of the past participle "begun" when creating the past perfect. (J) uses the correct tense. (H) also uses the correct past participle, but the use of "have" changes the tense to the present perfect, incorrectly stating that the beginning of explorations started in the past and are continuing to the present. (G) uses the incorrect "would of" to replace the correct phrase "would have."

43. **(D)** *English/Knowledge of Language/Style/Idiomatic Expression.* The word "arouse" means to evoke or awaken a feeling, emotion, or response. (A), (B), and (C) all share similar meanings, but "disturb," (D), means to interfere with the normal functioning of something, and that doesn't make sense here.

44. **(G)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* Process of elimination is a good strategy here for finding a concluding sentence that best expresses the writer's thoughts about Méliès's impact on science fiction filmmaking. Let's go through each answer choice in turn:

Tip

When in doubt, use process of elimination. If you can eliminate one or more answer choices, you give yourself a much better chance of getting the right answer—even if you have to guess.

(F): While referencing modern science fiction films, this sentence has nothing to do with Méliès. Eliminate.
(G): This choice doesn't reference Méliès by name, but it does discuss his film ("this first space odyssey") as well as referencing modern science fiction films. Keep.
(H): This choice talks about Méliès, but it discusses impact on general filmmaking, not on science fiction films in particular. Eliminate.
(J): Méliès is mentioned, and space, but this sentence veers off topic with its sudden mention of the film crew. Eliminate.

Only one choice effectively concludes this essay: (G).

45. **(B)** *English/Production of Writing/Strategy/Main Idea.* Does this essay highlight the contributions that one artist can make to an art form? Méliès the magician/filmmaker is the one artist discussed in the essay, and the essay details some contributions (his film, his discovery of special effects) he made to the art of film. So the answer is yes, and that eliminates (C) and (D). As for (A), nothing in the essay hints that Méliès would not have succeeded as a magician if it hadn't been for the film industry. Méliès was a magician before he ever got into film. So that leaves (B) as the correct answer, and it fits with our earlier analysis.

46. **(G)** *English/Conventions of Standard English/Grammar and Usage/Verb Tense.* The use of "had" clues us in that the past perfect tense is going to be used here, and the past perfect tense requires "had" + the past participle form of a verb. The past participle of "go" is "gone," not "went," which eliminates (F) and (H). As for the other two choices, (J) uses an idiom that doesn't make sense here: "gone from" means to move from one place or idea to another. (G) uses the correct idiom: "gone out of style."

47. **(B)** *English/Conventions of Standard English/Grammar and Usage/Diction.* "Would of" is an improper spelling of a grammatical English contraction: "would've," or "would have." "Would of" as a verb has no place in writing, and so both (A) and (C) can be eliminated. (D) can also be eliminated since removing the underlined phrase would incorrectly place the action completely in the past instead of, as the present perfect tense denotes, continuing a past action up to the present. (B) provides the correct verb.

48. **(J)** *English/Conventions of Standard English/Punctuation/Commas* and *Grammar* and *Usage/Nouns and Noun Clauses.* "Back" in this case is not an adjective modifying "rooms" but is part of the compound noun "back rooms" (like "swimming pool"). As such, there should not be, as in (F) and (G), a comma separating a single adjective from a noun. The possessive of "library" is also needed here, since the sentence means to assert what has the dusty back rooms. (J) correctly uses the possessive, not the plural, as (H) does incorrectly.

49. **(C)** *English/Knowledge of Language/Style/Clarity of Meaning.* "Heaps" is an informal and nonspecific word to describe a lot of something—though we don't know exactly how much of something a "heap" is. (B) and (D) are similarly vague; (C) offers the most specific information as to how many Nancy Drew novels there are.

50. **(F)** *English/Conventions of Standard English/Punctuation/Commas.* The original sentence is correct. The comma between "novels" and "is" is the concluding comma for the appositive phrase "the teenaged . . . novels" that describes more about Nancy Drew. Adding an additional comma after "alive," as (G) does, incorrectly separates the list of adjectives already separated by "and." Moving the comma, as (H) does, or removing the comma, as (J) does, puts the verb as part of the appositive, which makes the rest of the sentence a fragment.

51. **(B)** *English/Conventions of Standard English/Grammar and Usage/Pronoun Usage.* "That," a relative pronoun, doesn't have a clear antecedent. It seems to be referring to "novels," but "novels" is plural and "that" is singular." (C) and (D) have similar errors, though (D) replaces the singular "that" with the singular "it." (B), however, replaces the offending pronoun with a noun that makes it clear what Liana and her friends were reading all summer long: "the mysteries."

52. **(G)** *English/Conventions of Standard English/Sentence Structure/Fragments.* The original sentence is a fragment. There seem to be a lot of verbs in this sentence ("went," "had followed," "had explored"), but the problem is that all are still a part of the dependent clause beginning with "By the time"—and a dependent clause by itself is a fragment. Both (G) and (J) end the dependent clause with the word "school" and create a new independent clause, but only (G) keeps the correct past perfect tense that is parallel with the compound predicate later in the sentence ("had explored").

53. **(A)** *English/Conventions of Standard English/Punctuation/Commas, Colons,* and *Semicolons.* "*The Spider Sapphire Mystery*" is the direct object of the verb "solve." Adding any punctuation between the verb and its direct object, as (B), (C), and (D) do, creates a sentence that is confusing as well as grammatically incorrect. The original, with no punctuation, is the correct answer choice.

54. **(H)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* (H) is the correct answer for this item. Not only does it provide specific examples of places that Liana read about in the Nancy Drew books ("illustrates a variety of settings"), but writing that Liana chased suspects "with Nancy in the lead" shows that Liana was involved and invested in the books ("expresses Liana's interest in these books"). None of the other choices have the level of detail that (H) offers.

55. **(C)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The main purpose of the third paragraph here is to detail some of the personality traits and characteristics of Nancy Drew that caused the narrator and her friends to love Nancy Drew so much. Details about the series itself, rather than about Nancy Drew as a character, are not relevant to the point of this paragraph and, as (C) correctly asserts, distract the reader from the main focus of the paragraph.

56. **(H)** *English/Conventions of Standard English/Sentence Structure/Faulty Parallelism.* The original sentence consists of a series of parallel nouns: "her loyal companions" and "her bravado." However, the last element in the series, "there was a love for her freedom to do what she wanted," doesn't follow the parallel structure. (G) and (H) both use "her freedom," which parallels the first two items in the series, but (G) incorrectly begins with "a love for," which repeats unnecessarily an idea already mentioned in the sentence ("we loved") and lacks parallelism with the other two items in the series. (H) eliminates any confusing redundancies and is parallel.

57. **(B)** *English/Conventions of Standard English/Grammar and Usage/Diction* and *Knowledge of Language/Style/Clarity of Meaning.* "Also" means "in addition": in addition to the reasons already mentioned, the narrator and her friends loved Nancy Drew for some more reasons. "Furthermore," (A), and "likewise," (C), also mean "in addition" or "in the same way" and could be equally acceptable alternatives. Even deleting "also," as (D) states, would not lose any of the original meaning of the sentence; using "we loved" to begin two sentences would be enough to imply that the second sentence contains additional reasons why the narrator and her friends loved the character. However, "therefore," (B), means "for that reason," and its use would incorrectly imply that the reasons given in the second sentence came about as a result of the reasons in the first sentence.

58. **(F)** *English/Conventions of Standard English/Sentence Structure/Faulty Parallelism.* The original sentence is correct. It contains a series of elements that each begins with the infinitive form of a verb ("to solve . . . win . . . kick . . . impress"). Any of the other choices would disrupt the parallelism of the series.

59. **(C)** *English/Conventions of Standard English/Punctuation/Semicolons.* The original sentence is a run-on. There are three ways to fix run-on sentences, and (C) is the only option that works.

> **Tip**
>
> The three ways to fix run-on sentences are
>
> (1) Comma + coordinating conjunction
> (2) Semicolon
> (3) End-stop punctuation (period, exclamation point, question mark)

60. **(F)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* If what the girls enjoy about the stories are the stories themselves, they are not looking to glean answers to the mysteries of life, (G); to find examples of a strong role model, (H); or to gain the ability to overcome obstacles, (J). The stories themselves consist of "exciting adventure tales spiced with mystery," as the original sentence correctly asserts.

61. **(C)** *English/Conventions of Standard English/Grammar and Usage/Nouns and Noun Clauses.* The use of "There were" in the original sentence creates a comma splice later on; "this planet has often been" is the other subject and verb of this sentence. The first clause needs to be a subordinate to the second. All of the other answer choices attempt this, but (C) is the only choice that results in a logical, grammatical sentence that uses an English idiom: "From [blank] to [blank]."

62. **(H)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The purpose of this paragraph is to introduce the fascinations humans have had with Mars, particularly as a "symbol of ill will and danger." Mentioning science fiction writers who have had best-selling works doesn't have anything to do with Mars and the associated danger, but the vivid description and specific word choices of (H) does an excellent job with furthering the idea of "ill will and danger."

63. **(B)** *English/Production of Writing/Strategy/Effective Transitional Sentence.* As mentioned in the previous item, the purpose of the first paragraph is to emphasize how humans have often viewed Mars in negative terms. The second paragraph, however, offers a contrast: instead of being afraid of Mars, humans are now searching for ways to explore it. So the negativity associated with Mars is no longer as strong, and (B) provides the best transition between the two ideas.

64. **(G)** *English/Conventions of Standard English/Grammar* and *Usage/Verb Tense* and *Diction.* The original sentence uses the improper "would of" instead of the grammatical "would have." Since the action of this sentence takes place in the past but before another past date ("By 2003"), the past perfect tense is needed—"had sent," (G). The other choices provide incorrect tenses given the context of the sentence.

65. **(C)** *English/Conventions of Standard English/Sentence Structure/Comma Splices.* The original sentence contains a comma splice—two independent clauses joined together with only a comma. Something needs to be done to the second clause; (C) changes it to a subordinate participial phrase describing the reaction to sending thirty spacecraft to Mars. (B) and (D) create subordinate clauses as well, but the relative pronoun "which" has no clear antecedent and results in confusing sentences.

66. **(H)** *English/Conventions of Standard English/Sentence Structure/Problems of Coordination and Subordination.* The use of the pronoun "Few" as a subject renders this sentence a run-on. The first clause needs to be subordinate to the second since the second is clearly an independent clause. (G) and (J) add some words to confuse the issue, but both contain the same error as the original sentence and result in run-on sentences. Only (H) correctly subordinates the first clause to the second by adding a necessary subordinating conjunction.

67. **(A)** *English/Conventions of Standard English/Punctuation/Commas.* "The most ambitious NASA project yet" is an appositive that gives further details about the International Space Station. Appositives, as nonrestrictive phrases, can be set apart from the main sentence by commas or dashes—as long as the punctuation marks are the same and there are two of them. The original sentence correctly uses two commas to set apart the appositive phrase, one at the beginning and one at the end. Using any other punctuation mark at the end of the appositive phrase, as the other choices attempt, would be incorrect.

68. **(F)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* The paragraph discussing costs and comparisons of the International Space Station and a potential voyage to Mars is rife with monetary details: $100 billion for a voyage to Mars, $17 billion to build

the International Space Station (ISS). The writer then asserts that NASA overspent on the ISS, and adding the detail about the final construction cost of the ISS would provide not only an important detail in the paragraph but also an important basis for comparison. Since the point *should* be added, that eliminates (H) and (J). (G) can also be eliminated since the point of adding the dollar figures is not to prove the affordability of space flight but to underscore its costliness. That leaves (F) as the correct answer, and it fits well with our analysis above.

69. **(B)** *English/Conventions of Standard English/Grammar and Usage/Nouns and Noun Clauses.* "If the final price of a human voyage to Mars would be" is a noun clause that functions as the direct object of the verb "imagine." But "if," (A); "how," (C); or deleting the word, (D), don't offer the pronouns necessary to begin a noun clause. (B) is the only choice that creates a logical noun clause that starts with the interrogative pronoun "what."

70. **(F)** *English/Production of Writing/Strategy/Appropriate Supporting Material.* If you are unfamiliar with what the Mars Rovers are, which choice would provide you with the best idea? Certainly not (G), (H), or (J), which give no details about the Rovers themselves. But the original sentence would correctly provide you with at least an idea of what the Rovers are: "robotic spacecraft."

71. **(D)** *English/Knowledge of Language/Style/Conciseness.* "Capacity" and "ability" both have similar meanings—what a person or thing is able to do. Both "genuine," (B), and "potential," (C), as adjectives describing "capacity" are unnecessary, too, since the idea of something's capacity is inherent in both adjectives. (D) provides the clearest and most concise way of rendering the idea.

72. **(J)** *English/Knowledge of Language/Style/Conciseness.* The original sentence suffers from a redundancy: "aging" and "older" both mean the same thing. (G) and (H) create logic problems. (G) seems to assert that visions come from old-age people, while (H) states that the visions themselves are aging. The use of the adjective "age-old" in (J), however, makes sense: the visions of space travel have existed for a very long time.

73. **(D)** *English/Production of Writing/Strategy/Effective Transitional Sentence.* "In other words" in the original sentence is a transitional phrase that means whatever comes after will be a restatement of what came before. That doesn't work here, though. The second sentence does not offer a restatement of the idea that sending machines to space isn't as romantic as sending people. (B) and (C) offer similar illogical transitions. The use of "even so," (D), correctly transitions a contrast between the two sentences—despite the lack of romance of robotic space travel, we need to keep in mind that robots can accomplish just as much as humans can.

74. **(G)** *English/Knowledge of Language/Style/Idiomatic Expression.* The original sentence is not idiomatic. "Such as a fraction of the cost" is not the correct idiom. Instead, the phrase is "at a fraction of the cost," (G). (H) muddies the water a little bit, since the use of "only" echoes a similar phrase: "at only a fraction of the cost." But "at" is not included, and "but" signals a contrast with the idea that came before when the reverse is true: the robots accomplish as much as scientists AND they do it for a fraction of the cost. Deleting the underlined portion, as (J) suggests, results in a sentence that asserts that something is a fraction of the cost of something else—but what both of those things are, we have no idea.

75. **(D)** *English/Production of Writing/Strategy/Effective Concluding Sentence.* Though the passage opens with an appeal to emotion (the fascination humans have with Mars), most of the passage deals with the financial costs of undertaking a mission to space, either through robots or with humans. So both (A) and (B) can be deleted. As for (C), though a few dates are mentioned, the passage does not deal with chronological history of anyone who traveled into space. (D) is the best answer because the focus of the essay is on cost.

Mathematics Test

1. **(E)** *Mathematics/Geometry/Triangles/Properties of Triangles* and *Number and Quantity/ Rates and Proportions*. The triangles composed of the flagpoles and their shadows are similar triangles: similar sides of the triangles have the same proportions. Create a direct proportion between the flagpole heights and their corresponding shadow lengths and solve for the missing flagpole height: $\dfrac{12 \text{ ft.}}{x} = \dfrac{4 \text{ ft.}}{12 \text{ ft.}} \Rightarrow x = \dfrac{12\,(12)}{4} = \dfrac{144}{4} = 36$ feet, (E).

2. **(K)** *Mathematics/Statistics and Probability/Measures of Center*. The average of the 5 test scores, 90, is equal to the sum of the 4 known test scores, $85 + 95 + 93 + 80 = 353$, plus the unknown fifth score, x, divided by 5: $90 = \dfrac{353 + x}{5} \Rightarrow x = 450 - 353 = 97$, (D).

3. **(A)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/ Evaluating Expressions*. Substitute -5 for x in the given expression and evaluate: $\dfrac{x^2 - 1}{x + 1} = \dfrac{(-5)^2 - 1}{(-5) + 1} = \dfrac{25 - 1}{-4} = \dfrac{24}{-4} = -6$, (A).

4. **(K)** *Mathematics/Number and Quantity/Basic Arithmetic Manipulations*. Rewrite the fractions of the mixed numbers with a common denominator and combine: $1\dfrac{2}{5} + 2\dfrac{1}{3} = 1\dfrac{6}{15} + 2\dfrac{5}{15} = 3\dfrac{11}{15}$, (K).

5. **(E)** *Mathematics/Statistics and Probability/Sets*. For an item like this, the number of possibilities are limited to the five answer choices, so eliminate the choices that cannot be true. Eliminate (A) because it violates the first statement. Eliminate (B) because it violates the second statement. Eliminate (C) because it eliminates the first and second statements. Eliminate (D) because it violates the third statements. Therefore, by the process of elimination, (E) must be necessarily true. Indeed, since Insect J is attracted to honey (third statement), it must be an ant (first statement).

6. **(G)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Evaluating Expressions*. Substitute -1 for x and -16 for m in the given expression and evaluate: $\sqrt{\dfrac{m}{x - 3}} = \sqrt{\dfrac{-16}{-1 - 3}} = \sqrt{\dfrac{-16}{-4}} = \sqrt{4} = 2$, (G).

7. **(B)** *Mathematics/Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities* and *Evaluating, Interpreting, and Creating Algebraic Functions*. The tickets cost \$6 per advanced ticket and \$8 per door ticket and the total ticket sales is at least \$2,000. Translate this information into an inequality: $6a + 8d \geq 2{,}000$, where a is the number of advanced tickets sold and d is the number of tickets sold at the door. Since 142 advanced tickets were sold, $6\,(142) + 8d \geq 2{,}000 \Rightarrow d \geq \dfrac{2{,}000 - 852}{8} \Rightarrow d \geq 143.5$.

Therefore, the minimum number of tickets that must be sold at the door is 144, (B).

8. **(J)** *Mathematics/Statistics and Probability/Counting Methods*. The number of possibilities for each ingredient is independent of the others. The total number of combinations is equal to the product of the number of possibilities for each ingredient: $(3)\,(5)\,(3) = 45$, (J).

9. **(E)** *Mathematics/Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations*. To solve the given equation for x, divide both sides by 12 and add 11: $12(x-11) = -15 \Rightarrow x - 11 = \dfrac{-15}{12} \Rightarrow x = 11 - \dfrac{5}{4} = 9\dfrac{3}{4} = \dfrac{39}{4}$, (E).

10. **(J)** *Mathematics/Geometry/Lines and Angles.* The length of $\overline{AD}$ is equal to the length of $\overline{BD}$, so $\angle BAD = \angle ADB = 25°$. The sum of the interior angles of a triangle is $180°$, so $\angle ADB + 25° + 25° = 180° \Rightarrow \angle ADB = 130°$. The angle measure of a straight line is $180°$, so $130° + \angle BDC = 180° \Rightarrow \angle BDC = 50°$. Since $\overline{BD}$ and $\overline{BC}$ are the same length, $\angle BCD = \angle BDC = 50°$. Therefore, $\angle BCE + 50° = 180° \Rightarrow \angle BCE = 130°$, (J).

11. **(C)** *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Function Notation*. Substitute -2 for x in the given function $9x^2 + 5x - 8$ and evaluate: $f(-2) = 9(-2)^2 + 5(-2) - 8 = 36 - 10 - 8 = 18$, (C).

12. **(J)** *Mathematics/Number and Quantity/Basic Arithmetic Manipulations*. The least common multiple of a set of numbers is the smallest integer into which all the numbers evenly divide. Rather than trying to determine it yourself, test the answer choices. The correct choice is the smallest value into which 30, 20, and 70 all divide evenly. Eliminate (F) and (G) because both are smaller than 70. Eliminate (H) because 120 is not evenly divisible by 70. (J) is evenly divisible by all three ($420 \div 30 = 14$, $420 \div 20 = 21$, and $420 \div 70 = 6$), so (J) is correct.

13. **(E)** *Mathematics/Number and Quantity/Basic Arithmetic Manipulations*. Tom must divide by 2 to reverse his mistake of multiplying by 2. However, this only returns the value to its original; it still needs to be divided by 2. Therefore, Tom must divide the result of the mistake by 4 to obtain the result he originally wanted, (E).

14. **(G)** *Mathematics/Geometry/Rectangles and Squares*. The total area of the 5 squares is 125 square inches, so the area per square is $\dfrac{125}{5} = 25$ square inches. Since the area of a square is the square of the side, the side length of each of the 5 squares in the figure is $\sqrt{25} = 5$ inches (distances are positive). The number of smaller square sides around the perimeter of the composite figure is 12, so the total perimeter is $12(5) = 60$ inches, (G).

15. **(A)** *Mathematics/Number and Quantity/Percentages* and *Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities* and *Evaluating, Interpreting, and Creating Algebraic Functions*. The cost of each drive is \$8 plus 7%, so the cost of d drives is $\dfrac{\$8}{\text{drive}}(d \text{ drives}) + 0.07\left(\dfrac{\$8}{\text{drive}}(d \text{ drives})\right) = \$8d(1.07)$. The total cost must be no more than \$100, so $8d(1.07) \leq 100 \Rightarrow d \leq \dfrac{100}{8.56} \approx 11.7$. Therefore, the maximum number of drives is 11, (A).

16. **(J)** *Mathematics/Number and Quantity/Scientific Notation* and *Rates and Proportions*. To determine the time in seconds, divide the number of calculations by the unit rate of calculations: $\dfrac{6.0 \times 10^{16} \text{ calculations}}{1.5 \times 10^8 \text{ calculations/second}} = 4 \times 10^{16-8} = 4 \times 10^8$ seconds, (J).

17. **(E)** *Mathematics/Algebra and Functions/Coordinate Geometry/Slope-Intercept Form of a Linear Equation.* Each of the answer choices is a linear equation in standard form: $y = mx + b$, where m is the slope and b is the y-intercept. Each equation in the answer choices has a different y-intercept, so look to the graph to determine the y-intercept for $x = 0$: $y = 5$. Only (E) has a y-intercept of 5.

18. **(K)** *Mathematics/Geometry/Rectangles and Squares.* The circle is inscribed in the square, so the side of the square is equal in length to the diameter of the circle: $7 + 7 = 14$. The area of the square is equal to the square of the side: $14^2 = 196$, (K).

19. **(A)** *Mathematics/Algebra/Evaluating, Interpreting, and Creating Algebraic Functions.* Worker A's salary as a function of years x is $\$20,000 + \dfrac{\$800}{\text{year}}(x \text{ years}) = 20,000 + 800x$; Worker B's salary is $15,200 + 2,000x$.

    Create the equation for equal salaries by setting the two salary expressions as equal: $20,000 + 800x = 15,200 + 2,000x$, (A).

20. **(J)** *Mathematics/Geometry/Triangles/Pythagorean Theorem.* Use the Pythagorean theorem to find the missing side length of the right triangle: $12^2 + ?^2 = 13^2 \Rightarrow ? = \sqrt{169 - 144} = \sqrt{25} = 5$, (J). A faster solution is to recognize that the triangle is the common Pythagorean 5-12-13 triple.

21. **(E)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Basic Algebraic Manipulations.* Apply the distributive property and combine like terms: $7(x + 3) - 3(2x - 2) = 7x + 21 - 6x + 6 = x + 27$, (E).

22. **(G)** *Mathematics/Number and Quantity/Percentages.* If x represents the unknown number, $1.15x = 460$. Solve for x: $x = \dfrac{460}{1.15} = 400$. Seventy-five percent of 400 is three-fourths of 400, or 300, (G).

23. **(C)** *Mathematics/Algebra and Functions/Solving Quadratic Equations and Relations* and *Manipulating Algebraic Expressions/Basic Algebraic Manipulations.* Use the FOIL method to square the binomial and combine like terms so it's in the form $ax^2 + bx + c$: $(2x - 3)^2 = (2x - 3)(2x - 3) = 4x^2 - 6x - 6x + 9 = 4x^2 - 12x + 9$. So, $a = 4$, $b = -12$, and $c = 9$. Therefore, $a + b + c = 4 - 12 + 9 = 1$, (C)

24. **(H)** *Mathematics/Geometry/Rectangles and Squares.* Break the figure into a 15-feet-by-15 feet square and a small rectangle:
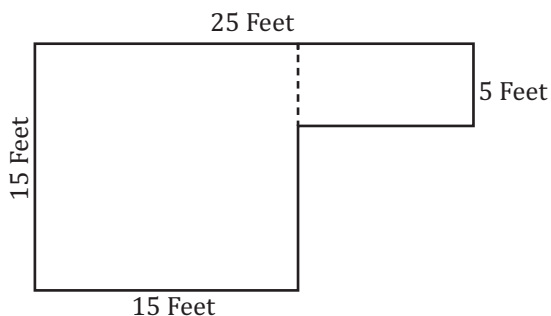
The length of the bottom of the rectangle is $25 - 15 = 10$ feet. Therefore, the total area of the figure is $15(15) + 10(5) = 225 + 50 = 275$ feet, (H).

25. **(B)** *Mathematics/Geometry/Rectangles and Squares*. The largest face of each block is the side measuring 4-inches-by-8-inches, so having this side face up will require the minimum number of blocks. Convert the dimensions of the patio to inches:

$8 \text{ feet} \left(\dfrac{12 \text{ inches}}{\text{foot}} \right) = 96 \text{ inches}$ and $10 \text{ feet} \left(\dfrac{12 \text{ inches}}{1 \text{ foot}} \right) = 120 \text{ inches}$. Divide each dimension

by 4 inches and by 8 inches to determine the minimum number of blocks. Check both

orientations: $\dfrac{96 \text{ inches}}{4 \text{ inches}} = 24$ and $\dfrac{120 \text{ inches}}{8 \text{ inches}} = 15$, for a total of $24\,(15) = 360$ blocks or

$\dfrac{96 \text{ inches}}{8 \text{ inches}} = 12$ and $\dfrac{120 \text{ inches}}{4 \text{ inches}} = 30$, for a total of $12\,(30) = 360$ blocks. Either way, the

minimum number of blocks is 360, (B).

26. **(H)** *Mathematics/Algebra and Functions/Coordinate Geometry/Slope-Intercept Form of a Linear Equation*. To find the slope of the line represented by $6y - 14x = 5$, rewrite the equation in slope-intercept form ($y = mx + b$, where m is the slope and b is the y-intercept):

$6y = 5 + 14x \Rightarrow y = \dfrac{14x + 5}{6} = \dfrac{7}{3}x + \dfrac{5}{6}$. Therefore, the slope of the line is $\dfrac{7}{3}$, (H).

27. **(C)** *Mathematics/Number and Quantity/Properties of Numbers*. Rather than reasoning through the answer choices algebraically, plug in numbers for m and n and evaluate each choice. Since the item stem asks which answer choice must be true, the correct choice will be true for any values of m and n such that $m < n$. Wrong choices may also be true for some values, so make unambiguous substitutions, such as 2 and 3. Use your calculator to estimate:

A) $0 < \sqrt{mn} < m : 0 < \sqrt{(2)(3)} < 2 \approx 0 < 2.4 < 2$ ✗
B) $1 < \sqrt{mn} < m : 1 < 2.4 < 2$ ✗
C) $m < \sqrt{mn} < n : 2 < 2.4 < 3$ ✓
D) $\sqrt{m} < \sqrt{mn} < \sqrt{n} : \sqrt{2} < 2.4 < \sqrt{3} \approx 1.4 < 2.4 < 1.7$ ✗
E) $\sqrt{m - n} < \sqrt{mn} < \sqrt{m + n} : \sqrt{2 - 3} < \sqrt{6} < \sqrt{2 + 3}$ ✗

Since only (C) is true, (C) must be the correct choice.

To solve this item algebraically, square all the expressions in the answer choices to clear the square roots:

A) $0 < \sqrt{mn} < m \Rightarrow 0 < mn < m^2$
B) $1 < \sqrt{mn} < m \Rightarrow 1 < mn < m^2$
C) $m < \sqrt{mn} < n \Rightarrow m^2 < mn < n^2$
D) $\sqrt{m} < \sqrt{mn} < \sqrt{n} \Rightarrow m < mn < n$
E) $\sqrt{m - n} < \sqrt{mn} < \sqrt{m + n} \Rightarrow m - n < mn < m + n$

Now the choices are easier to evaluate for $m < n$. (C) is true for the same reason that (A) and (B) are false: $m < n$, so $mn > m^2$ and $mn < n^2$. This is enough to prove the answer is (C). Indeed, (D) is false because $mn > n$, and (E) is false because $mn > m + n$.

28. **(J)** *Mathematics/Geometry/Triangles/Properties of Triangles* and *Number and Quantity/ Rates and Proportions*. The perimeter of the smaller triangle is the sum of the three sides: $3 + 5 + 7 = 15$ centimeters. The two triangles are similar, so the ratio of the perimeter of the small triangle to the perimeter of the large triangle is 3 to 5. Create a proportion between the ratios and the perimeters: $\dfrac{3}{5} = \dfrac{15 \text{ cm.}}{x}$, where x is the perimeter of the large triangle. Solve for

x: $x = \dfrac{15\,(5)}{3} = 25$ inches, (J).

29. **(A)** *Mathematics/Statistics and Probability/Probability* and *Geometry/Circles.* To score at least 30 points, Thomas needs to hit the board within the circle that is the outer boundary of the "30" point section. The probability of hitting within this circle is the ratio of the area of this circle to the area of the entire board: $\dfrac{\pi (2 + 2 + 2)^2}{\pi (10)^3} = \dfrac{36}{100} = 36\%$, (A).

30. **(G)** *Mathematics/Algebra and Functions/Solving Quadratic Equations and Relations* and *Evaluating, Interpreting, and Creating Algebraic Functions.* Translate the given information into an equation, where A represents the age: $A^2 - 23A = 50$. Rewrite this in the standard form for a quadratic equation: $A^2 - 23A - 50 = 0$. Factor the quadratic: $A^2 - 23A - 50 = (A - 25)(A + 2) = 0$. For the quadratic to be true, $A = 25$ or $A = -2$. Since age must be positive, $A = 25$, (G).

31. **(B)** *Mathematics/Algebra and Functions/Expressing and Evaluating Algebraic Functions/ Functions as Models.* The item stem gives an equation for distance, and asks for the value of t, in seconds, for $a = \dfrac{20 \text{ meters}}{\sec^2}$ and $d = 80$ meters. Solve the given equation for t:

$d = \dfrac{1}{2}at^2 \Rightarrow \sqrt{\dfrac{2d}{a}}$. Substitute 20 for a, 80 for d, and evaluate:

$t = \sqrt{\dfrac{2d}{a}} = \sqrt{\dfrac{2(80 \text{ meters})}{20 \text{ meters}/\sec^2}} = \sqrt{\dfrac{160}{20}} \approx 2.8$ seconds. This is between 2 and 3, (B).

32. **(F)** *Mathematics/Algebra and Functions/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities.* There is no value of x for which the inequality is true: $x + 3 > x + 5 \Rightarrow x - x > 5 - 3 \Rightarrow 0 > 2$, which is false. Therefore, the correct answer is the empty (or null) set, (F).

33. **(D)** *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs* and *Probability.* The number of students who responded that they studied less than 3 hours is the total number of students included in the first 3 bars, as represented by the frequency counts on the y-axis: $2 + 5 + 6 = 13$. According to the item stem, the total number of students is 20, so, the fraction is $\dfrac{13}{20}$, (D).

34. **(J)** *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs* and *Number and Quantity/Rates and Proportions.* According to the graph, the number of students who studied 3 hours is 4 out of 20 respondents. Create a proportion between the number of students and the corresponding sector angles, where x is the unknown sector angle: $\dfrac{4 \text{ students}}{20 \text{ students}} = \dfrac{x}{360°}$. Solve for x: $x = \dfrac{4(360°)}{20} = 72°$, (J).

35. **(B)** *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs* and *Measures of Center.* The average of the data is a weighted average. First, find the total number of hours by adding the products of each of the hour values and the corresponding number of students: $2(0) + 5(1) + 6(2) + 4(3) + 2(4) + 1(5) = 5 + 12 + 12 + 8 + 5 = 42$ hours. Divide by 20 students to find the average hours per student: $\dfrac{42 \text{ hours}}{20 \text{ students}} = 2.1$ hours per student, (B).
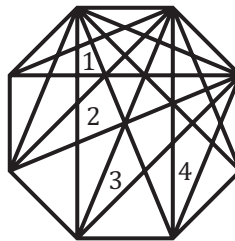
36. (H) *Mathematics/Geometry/Lines and Angles.* The diagonals are lines from each angle to every angle. Start by drawing diagonals from one angle and count them:
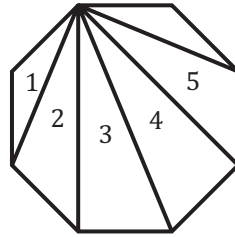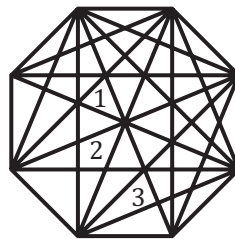

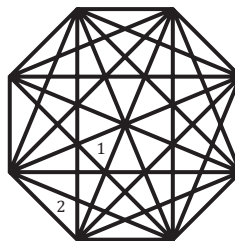Move to the next angle and draw diagonals to every other angle:
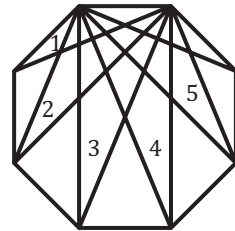
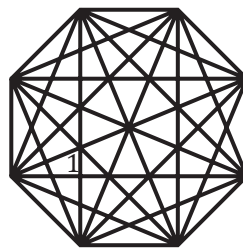So far, there are $5 + 5 = 10$ diagonals. Move on to the next angle:

Now, there are $10 + 4 = 14$ diagonals. Move on to the next angle:

We're up to $14 + 3 = 17$ diagonals. Move on to the next angle:

The total number of diagonals is now $17 + 2 = 19$. There's one more diagonal to draw:

Therefore, the total number of diagonals is $19 + 1 = 20$, (H).

37. **(E)** *Mathematics/Geometry/Trigonometry/Definitions of the Six Trigonometric Functions.* The sine of an angle in a right triangle is the ratio between the length of the side opposite the angle and the hypotenuse: $\sin 72° = \dfrac{\text{side opposite } 72°}{\text{hypotenuse}} \Rightarrow$ side opposite $72° = 144\,(\sin 72°)$, (E).

38. **(G)** *Mathematics/Algebra and Functions/Coordinate Geometry/Distance and Midpoint Formulas.* The midpoint of a line with endpoints at coordinates (x_1, y_1) and (x_2, y_2) has coordinates $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$. Therefore, the x-coordinate of the midpoint between $(-8, -3)$ and $(2, 3)$ is $\dfrac{-8 + 2}{2} = \dfrac{-6}{2} = -3$, (G).

39. **(E)** *Mathematics/Algebra and Functions/Solving Simultaneous Equations.* The item stem asks for the value of $8x + 9y$, so you'll need to solve for both x and y. To eliminate the y-variable, multiply the first equation by -2 and then combine the equations:

$-2\,(2x + 3y = 4)$

$+\ \ 5x + 6y = 7$

$-4x + 5x - 6y + 6y = -8 + 7 \Rightarrow x = -1$

Substitute -1 for x in either equation and solve for y: $5x + 6y = 7 \Rightarrow 5\,(-1) + 6y = 7 \Rightarrow y = \dfrac{7 + 5}{6} = 2$. Therefore, $8x + 9y = 8\,(-1) + 9\,(2) = -8 + 18 = 10$, (E).

40. **(H)** *Mathematics/Geometry/Trigonometry/Determining Trigonometric Values.* The tangent of angle θ is negative in Quadrants II and IV. Quadrant II corresponds to $\dfrac{\pi}{2} < \theta < \pi$ and Quadrant IV corresponds to $\dfrac{3\pi}{2} < \theta < 2\pi$. The only answer choice that gives values for θ in these two ranges is (H): $\dfrac{\pi}{2} < \dfrac{3\pi}{4} < \pi$ and $\dfrac{3\pi}{2} < \dfrac{7\pi}{4} < 2\pi$.

41. **(B)** *Mathematics/Number and Quantity/Complex Numbers* and *Properties of Numbers.* Integers are all negative and positive whole numbers and zero. Any number, regardless of the value, including i, raised to the zero power is 1. Therefore, (B) must be correct. Indeed, for any integer x, the only possible values of i^x are i, -1, $-i$, and 1.

42. **(F)** *Mathematics/Geometry/Solids.* To determine the height of the soda in the glass, first find the volume of soda in the can. The item stem gives the formula for the volume of a cylinder: $\pi r^2 h$, where r is the radius and h is the height. The can has a diameter of 2 inches, so the radius is 1 inch and the volume is $\pi (1)^2 (6) = 6\pi$ cubic inches. Set this volume equal to the volume of the glass with a radius of $\dfrac{3}{2}$ inches, for which the height h is unknown:

$6\pi = \pi r^2 h = \pi \left(\dfrac{3}{2}\right)^2 h$. Solve for h: $h = \dfrac{6\,(4)}{9} = \dfrac{24}{9} = 2\dfrac{6}{9} = 2\dfrac{2}{3}$ inches, (F).

43. (**C**) *Mathematics/Geometry/Solids*. Apply the formula for the volume of a right cylinder. Conveniently, it's given to you in the previous problem if you don't remember it: $\pi r^2 h$, where r is the radius and h is the height. Therefore, the volume of the cylinder is $\pi(5)^2(6) = \pi(25)(6) = 150\pi$ cubic meters, (C).

44. (**F**) *Mathematics/Geometry/Triangles/Properties of Triangles* and *Number and Quantity/ Rates and Proportions*. The three triangles $\triangle ABC$, $\triangle ADE$, and $\triangle AFG$, are all similar because the corresponding sides are in proportion and the corresponding angles are equal (congruent). For similar triangles, the ratios of the sides, altitudes, perimeters, and medians are all in the same ratio. Since the ratio of the perimeter of $\triangle ABC$ to the perimeter of $\triangle AFG$ is 1:3, $AC:AG = 1:3$. Similarly, since $DE:FG = 2:3$, $AE:AG = 2:3$. From the three-part ratio, $AC:AG:AE = 1:3:2$, $AC:AE = 1:2$. The length of AE is twice the length of AC, so CE must be the same length as AC. The ratio of AC to CE is 1:1, (F).

45. (**E**) *Mathematics/Geometry/Triangles/30°-60°-90° Triangles* and *45°-45°-90° Triangles*. The rocket has three stages of travel contributing three increases of altitude:
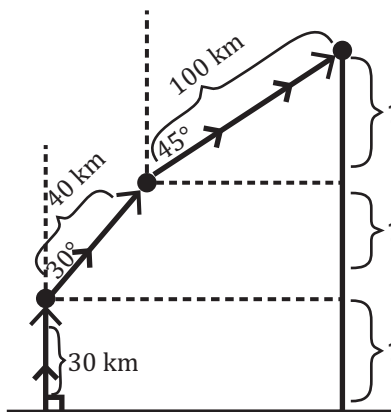
The total height of the rocket is the combined heights of the top triangle, the middle parallelogram, and the bottom rectangle, which is 30 meters. Determine the height of the top triangle by applying the ratio of the sides of a $45° - 45° - 90°$ triangle, $1:1:\sqrt{2}$.
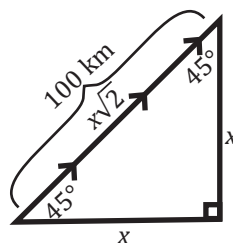
So, $\dfrac{?}{100\text{ km}} = \dfrac{x}{x\sqrt{2}} \Rightarrow ? = \dfrac{100}{\sqrt{2}}\left(\dfrac{\sqrt{2}}{\sqrt{2}}\right) = 50\sqrt{2}$ meters. If you forgot the ratio of the sides of

a $45° - 45° - 90°$ triangle, you can use the Pythagorean theorem:

$x^2 + x^2 = 100^2 \Rightarrow 2x^2 = 100^2 \Rightarrow x = \dfrac{100}{\sqrt{2}} = 50\sqrt{2}$ meters. At this point, eliminate (A), (B),

and (C), as these don't include a $\sqrt{2}$ term. Even without determining the height of the parallelogram, you can eliminate (D) because the total height is at least $30 + 50\sqrt{2}$ and there is no integer term in (D). Indeed, the height of the parallelogram can be determined by using the ratio of the sides of a $30° - 60° - 90°$ triangle, $1:\sqrt{3}:2$.
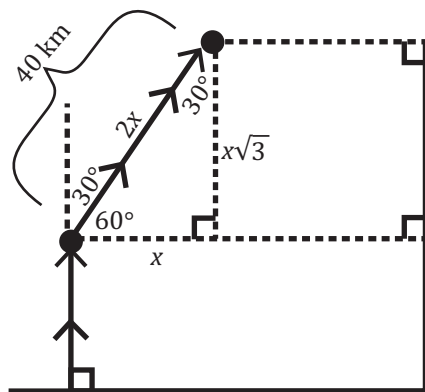
To find the height of the triangle, create a ratio between the missing side and the known side: $\frac{?}{40} = \frac{x\sqrt{3}}{2x} \Rightarrow ? = 20\sqrt{3}$ meters. Therefore, the total height of the parallelogram is $30 + 50\sqrt{2} + 20\sqrt{3}$, (E).

46. **(G)** *Mathematics/Statistics and Probability/Probability* and *Data Representation/Tables*. The expected number of defective springs that will be produced in any single day is equal to the sum of the products of the probabilities and the corresponding number of defective springs: $(0.70)(0) + (0.20)(1) + (0.05)(2) + (0.05)(3) = 0.20 + 0.10 + 0.15 = 0.45$, (G).

47. **(E)** *Mathematics/Algebra and Functions/Solving Quadratic Equations and Relations* and *Evaluating, Interpreting, and Creating Algebraic Functions/Concepts of Domain and Range* and *Coordinate Geometry/Graphs of Quadratic Equations and Relations*. The given equation is quadratic, the graph of which is a parabolic function. The solutions to a quadratic function correspond to the points where the function crosses the x-axis at $y = 0$. Set the equation equal to zero and factor: $0 = -2t^2 + 10t + 48 \Rightarrow 0 = t^2 - 5t - 24 = (t-8)(t+3)$. The solutions for t are 8 and -3, so the parabola intersects the x-axis at $t = -3$ (if it were extended to the left of $t = 0$, but time isn't negative) and $t = 8$. In other words, the object hits the ground 8 seconds after it is thrown, (E).

48. **(H)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/ Manipulating Expressions Involving Exponents*. Apply the rule for multiplying exponents with the same base ($x^m x^n = x^{m+n}$) to the expression in the item stem: $g^2 \sqrt{g^5} \cdot h^2 \sqrt[4]{h^5} = g^2 g^{\frac{5}{2}} h^2 h^{\frac{5}{4}} = g^{2+\frac{5}{2}} h^{2+\frac{5}{4}} = g^{4\frac{1}{2}} h^{3\frac{1}{4}}$. Check the answer choices; only the correct choice will equal $g^{3\frac{1}{2}} h^{3\frac{1}{4}}$:

F. $g^2 h^2 \sqrt[5]{g^2 h^2} = g^2 g^{\frac{2}{5}} h^2 h^{\frac{2}{5}} = g^{2\frac{2}{5}} h^{2\frac{2}{5}}$ ✘

G. $g^3 h^4 \sqrt[4]{g^2 h^3} = g^3 g^{\frac{2}{4}} h h^{\frac{3}{4}} = g^{3\frac{1}{2}} h^{1\frac{3}{4}}$ ✘

H. $g^4 h^3 \sqrt[4]{g^2 h} = g^4 g^{\frac{2}{4}} h^3 h^{\frac{1}{4}} = g^{4\frac{1}{2}} h^{3\frac{1}{4}}$ ✔

The expression in (H) matches the simplified item stem expression, so (H) is the correct choice.

49. **(D)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Logarithmic Expressions*. 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 item stem asks for the approximate value of $\log_5 \left(5^{\frac{13}{2}} \right)$:

$\log_5 \left(5^{\frac{13}{2}} \right) = x$, so $5^x = 5^{\frac{13}{2}}$. Therefore, $x = \frac{13}{2} = 6.5$, which is between 6 and 7, (D).

50. **(F)** *Mathematics/Statistics and Probability/Data Representation/Tables* and *Number and Quantity/Percentages* and *Rates and Proportions*. According to the table, the monthly rate for a Size 3 unit is \$100 per month. The rental amount for 12 months at the regular rate is \$1,200. The rental amount for 12 months at the special rate is \$1 plus $\frac{\$100}{\text{month}}$ (11 months), or \$1,101. The cost at the special rate is $\frac{\$1,101}{\$1,200} = 0.9175 = 91.75\%$ of the cost at the regular rate, so the discount is $100\% - 91.75\% = 8.25\%$, (F).

51. **(E)** *Mathematics/Statistics and Probability/Data Representation/Tables* and *Geometry/Rectangles and Squares*. According to the table, the Size 1 units are 2-meters-by-4-meters and the Size 5 units are 8-meters-by-16-meters. Divide both dimensions of the Size 5 unit by the dimensions of the Size 1 units. Multiply the results to find the total number of Size 1 units that can fit in one Size 5 unit: $\frac{16 \text{ meters}}{2 \text{ meters}} = 8$ units and $\frac{8 \text{ meters}}{4 \text{ meters}} = 2$ units, for a total of $8(2) = 16$ units, or $\frac{16 \text{ meters}}{4 \text{ meters}} = 4$ units and $\frac{8 \text{ meters}}{2 \text{ meters}} = 4$ units, for a total of 16 units. Therefore, regardless of the way the units are arranged, the maximum number is 16, (E).

52. **(H)** *Mathematics/Algebra and Functions/Solving Algebraic Equations and Inequalities with One Variable/Equations Involving Integer and Rational Exponents* and *Evaluating, Interpreting, and Creating Algebraic Functions* and *Evaluating Sequences* and *Statistics and Probability/Data Representation/Tables*. Rather than trying to determine the relationship from the data, plug a non-ambiguous value for x in the answer choices, say 5, and compare with the corresponding area as determined from the floor dimensions given in the table. Only the correct choice will have an expression equal to the area of a Size 5 floor, which is $8 \times 16 = 128$ square meters:

F. $2^3 \cdot x = 8(5) = 40$ ✗
G. $2^{3(5)} = 2^{15} = 32{,}678$ ✗
H. $2^{(2+x)} = 2^7 = 128$ ✓

Since (H) matches the area from the table, (H) must be correct.

53. **(B)** *Mathematics/Geometry/Trigonometry/Graphs of Trigonometric Functions*. The period of a trigonometric function is the x-interval over which the function repeats. In this case, the function repeats over an x-interval distance equal to π, (B):
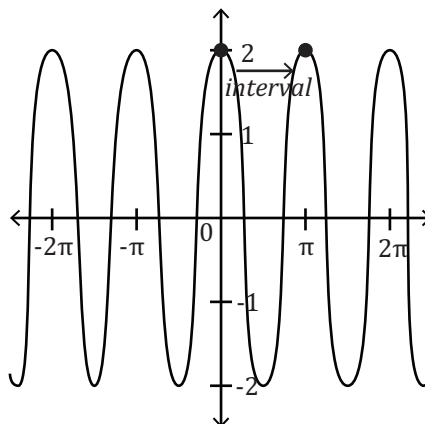
54. **(G)** *Mathematics/Number and Quantity/Matrices and Vectors.* The item stem gives an equation in terms of vectors **u**, **v**, and **w**. Solve the given equation for **w**: $2\mathbf{u} + (-3\mathbf{v}) + \mathbf{w} = 0 \Rightarrow \mathbf{w} = 3\mathbf{v} - 2\mathbf{u}$. To express **w** in component form, replace the vectors with the component forms: $\mathbf{w} = 3\mathbf{v} - 2\mathbf{u} = 3\langle 2, -7 \rangle - 2\langle 5, 3 \rangle = \langle 6, -21 \rangle - \langle 10, 6 \rangle \mathbf{w} = \langle 6 - 10, -21 - 6 \rangle = \langle -4, -27 \rangle$. Combine the corresponding components: $\mathbf{w} = \langle 6 - 10, -21 - 6 \rangle = \langle -4, -27 \rangle$, (G).

55. **(B)** *Mathematics/Algebra and Functions/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents.* To compare the exponents, the bases need to be equal. Rewrite 9 as 3^2: $3^{x+1} = 9^{x-2} = (3^2)^{x-2} = 3^{2x-4}$. Therefore, $x + 1 = 2x - 4 \Rightarrow x = 5$. Therefore, the equation is true for one integer, (B).

56. **(H)** *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Functions as Models* and *Solving Algebraic Equations and Inequalities with One Variable/Simple Equations.* At first glance, this item looks like a complicated geometry/trigonometry problem, but it's really an algebraic function problem. The item stem gives the formula for the area of the triangle: $\frac{1}{2}ab\sin x = \frac{1}{2}(AC)(BC)\sin x = \frac{1}{2}(20)(BC)\sin\theta$.

The area applies to both the original area ($BC = 15$) and the final area $(BC = 15 - 2t)$.

Set the new area equal to half the original area and solve for t: $\frac{1}{2}(20)(15 - 2t)\sin\theta =$

$\frac{1}{2}\left(\frac{1}{2}(20)(15)\sin\theta\right) \Rightarrow 15 - 2t = \frac{1}{2}(15) \Rightarrow 2t = 15 - \frac{15}{2} = \frac{15}{2} \Rightarrow t = \frac{15}{4}$, (H).

57. **(E)** *Mathematics/Statistics and Probability/Counting Methods.* If the six letters in PEOPLE were distinct independent events, the total number of permutations would be the product of the number of possibilities each time a letter is chosen: $(6)(5)(4)(3)(2)(1) = 6!$. Since the letter P is repeated twice, the number of possibilities is divided by 2! And the letter E is repeated twice, so again divide the number of possibilities by 2!: $\frac{6!}{(2!)(2!)}$, (E).

58. **(K)** *Mathematics/Number and Quantity/Complex Numbers* and *Algebra and Functions/Solving Quadratic Equations and Relations* and *Manipulating Algebraic Expressions/Factoring.* A glance at the answer choices indicates that the given quadratic needs to be factored into two binomials. Since $7^2 = 49$ and $9^2 = 81$, $49x^2 + 81 = (7x)^2 + 9^2$. The sum of two squares can be factored into the product of the complex conjugate pairs: $(a + bi)(a - bi) = a^2 - b^2 i^2 = a^2 + b^2$. Therefore, $(7x)^2 + 9^2 = (7x + 9i)(7x - 9i)$, (K).

You can also solve this item by testing the answer choices. Only (K) equals the original expression: $(7x - 9i)(7x + 9i) = 49x^2 - 56i + 56i - 81i^2 = 49x^2 - 81(\sqrt{-1})^2 = 49x^2 + 81$.

59. **(B)** *Mathematics/Algebra and Functions/Evaluating, Interpreting, and Creating Algebraic Functions/Concepts of Domain and Range* and *Coordinate Geometry/The Coordinate System.* This problem is intimidating because of the language and notation. However, with a little coordinate geometry knowledge, everything you need to answer the item is given in the stem and graph. According to the stem, a residual is defined as $y_i - y(x_i)$, where y_i is the observed *y*-value for input x_i. The stem also states that point $(x_i, y(x_i))$ is on the line of best fit. So, the residual is the difference between the observed *y*-value and the *y*-value (for the same *x*-value) on the line of best fit. Therefore, the largest residual will correspond to the data point furthest from the line of best fit.

In the graph, the data point $(32, 135)$ is clearly farther from the line of best fit than the others, so it has the greatest residual: the x-value is 32, and the observed y-value is 135. To find the corresponding y-value on the line of best fit, substitute 32 for x in the equation for the line of best fit: $y = 1.1(32) + 93 = 128.2$. The absolute value of the difference between the observed and line of best fit y-values is $|135 - 128.2| = 6.8$, (B).

60. **(K)** *Mathematics/Statistics and Probability/Data Representation/Tables* and *Probability*. The item stem asks for the probability of making at least 1 error. The table gives the "first 5 possible values of x" only. The sum of all probabilities of making errors is 1; subtract the probability of making 0 errors to find the probability of making at least 1 error: $1 - 0.0823 = 0.9177$, (K).

Reading Test

1. (A) *Reading/Key Ideas and Details/Implied Idea.* The best answer to this question is (A). Shades Bowen is described as being in the "bullpen" with the other musicians while Everett Payne was "the one" invited to "sit in" (lines 14–15). "The one" indicates that Payne was the only person asked to play, so it can be inferred Shades Bowen did not accompany Payne, (A).

2. (G) *Reading/Craft and Structure/Main Idea.* This question asks about a specific line of the passage. Line 62 is a one-sentence paragraph: "A collective in-suck of breath throughout the club." An "in-suck" of air is a gasp—a physical reaction to Payne's music by the "collective" audience, (G). (F) is wrong because an intake of air doesn't signal any expectations from the audience. (H) is wrong because the audience's reaction corroborates the narrator's description of Payne's performance, not counteracts it, and (J) is wrong because a physical reaction does not show that the musician is well known.

3. (A) *Reading/Key Ideas and Details/Implied Idea.* The answer to this question can be found in the opening lines of the passage that describes the setting: It was near the end of the second set, the show "winding down." If the second set is nearing the end, and that means the show, overall is coming to a close, it can be inferred that the second set is the final set, (A).

4. (H) *Reading/Craft and Structure/Explicit Detail.* When the purists first heard Payne's music they "slouched deeper in their chairs in open disgust" (lines 36–37). Slouching refers to posture, so (H) is the best answer. (F), (G), and (J) are all reactions the audience had to Payne's music as he continued to play, but these were not their initial reactions.

5. (C) *Reading/Key Ideas and Details/Explicit Detail.* This question asks about a specific detail in the passage that can be found in paragraph 5 that describesHatti e's observation of Everett Payne before he began to play. In this paragraph it states that he moved slowly, and did not "acknowledge the audience" or announce the "tune he intended to play," so (A), (B), and (D) can be eliminated. Only (C) corroborates Hattie's observation: he "mounted the bandstand and conferred with the bassist and drummer."

6. (G) *Reading/Key Ideas and Details/Implied Idea.* The answer to this question can be found in the description of the purists' initial response to Payne's music in lines 35–37: they "looked askance at each other...and slouched deeper in their chairs in open disgust." The purists couldn't believe he was playing a "hokey-doke tune," and their physical reactions showed their disgust, so it can be inferred that they were snobbish and intolerant, (G). (F) and (H) indicate that the purists were open to Payne's music, so they can be eliminated, and (J) describes them as people who did not have knowledge of music; if that was the case, there would be no cause for the disgust they show because they would not know any better.

7. (B) *Reading/Key Ideas and Details/Implied Idea.* Lines 76–77 describe Bach and the blues as the "bedrock" on which Payne trained. "Bedrock," means "foundation," so (B) is the best answer. (A) is wrong because it implies that Payne rejected Bach and the blues; (C) is wrong because "music of the heavens" describes "new" music Payne kept his other ear tuned to; and (D) is wrong because Bach and the blues are not attributed to Tin Pan Alley tunes.

8. (F) *Reading/Key Ideas and Details/Explicit Detail.* This question asks about a specific detail of the passage: the way Payne first began to play the tune. The answer can be found in lines 40–41: he played it with great care, "although at a slower tempo than was called for," so (F) is the best answer. There is no evidence in the passage to support (G) or (H), and the passage explicitly states that Payne followed the original tune, so (J) is also wrong.

9. (A) *Reading/Prose Fiction/Explicit Detail.* In paragraph 11, Hattie speculates on how Payne showed his feelings as he played and decides it had to do with "the way he held his head, angled to the left like that, tilted toward both heaven and earth" (lines 65–67), (A).

10. (J) *Reading/Key Ideas and Details/Explicit Detail.* This question asks you to look for a specific description of Payne's performance as Hattie saw it. The description of Payne's performance from the narrator can be found in lines 78–80: "Again and again, he took them on a joyous, terrifying, roller coaster of a ride," (J). (F) and (G) can be eliminated because there is no evidence in the passage to support she saw it as formal or absentminded, and while there are comparisons to heaven, there is not a comparison made to a song in church, so (H) is also wrong.

11. (A) *Reading/Integration of Knowledge and Ideas/Main Idea.* This question asks you to identify tone to understand the overall aim of the passage. The author of the passage stands firm on the stance sprawl is harmful, and insists that something should be done to prevent further destruction. The last paragraph lists all of the things that should happen and that people should do, enticing the reader to want to take the same actions. The negative depiction of the sprawls and the rhetoric encouraging action makes this passage a persuasive piece, (A).

12. (J) *Reading/Integration of Knowledge and Ideas/Application.* The best answer to this question can be found in the final paragraph, that chronicles everything the author wants to happen to combat the destructiveness of the sprawl. One of the requests is an integrated system of planning decisions and regulations, (J). (F) is wrong because the author is clearly against sprawl, not for it and would not want laws in their favor. (G) is wrong because the destruction of downtowns is an effect the author attributes to the sprawl, and (H) is wrong because the author criticizes "affordable" housing, insisting that it is only affordable for certain people and does more harm than good.

13. (D) *Reading/Craft and Structure/Development.* The entire passage, with the exception of the last paragraph, highlights the many problems associated with the sprawl. The last passage takes a different approach: it explores what should be done to help or solve these problems, (D). (A), (B), and (C) can all be eliminated because the author does not ask any questions, incorporate statistics, or use emotional language.

14. (F) *Reading/Craft and Structure/Development.* The author blames many issues associated with the sprawl in the passage, including addressing the difference between development and progress (lines 17–18) and the need to drive (lines 69–74), so both (G) and (H) can be eliminated. The author also provides solutions in the last paragraph, so (J) is wrong. Only (F) isn't answered in the passage.

15. (B) *Reading/Key Ideas and Details/Explicit Detail.* In the passage, the author criticizes the superstore, saying it makes a downtown "become a ghost town," which means it drives out all business. It can be inferred that without people, there will not be renovations, (B). The author does believe the superstore will have more retail space than downtown (lines 42–44), make the downtown area into a ghost town (lines 46–47), and shift the center of gravity away from downtown (lines 45–46), so they can all be eliminated.

16. (H) *Reading/Craft and Structure/Development.* This paragraph details the costs associated with transportation to show that land-use regulations are to blame for these high costs: "… most current zoning laws make it impossible—even illegal—to create the sort of compact walkable environment that attracts us to older neighborhoods" (lines 67–72) and "[t]hese codes are a major reason why 82 percent of all trips…are taken by a car" (lines 73–74), so (H) is the correct answer. The statistics regarding travel do not support causes of environmental destruction, so (F) is wrong. The author explicitly states that these laws do not create a walkable environment, so (G) can be eliminated, and (J) is wrong because the statistic suggests that Americans spend too much on transportation, not healthcare.

17. (C) *Reading/Key Ideas and Details/Explicit Detail.* The answer to this question can be found in the beginning of the fifth paragraph: "One form of sprawl—retail development that transforms roads into strip malls—is frequently spurred on by discount retailers," (C). (A), (B), and

(D) are all wrong because the author cites these things as evidence of ways a sprawl hurts development.

18. **(G)** *Reading/Craft and Structure/Vocabulary.* This question is a Vocabulary item that asks you to understand the context of a word to determine its meaning. "Detached" in line 51 is used to describe a home, so it can be inferred that a detached home is one that is on its own and not attached to other buildings, so the best answer is (G), set apart.

19. **(D)** *Reading/Craft and Structure/Implied Idea.* The author uses this phrase to combat the belief that sprawl is "merely the natural product of marketplace forces at work" (lines 62–63). In the next sentence the author attributes government policies "that mandate or encourage sprawl," to show that those policies do have an effect on the market, (D). (A) is wrong because there is no mention of duplicate services; (B) is wrong because the author does not refer to taxes in this section; and (C) is wrong because "market forces at work" suggests that the playing field is, in fact, even.

20. **(J)** *Reading/Craft and Structure/Vocabulary.* In this section, the author blames zoning laws that prohibit mixed use for the lack of a walkable environment, which suggests that areas are, by law, only available for a single use or development, (J). (F) is wrong because the passage attributes both parking lots and large stores to the sprawl, which the zones that don't allow "mixed use" support. Although the allowance of mixed uses would help create a walkable environment that would attract people to historic communities, it does not say that it would preserve those communities, so (G) is wrong. (H) is wrong because there is no connection between "mixed uses" and the inability to drive.

21. **(A)** *Reading/Craft and Structure/Voice.* This question asks about the author's Voice: from what standpoint is the passage being told? The author begins with describing a nature walk that led her to a book on flowers that became her guide. The rest of the passage chronicles the author's growing fascination with flowers, so (A) is the best answer. (B) is wrong because the passage covers an overall interest, not just an event. While some of her relationships with people are included, they are not the focus of the passage, so (C) is incorrect. And (D) is wrong because no information is provided about the author's interest turning into a profitable career.

22. **(H)** *Reading/Key Ideas and Details/Implied Idea.* The author states that she asked the young man leading her nature walk about a flower, and with his response there was "a hint of a sniff" (line 7), making the author feel like an "ignoramus" (line 9). It can be inferred that the young man made the author feel stupid for asking her question, because he assumed it was common knowledge, so (H), condescension, is the best answer.

23. **(D)** *Reading/Key Ideas and Details/Explicit Detail.* This question asks specifically about the yellow flower the author finds during a hike; lines 30–51 detail this flower. The author tells her friends to go ahead without her and she uses her guide to try to figure out what the flower is, but never provides a definite answer, so (D) is the best answer. (A), (B), and (C) are all flowers discussed in the passage but are not attributed to the yellow flower in question.

24. **(F)** *Reading/Key Ideas and Details/Implied Idea.* The author describes the book as "stubborn"; a "less complete guide would have been easy to start with, but more frustrating in the end" (lines 54–60). It can be inferred that the author initially saw it as difficult, but became grateful for all that it taught, (F).

25. **(C)** *Reading/Craft and Structure/Vocabulary.* The phrase "get in" is used in the author's detailing of the guide and the impact it had. The book was "stubborn" but it was necessary to work through the difficulty to really understand the subject matter, so (C) is the best answer. (A) is wrong because this section discusses the book, not an actual place. (B) is wrong because there is no mention of group membership in this section, and (D) is wrong because this section doesn't describe friendly communication with others, only with the book.

Tip

Vocabulary items are a little tricky. The test writers will often throw in a word or two that is usually associated with the word in question to throw you off. Reread the sentences around the word so you understand the context of its use; this will help you be better able to determine the correct answer choice, rather than the one that just seems right because it's familiar.

26. (H) *Reading/Key Ideas and Details/Application*. The author's friend Julie is introduced in the last paragraph. Together, they "identified individual plants" and "began to know wholes" (lines 81–83). Julie had to be curious and interested in the same plants as the author for them to work and learn about them together, and (H) best captures this idea. (F) is wrong because Julie isn't described as having more experience; rather, she and the author learned together. (G) is wrong because no mention is made of Julie having a house close to the a bog—it was a community she and the author studied, and (J) is wrong because there is no information that suggests Peterson's was no longer the guide used.

27. (D) *Reading/Key Ideas and Details/Explicit Detail*. This question asks about a specific detail provided in the passage. After finding the book, the author states it was her "closest companion" for "several years" (lines 25–26), so (D) is the correct answer.

28. (J) *Reading/Craft and Structure/Implied Idea*. The passage in question deals with Peterson's as a guide. The author didn't want the landscape, or general version; she wanted the particulars, the details. (J) best makes this association to the individual parts. (F) is a contradiction of the section; (G) attributes landscapes as losing their appeal, but the word "landscapes" is used to refer to generalities; and (H) refers to painting, which is not mentioned in the passage.

29. (B) *Reading/Key Ideas and Details/Explicit Detail*. These lines follow a description of the Peterson's book and its impact on the author. The book was her closest companion so much so that the author "persisted in wrestling" with it; she used it so often it became stained, tattered, and annotated. (B) best makes the association of the book's transformation because of its heavy use.

30. (H) *Reading/Key Ideas and Details/Explicit Detail*. The *Solidago hispida* is mention in lines 67–80. The author, excited that she met a flower for a second time, called it by its Latin name. (H) best captures this detail. (F) is wrong because no mention is made of the author having a hard time identifying it the first time. (G) is wrong because no mention is made of the author hoping to find it. (J) is wrong because there is no mention of the author disliking the Latin name of the plant; in fact, she states that Latin names make sense.

31. (D) *Reading/Integration of Knowledge and Ideas/Implied Idea*. The passage states, in the second paragraph, that the information about the "magical world of snow crystals" has practical applications in "such diverse areas as agriculture and the production of electricity." The passage goes on to discuss some of those practical applications, so (D) is the correct answer. (A) is wrong because the passage makes no mention of the importance of scientists communicating with each other. (B) is wrong because there is no clear connection that snow crystal facets are an influence of snowpack in western states, and (C) is wrong because snow crystals are the focus of the passage, not the scanning electron microscope.

32. (G) *Reading/Key Ideas and Details/Explicit Detail*. The passage explains that the previously forecasted amounts of snowpack water were "inaccurate whenever the size and shape of the snow crystals varied much from the norm" (lines 63–65). The scanning electron microscopy results "[provide] precise detail about the crystals' shape" (lines 46–47), which can improve prediction and "save $38 million in irrigation and hydropower" (lines 71–73), (G).

33. (C) *Reading/Craft and Structure/Implied Idea*. The phrase in parenthesis that follows the use of "metamorphosed conditions" states that crystals often change once they are on the ground. "Metamorphosed" means "changed" so it can be inferred that the snow crystals changed once they were on the ground, (C). There is no information provided in the passage about "metamorphosed conditions" to support (A), (B), or (D).

34. **(G)** *Reading/Key Ideas and Details/Explicit Detail.* This question asks about a specific detail in the passage. The predicted amounts of snowpack water were not accurate because the change in size and shape made it difficult for hydrologists' to measure. The more they know about the crystals, "'the easier it will be to use the microwave satellite data for predictions'" (lines 66–67), predictions that are currently "90 percent accurate" (line 70). The detailed information about the size and shape, (G), allows these more accurate forecasts.

35. **(D)** *Reading/Key Ideas and Details/Explicit Detail.* The answer to this question can be found in lines 74–83). Rango predicts temperature increases will result in a reduction of stream flow, creating a "gap between water supply and demand" that will become more and more apparent, "greatly increasing water's economic value," (D). There is no mention of water pollution, so (A) can be eliminated. (B) claims less water will be wasted, which logically would result in more water; this is a contradiction of the passage. Rango makes no mention of sulfur and nitrogen being a cause for the ultimate decrease in water supply, so (C) is also wrong.

36. **(G)** *Reading/Key Ideas and Details/Explicit Detail.* The passage provides many details about snowflakes, one being their infinite variety. In the first paragraph, the author states that as crystals fall, they "encounter different atmospheric conditions." These varying conditions create different, or unique, snowflakes, (G). While the enormous number of snow crystals is mentioned, it is not a reason they have variety, so (F) is wrong. (H) is wrong because no attribution is given to the rate at which snowflakes fall to account for their uniqueness, and while the complexity of the atmosphere is attributed to snowflake uniqueness, the passage does not indicate that it slows their development.

37. **(D)** *Reading/Key Ideas and Details/Explicit Detail.* The distinction between snow crystals and snowflakes is in the third paragraph. Snow crystals are individual crystals that usually take the shape of a hexagon, while snowflakes are the product of two or more crystals. (D) best captures this difference. While the passage does indicate that snow crystals grow around a nucleus of dust, it is not a distinguishing factor between the snow crystal and the snowflake, so (A) can be eliminated. Snow crystals are individual or singular, not a combination, so (B) can also be eliminated, and (C) describes snow crystals but does not show how they are different from snowflakes, so it is also wrong.

38. **(G)** *Reading/Craft and Structure/Vocabulary.* In context, "designer snowflakes" refer to the snowflakes Libbrecht "creates" in his lab during experiments. The use of the word "create" shows that he is the producer or maker of these flakes, (G). The passage does state that snowflakes are unique, but that subject is not dealt with near the use of the term "designer," so (F) can be eliminated. There is no evidence in the passage to support snowflakes' role in the design of nature or to support the beauty of Libbrecht's snowflakes, so (H) and (J) are also wrong.

39. **(C)** *Reading/Craft and Structure/Vocabulary.* This question tests your ability to understand the context around a word to determine its meaning. In lines 58–61, the author says that crop irrigation, hydroelectric power, recreation and domestic water supplies, fisheries management, and flood control are all dependent on snowmelt water; it is important, or vital, to them, (C).

40. **(F)** *Reading/Key Ideas and Details/Explicit Detail.* The passage lists many ways research on snow crystals have helped scientists: they help gauge snowmelt (lines 84–85), produce, or design, "designer" or artificial snow (lines 31–32), and can be useful in predicting avalanches (line 85). The only answer choice not covered in the passage is (F). While research of snow crystals has helped scientists determine what kind of pollution is in areas (line 90), it has not helped extract pollutants.

Science Test

Passage I: The passage presents data from a water quality report: the number of *E. coli* colonies (Figure 1) and water flow rate (Figure 2) every 5 days over 60 days for two sites. Table 2 gives the biotic index (BI) for the two sites; Table 1 gives the correlations between BI and water quality ratings.

1. **(B)** *Science/Interpretation of Data/Comprehension.* The item stem asks for the day and site for which the *E. coli* level was over 400 colonies per 100 mL of water. According to Figure 1, which has units of colonies per 100 mL, there is only one data point greater than 400: 708 for Day 30 and Site 1, (B).

2. **(F)** *Science/Interpretation of Data/Comprehension.* The item stem asks for both the site with the higher average water flow and the site with the higher average *E. coli* levels. It's easy to see with a glance at Figure 1 that the total for the Site 1 bars is greater than the total for the Site 2 bars, so the average *E. coli* level was higher for Site 1. The same is true of Figure 2, so the average water flow was higher for Site 1. Therefore, (F) is the correct choice.

3. **(A)** *Science/Interpretation of Data/Analysis.* According to Table 1, as the water quality rating improves (from bottom to top in the second column), the BI value increases (from bottom to top in the first column), (A).

4. **(G)** *Science/Evaluation of Models/Analysis.* If more stone fly larvae are found at Site 1 than at Site 2, and the number of larvae increase as water quality improves, then the expectation is that Site 1 would have higher water quality than Site 2. According to Table 2, the average BIs for Sites 1 and 2 are 6.3 and 2.5, respectively. According to Table 1, these BI values correspond to Site 1 having excellent water quality and Site 2 having fair water quality. Therefore, data are consistent with the student's hypothesis that more fly larvae would be found at Site 1 than at Site 2 because the water quality at Site 1 is excellent and fair at Site 2, (G).

5. **(A)** *Science/Evaluation of Models/Analysis.* According to the item stem, one of the data presentations supports the claim that Site 1 has lower water quality than Site 2. Immediately eliminate (C) because Table 1 does not present data—it gives the scale relating water quality with BI value. The second paragraph of the passage says that *E. coli* levels above 100 colonies formed per 100 mL of water indicate reduced water quality. Since Figure 1 shows that Site 1 exceeds this level more than Site 2, the data in Figure 1, (A), support the claim that Site 1 has lower water quality than Site 2. Note that (B) is wrong because the passage does not state that the Figure 2 data—the water flow rates at the two sites—has anything to do with water quality. And (D) is wrong because Table 2 actually supports the opposite—that water quality at Site 1 is higher than at Site 2.

6. **(J)** *Science/Evaluation of Models/Application.* This item requires knowledge that fertilizers cause problems with water quality when they run off into rivers or get into groundwater aquifers. According to Table 1, if water quality decreases, the BI value decreases, (J).

Passage II: The passage presents data from trials that measured the volume of H_2 produced by three aluminum water-based paints (AWPs) of different pHs, in which aluminum flakes react with the water in the paint (Table 1). Figure 1 gives the results of testing one of the paints with four different corrosive inhibitors added.

7. **(B)** *Science/Interpretation of Data/Analysis.* According to Table 1, the volume of H_2 produced by the AWP 2 sample increases with increasing time, so eliminate (C) and (D). To choose between (A) and (B), look at the last two data points: (A) shows a small change and (B) shows a large change. Since Table 1 shows the volume almost doubles over the last two measurements, (B) is the correct graph.

8. **(G)** *Science/Interpretation of Data/Analysis.* This item requires extrapolating two days beyond the last data point for the AWP 1 sample. Look at how the data change between the data points: between Days 2 and 4, the volume increased by about 30 mL; between Days 4 and 6, the volume increased by about 50 mL; and between Days 6 and 8, the volume increased again by about 50 mL. The expectation is that two days later, the volume will increase by about 50 mL from the Day 8 reading of 133 mL. (G) is the best match: between 133 mL and 461 mL.

9. **(A)** *Science/Interpretation of Data/Comprehension.* According to Table 1, the volume of H_2 produced by the AWP 1 sample on Day 6 was 81 mL; on Day 8, it was 133 mL. Therefore, the amount of H_2 produced over those two days was $133 - 81 = 52$ mL, (A).

10. **(H)** *Science/Scientific Investigation/Comprehension.* According to the chemical equation given in the passage, the aluminum flakes (Al) react with the water (H_2O) to produce $Al(OH)_3$ and H_2, which is measured in the trials. Therefore, by measuring the volume of H_2 produced, the experimenters can monitor the rate at which the Al is converted to $Al(OH)_3$, (H).

11. **(D)** *Science/Scientific Investigation/Application.* This item tests basic understanding of the pH scale—information that is not given in the passage. According to the last sentence of the second paragraph in the passage, DMEA is an AWP ingredient that increases pH. An increase in pH of the AWP means it's becoming less acidic and more basic, so DMEA must be a base because it increases the pH, (D).

12. **(J)** *Science/Interpretation of Data/Comprehension.* According to Table 1, the volume of H_2 produced by Day 2 from the AWP 3 sample was 121 mL. In Figure 1, the AWP 3 sample containing EDTA corresponds to the data set second from the bottom in Figure 1: the volume of H_2 reached 120 mL by Day 10, (J).

Passage III: The passage describes two studies in which students measured forces using scales. Figure 1 illustrates a scale reading (which reads clockwise from the top). In Study 1, the scales were stacked, and three trials performed using three different weights. Figure 2 shows the results from Study 1. In Study 2, the scales were placed side-by-side with a board across the top of the scales (on pencils) and a weight placed at different places on the board. Figure 3 illustrates the setup for Study 2 and Figure 4 shows the results.

13. **(B)** *Science/Interpretation of Data/Comprehension.* If the force of the weight is distributed equally between the two scales in Study 2, the dial readings on the two scales will be the same. According to Figure 4, the dial readings are the same in Trial 6, (B). You can also solve this item by using your common sense—the force on the two scales can only be equal when the weight is equal distance from both scales, as in Trial 5.

14. (G) *Science/Interpretation of Data/Analysis.* Scale B in Trial 1 (Figure 2) gives the reading for the weight of Scale A, which is the same as the weight of Scale B. To determine the weight given by the dial reading, look to Trial 2. A 5.0-N weight was added to Scale A, causing Scale A's dial reading to read the same as Scale B in Trial 1. Therefore, the weight of each of the scales is 5.0 N, (G).

15. (C) *Science/Interpretation of Data/Application.* This item requires understanding that a compressed spring stores potential energy—the more the spring is compressed, the more potential energy stored in the spring. According to the item stem, as the weight on the spring increases, the compression of the spring increases, which means greater potential energy stored in the spring. According to Figure 2, the weight in Trial 3 was greater than the weight in Trial 2, so the potential energy stored in Scale A's spring was greater in Trial 3 than in Trial 2, (C).

16. (F) *Science/Scientific Investigation/Application.* The total weight on Scale B is the same, regardless of the position of Scale A, so the dial reading of Scale B should match that of Trial 1. This eliminates (G) and (J). The dial reading of Scale A is upside down, so it should read opposite to that of Scale B, as in (F).

17. (A) *Science/Scientific Investigation/Analysis.* The item stem asks for a plausible explanation for the placement of the pencils between the board and the scales in Study 2. Check each answer choice for relevance to the study. (A) is a plausible explanation because Study 2 includes measurements of distance from the weights to the points of contact on the scales at the pencils. Quickly check the remaining choices to ensure that (A) is the best explanation. (B) is not plausible because the board is intended to be motionless with respect to the scale platforms in the study. (C) is not plausible because the description of Study 2 states that the dial readings are zeroed after the board and pencils are added—the scale readings do not include these weights, so they don't factor into the study results. (D) is not plausible because the air pressure above and below the scale platforms would be the same regardless of whether the pencils are included or not. Therefore, (A) is definitely the best explanation.

18. (H) *Science/Interpretation of Data/Analysis.* This item asks for the relationship between the amount of force exerted on Scale B and the distance between the 10.0-N weight and the pencil on Scale B. According to Figure 4, as the distance increased, the dial reading, which correlates with the amount of force, decreased, (H). This makes logical sense—as the weight moves closer to Scale A, more of the force is on Scale A, leaving less force on Scale B.

19. (D) *Science/Scientific Investigation/Comprehension.* The description of Study 2 states that the scales are zeroed after the board and pencils are added to the platforms, before the weights are added. This is done so that the scale dial readings do not include the weights of the board and pencils, instead reflecting only the weights of the added masses.

Passage IV: The passage explores fuel octane numbers—which corresponds to how smoothly a fuel burns in a gasoline engine: the lower the octane number, the smoother the burn (less knocks). Table 1 describes six fuel mixtures and their octane numbers, as determined in Experiment 1. In Experiment 2, TEL was added to the first mixture in Table 1 to change its octane number. Figure 1 shows how the octane number changed with the volume of TEL added. Experiment 3 compares the EOR, which is the minimum octane number of a fuel required for a particular engine to operate without damage, with octane numbers for two fuels in an engine at 5 engine speeds, as detailed in Table 2.

20. (G) *Science/Interpretation of Data/Analysis.* The item stem asks for the relationship between the engine speed in Figure 3 and the minimum octane number, or EOR. According to Table 2, as the engine speed increases, the EOR decreases, (G).

21. **(B)** *Science/Scientific Investigation/Analysis.* The item stem asks for an interpolation using the data in Table 2. The value 2,200 rpm would fall between 2,000 and 2,500 in the first column of Table 2. The corresponding octane number for Fuel A would be between 96.6 and 95.0, which eliminates (A), (C), and (D). Therefore, by the process of elimination, (B) must be correct. Indeed, the corresponding octane number for Fuel B would be between 96.1 and 95.4, so 95.8 works.

22. **(H)** *Science/Interpretation of Data/Analysis.* According to Table 1, the octane number is always equal to the volume of isooctane in the mixture. Since the volume of the mixture is always 100 mL, the octane number is the same as the percentage of isooctane in the mixture, which is represented by the ratio of the volume of isooctane to the total volume of the mixture times 100: $\dfrac{\text{volume of isooctane}}{(\text{volume of heptane } + \text{ volume of isooctane})} \times 100$, (H).

23. **(C)** *Science/Scientific Investigation/Analysis.* The data in Figure 1 is for a sample containing 1,000 mL of isooctane only. According to Figure 1, the octane number increases from 100 (the value for no TEL, which corresponds to Table 1) to approximately 125—an increase of 25 mL—over the first 1.5 mL addition of TEL and then remains constant. If the ratio was changed to include 1,000 mL of heptane and 9,000 mL of isooctane, the octane number with no TEL that would correspond to this, according to Table 1, is 90. Therefore, the octane number after the addition of 3 mL of TEL would be approximately $90 + 25 = 115$. This falls between 90 and 125, (C).

24. **(G)** *Science/Evaluation of Models/Analysis.* For a fuel to burn in an engine without causing damage, its octane number must be higher than the EOR. According to Table 2, Fuel A's octane numbers are higher than the EOR for all five engine speeds; Fuel B's octane numbers are higher than the EOR for only four of the engine speeds. Therefore, Fuel A is the better fuel because its octane numbers are higher than the EORs for every speed, (G).

25. **(D)** *Science/Scientific Investigation/Analysis.* The ratio of 2 mL of heptane to 8 mL of isooctane corresponds to a ratio of 20 mL of heptane to 80 mL of isooctane. According to Table 1, the octane number for 25 mL of heptane mixed with 75 mL of isooctane is 75; the octane number for 10 mL of heptane mixed with 90 mL of isooctane is 90. Therefore, the octane number for 2 mL of heptane mixed with 8 mL of isooctane will be between 75 and 90. The only answer choice within this range is 80, (D).

26. **(F)** *Science/Scientific Investigation/Application.* According to Table 1, 100% heptane has the lowest octane number. According to Figure 1, adding TEL increases the octane number by approximately 25 at the most. Adding 1 ml of TEL will make the octane number higher than for pure heptane, which is 0, and probably less than 25, but definitely lower than 115, (F).

Passage V: The passage introduction describes both long-period comets and short-period comets, and the two viewpoints discuss the origins of short-period comets. According to Scientist A, short-period comets originate in the Kuiper Belt (KB and evidence of the KB is indirect. Scientist B believes the KB does not exist and that short-period comets were once long-period comets that pass close enough to giant planets to have their orbits altered by the planets' gravitational fields.

27. **(C)** *Science/Evaluation of Models/Comprehension.* According to Scientist B, short-period comets originate as long-period comets that pass close enough to a giant planet that their orbit is altered by the planet's gravitational field. Therefore, the generalization most consistent with Scientist B's viewpoint is (C): long-period comets can become short-period comets.

28. **(H)** *Science/Evaluation of Models/Comprehension.* According to the second sentence of Scientist A's viewpoint, "the KB has a small inclination with respect to the ecliptic plane and is located in the solar system between 30 A.U. and 50 A.U. from the Sun," (H).

29. **(D)** *Science/Evaluation of Models/Comprehension.* According to the first sentence of the third paragraph in the introduction, the orbital plane of short-period comets "have inclinations 30° or less with respect to the ecliptic plane." Therefore, the only inclination that would most likely NOT be observed is 45°, (D).

30. **(J)** *Science/Evaluation of Models/Application.* Scientist B gives Jupiter as an example of a planet large enough to alter the orbit of a close-passing long-period comet. Since Jupiter is not one of the answer choices, the item tests your basic knowledge of the planets in our solar system. Of the answer choices, Saturn is the largest, so (J) is correct.

31. **(A)** *Science/Evaluation of Models/Analysis.* According to Scientist B, any short-period comet with an orbit less than 200 years is formerly a long-period comet that has passed too close to a giant planet and had its orbit altered by the planet's gravitational field. According to the first sentence of the second paragraph in the introduction, long-period comets originate in the Oort Cloud. Therefore, Scientist B would most likely classify Comet Hailey as a short-period comet that originated in the Oort Cloud, (A).

32. **(J)** *Science/Evaluation of Models/Comprehension.* In the viewpoint of Scientist A, the mention of the "much larger icy bodies" comes after a discussion of icy bodies with diameters between 10 km and 30 km. Therefore, it can be inferred that the larger icy bodies refers to those with dimeters greater than 30 km, (J).

33. **(D)** *Science/Conflicting Viewpoints/Analysis.* Whether or not another star has a spherical shell of material similar to the Oort Cloud has no impact on either scientist's viewpoint, (D), because they do not disagree on the existence of the Oort Cloud.

Passage VI: The introductory material describes what causes tomatoes to grow poorly in high-salt environments and describes four lines of tomato plants, three of which have copies of the *AtNHX1* gene incorporated into the genome. The experiment involves growing 50 of each of the four lines of tomato plants in nutrient solutions containing three different concentrations of salt. The three tables correspond to the three salt concentrations and the final averages for the height, plant mass (without fruit), and fruit mass of the four lines of tomato plants.

34. **(J)** *Science/Interpretation of Data/Comprehension.* The entries in the tables are averages for 50 seedlings of each type of plant. Only Table 3 has any entries for a fruit mass of 0, which corresponds to the L3 and L4 plants grown in 120 g of NaCl/10 L nutrient solution. L3 is not an option in the choices, so (J) is correct.

35. **(C)** *Science/Interpretation of Data/Application.* Osmosis is mentioned in the first bullet point in the passage introduction as one of two causes for poor growth in high-salt environments: "net movement of H_2O between the cytoplasm of the plants' cells and the environment via osmosis." Therefore, the water is passing from the inside of the cell (cytoplasm) to the outside of the cell (environment). Only the cell membrane, (C), describes the wall structure of a cell; the other choices describe structures inside a cell.

36. **(G)** *Science/Interpretation of Data/Analysis.* As the salt concentration increases across Tables 1 through 3, the plant mass for each line of tomato plants decreases, (G).

37. (**A**) *Science/Interpretation of Data/Comprehension.* According to the last paragraph in the passage introduction, the researchers controlled which lines received which type of *AtNHX1* allele, so there were four different genotypes for *AtNHX1*, (A). If this isn't immediately evident, eliminate the remaining choices. Eliminate (B) because only tomato plants were used in the experiment. Eliminate (C) because plant mass without fruit is a dependent variable—it's a measured variable as a function of salt concentration, which is an independent variable. Likewise, eliminate (D) because plant height is a dependent variable. Therefore, by the process of elimination, (A) must be correct.

38. (**J**) *Science/Interpretation of Data/Application.* According to the last paragraph in the passage introduction, two identical copies, or alleles, of the *AtNHX1* gene were incorporated into L1's genome. That the two copies were identical eliminates (F) and (H). To choose between (G) and (J), you must know the difference between heterozygous and homozygous. The prefix "hetero" means different or dissimilar, and "homo" means the same. Therefore, the genotype of L1 was homozygous because two identical alleles, or copies, of the *AtNHX1* gene were incorporated into its genome, (J).

39. (**D**) *Science/Interpretation of Data/Analysis.* According to Tables 1 through 3, as height increases, the plant mass increases. Therefore, a graph of height as a function of plant mass would have a positive slope, (D).

40. (**J**) *Science/Interpretation of Data/Analysis.* According to the last paragraph in the passage introduction, two identical copies of the *AtNHZ1* gene were incorporated into L1, and both L2 and L3 got different copies of the *AtNHZ1* gene. No copies of the gene were incorporated into L4, so L4 serves as the control, (J).