

# 2018: Form 1874

## English Test

### 1. Answer: A. E110 Relevancy: Adding, Deleting, and Replacing Information

The clue in this question is a single word: *complexity*. You need to look for a word that is a synonym for *complexity*. Alternately, you can eliminate words that don't mean complex. Even if you're not sure about the word *intricately*, you should be able to eliminate **B**, **C**, and **D**.

### 2. Answer: G. E115 Modification: Dangling Modifiers

Look carefully at **F**, **H**, and **J**. In each of these answer choices, it is the sculpture that is delighted. Inanimate object like sculptures cannot *literally* be delighted. While sculptures can be *figuratively* delighted, you won't see anthropomorphism on the English section of the test.

### 3. Answer: A. E111 Word Choice: Correct Word

This is a you-know-it-or-you-don't question. Since many of the answer choices have similar meanings, you need to know that the verb *to dub* means to give someone a nickname.

### 4. Answer: F. E102 Commas

You really need to know your comma rules for this question. First, *At Edinburgh's Filmhouse Cinema* is a prepositional phrase, so it gets a comma after it, which eliminates **H** and **J**. **G** is incorrect because there is a comma between the adjective *sculpted* and the noun it modifies, *scene*.

### 5. Answer: C. E101 Verbs: Agreement/Tense

There are two things tested here. **B** and **D** are incorrect because the apostrophes are wrong. Both *horse* and *theater* should be plural, not possessive. **A** is incorrect because *horses* does not agree with the verb *leaps*. Whenever you see a verb underlined, immediately look for the subject (the noun that does the verb's action).

### 6. Answer: F. E102 Commas

**F** can be eliminated because a single dash can only follow an independent clause. **H** is wrong because we can't remove the phrase between the commas without the sentence breaking down, and **J** puts a comma before the preposition *of*.

### 7. Answer: D. E113 Short and Simple

Each of these answer choices says essentially the same thing. In situations such as this, pick the shortest and simplest answer.

### 8. Answer: G. E114 Transition Words/Phrases

Look at each of these words in context. *Therefore* indicates cause and effect (not *affect*), so **F** is wrong, as is **H** since there is no evidence in the text that this is obvious. **J** is wrong because these sentences are not contradicting each other.

**9. Answer: C. E101 Verbs: Agreement/Tense**

This is a common trick on the ACT. When there is a verb underlined, look for the word *of* since it's often used to separate the correct subject from the verb. The subject here is *creator* not *sculptures*. So the correct subject verb agreement is *the creator is*.

**10. Answer: J. E113 Short and Simple**

We can eliminate F since *Whatever* doesn't serve any purpose and is too informal in this context. We are left with three answer choices that sound correct: **G**, **H**, and **J**. Just pick the shortest and simplest.

**11. Answer: C. E105 Pronouns: Agreement/Case**

Whenever you see a pronoun, always look for the noun that the pronoun replaces (it might be in the preceding sentence) and make sure they agree in number and gender. In the previous sentence, you can see the phrase *reveals her gender*, indicating the pronoun should be *she*.

**12. Answer: F. E113 Short and Simple**

Each of these answer choices says essentially the same thing. In situations such as this, pick the shortest and simplest answer. The wrong answers are redundant: *gratitude*, *gratefulness*, *thank you*, and *thanks*, all mean the same thing.

**13. Answer: B. E110 Relevancy: Adding, Deleting, and Replacing Information**

This question is asking about the sentence *Each gift . . . ideas*. **B** is correct because the previous sentence answers the *why*. *Why* did she make the sculptures? *Because* she wanted to express thanks for *libraries books, words, ideas*. The wrong answers are wrong because they are not completely relevant to the preceding sentence.

**14. Answer: J. E104 Non-Essential Information: Commas, Dashes, Parentheses**

Whenever you see a dash, always look for another dash somewhere else in the sentence, indicating that you're dealing with non-essential information. (For a single dash, the rules are different.) Since you have two dashes here, take out everything in between the dashes and use your ear. Look for the one that sounds like a mechanically correct sentence.

**15. Answer: B. E111 Word Choice: Correct Word**

Here you need to identify the correct conjunction. Only *and* properly joins *cutting up* and *refashioning*.

**16. Answer: G. E104 Non-Essential Information: Commas, Dashes, Parentheses**

Whenever you see an answer choice with commas around a word or group of words, see if you can take them out. **G** is correct because you can remove *as Pollock is likely to point out* and you are left with a grammatically correct sentence.

**17. Answer: C. E104 Non-Essential Information: Commas, Dashes, Parentheses**

Whenever you see an answer choice with commas, dashes, or parentheses around a word or group of words, see if you can take out what's in between. **C** is correct because you can remove *--165,231 in all--* and you are left with a grammatically correct sentence.

**18. Answer: F. E102 Commas**

This is a classic example of how you can use the Big Three Comma Rules: No commas 1. Between a subject and a verb. 2. Before or after prepositions. 3. Between adjectives and the nouns they modify, UNLESS the commas are setting off non-essential information. G and H are wrong because they put commas before the preposition *from*. The reason to eliminate J is a bit more complicated. The phrase *based in Portugal* is actually acting as an adjective describing *company*. This violates Comma Rule 3.

**19. Answer: C. E111 Word Choice: Correct Word**

A indicates that this was Pollack's last step, but the rest of the sentence indicates that he found a flaw. D is wrong because *also* would indicate he did something prior to this, which he didn't.

**20. Answer: G. E111 Word Choice: Correct Word; 106 Apostrophes: Possessive, Plural, Contractions**

For this question you need to know two concepts. First, you need to see and know the difference between *then* and *than*. *Then* is typically used to indicate time, while *than* is used for a comparison. You also need to know that 's is used to show possession for a singular noun. Since it's *a year's worth*, you know that it's a single year.

**21. Answer: D. E110 Relevancy: Adding, Deleting, and Replacing Information**

Because the question asks which answer *most effectively introduces the paragraph*, you need to read (quickly) the paragraph to see what it's about. The paragraph is about the how Pollock *devised a workable strategy: He used a foam template . . .*

**22. Answer: G. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue here is the phrase *most specific description of the . . . corks*. *Hexagon* is the most specific answer.

**23. Answer: C. E120 Parallel Structure**

*Binding* and *shaping* need to be parallel, that is they have to have the same form, because they are joined by the conjunction *and*.

**24. Answer: H. E110 Relevancy: Adding, Deleting, and Replacing Information**

You can identify this as a relevancy question when you see the phrase *which choice best indicates*. When you get a question like this, look for the clue word(s). Here the clue is *challenging*, and *rigorous* and *challenging* mean the same thing in this context.

**25. Answer: B. E101 Verbs: Agreement/Tense; E109 Relative Pronouns**

For answer choices A and C, the verb does not agree with the subject *he*. Both *he had saw* and *he seen* should sound wrong. D has a verb that could be correct, but the sentence indicates that he is looking at *himself*, not someone else. *He looked at him* would mean that there are two people

**26. Answer: F. E102 Commas; E103 Independent Clauses: Period, Semicolon, Comma and FANBOYS**

This is a classic example of how you can use the Big Three Comma Rules: No commas 1. Between a subject and a verb. 2. Before or after prepositions. 3. Between adjectives and the nouns they modify, UNLESS the commas are setting off non-essential information. The word *of* is a preposition, so you can eliminate **G**. It's also helpful to know that *But at a length of twenty-two feet* is an introductory phrase, which needs a comma, so that eliminates **J**. **H** is wrong because semicolons can only separate two independent clauses.

**27. Answer: C. E111 Word Choice: Correct Word**

**A** and **D** are both wrong because *with* and *as* cannot be used as prepositions after *suited* in this context. **B** is wrong because *most well suited to* is a superlative, which would indicate that more than one thing is being compared.

**28. Answer: F. E109 Relative Pronouns**

Both *whom* and *who* are incorrect because the noun is *company* and things are *whiches* and *thats*, not *whos* and *whoms*. (If you want to test *whom*, go for it. Remember that if *whom* is correct, *him* or *them* will also work. You would have *them had donated thousands of corks*. That should sound wrong to you.) *Which* always introduces non-essential information, which we don't have here.

**29. Answer: D. E113 Short and Simple**

Each of these answer choices says essentially the same thing, and all are grammatically correct. In situations such as this, pick the shortest and simplest answer. If you need proof that the wrong answers are redundant, you can see in the previous sentence that the launch was in *Portugal*.

**30. Answer: G. E117 Moving sentences.**

Think *puzzle pieces*. We don't know *who* was doing the pickups or *what* the pickups were. The previous sentence must clearly provide that information. *Pollack* was picking up the *corks*.

**31. Answer: C. E113 Short and Simple**

Each of these answer choices is grammatically correct. In situations such as this, pick the shortest and simplest answer. Keep in mind, you should pick the *shortest and simplest* answer that is *correct*. **D** is actually the shortest, but you are left with an incomplete comparison: *one as translucent white as* needs a noun to complete it.

**32. Answer: J. E102 Commas**

**F** is wrong because there is a comma before the *and*, but the *and* isn't separating two independent clauses, so there's no comma. There should be no comma between *sand* and *heated* because *heated* is an adjective describing *sand*. **J** corrects this error, which is why it's correct. **G** is wrong because the parentheses are not setting off a nonessential clause.

**33. Answer: C. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue in this sentence is *dramatic nature*. *Burns* is the most dramatic answer.

**34. Answer: G. E104 Non-Essential Information: Commas, Dashes, Parentheses**

Whenever you see an answer choice with commas around a word or group of words, see if you can take them out. Both choices **G** and **H** have pairs of commas, but only **G** sounds correct when the information between the commas is removed.

**35. Answer: A. E110 Relevancy: Adding, Deleting, and Replacing Information**

For questions such as this look for the clue in the sentences immediately before and after the sentence to be inserted. The sentence before says *experts are rarely able to locate a fully intact fulgurite* and the sentence after says *occasionally . . . an unbroken . . .* so the correct answer is **A**, *breaks easily*.

**36. Answer: J. E111 Word Choice: Correct Word**

This one looks like a short and simple, but not all of the answer choice are correct. Use your ear and you should hear that deleting the underlined portion is the only option.

**37. Answer: C. E110 Relevancy: Adding, Deleting, and Replacing Information**

This question is asking which answer connects to *both* the sentence before and the sentence after. The sentence before says *strong, sustained winds* and the sentence after indicates she is *hopeful*, so the answer that connects those two ideas is **C**.

**38. Answer: F. E113 Short and Simple**

Each of these answer choices is grammatically correct. In situations such as this, pick the shortest and simplest answer. Notice that each wrong answer, while mechanically correct, is wordier than necessary.

**39. Answer: D. E110 Relevancy: Adding, Deleting, and Replacing Information**

This question is asking which answer connects to *both* the partially underlined and the sentence after. This is tricky because the sentence after is on the next page. Don't be lazy. The next sentence--*Their interiors, though. . .*--indicates that there is a contrast. The contrast is between their *interiors* and their *exteriors*.

**40. Answer: H. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue in this question is *light, sporadic arrangement*, which can only be *speckled*. (By the way, notice how the ACT puts a comma between *light* and *sporadic*? That's because the order of the adjectives can be reversed.)

**41. Answer: B. E116 Modification: Moving Modifiers**

Since the underlined portion, *formed by air and moisture*, is acting as an adjective, the question is who or what was formed by air in moisture. The bubbles were.

**42. Answer: F. E120 Parallel Structure**

When you see a verb underlined, look for other verbs in the same sentences, or in the sentences immediately before or after and make sure all of the verbs are in the same form. Here, *to unearth* has to match with *to stop*.

**43. Answer: C. E110 Relevancy: Adding, Deleting, and Replacing Information**

For questions such as this, the clue is in the sentence itself: *Anna laughed*, which matches with *light moment. . . good-natured joke*.

**44. Answer: G. E105 Pronouns: Agreement/Case**

Whenever you see a pronoun underlined, immediately look for its antecedent (the noun it replaces). All pronouns must replace specific, identifiable nouns in the same sentence or the sentence immediately before the one with the pronoun. The pronoun and its antecedent must agree in number, gender, and/or case.

**45. Answer: A. E110 Relevancy: Adding, Deleting, and Replacing Information**

For questions such as this, the answer is in the question itself: *new information*. If you scan back through the passage, you'll see that only **A** provides you with *new* information.

**46. Answer: F. E105 Pronouns: Agreement/Case**

First, you can eliminate *it's* by remembering that it means *it is*, which doesn't work here. Next, since you are looking for a pronoun, you need to find the specific noun the pronoun is replacing, in this case *facility*.

**47. Answer: B. E101 Verbs: Agreement/Tense**

If you can see the long nonessential phrase here between the commas, *which . . . New Hampshire*, and take it out, it's easier to see that the subject is *weather conditions* so the verb must be *have earned*.

**48. Answer: G. E104 Nonessential Information: Commas, Dashes, Parentheses**

Nonessential phrases everywhere. What you have here is the very rare nonessential phrase inside another nonessential phrase. This is the grammar equivalent of  $f(g(x))$ . To figure out the commas, remember that when you remove a nonessential phrase, you must be left with a grammatically correct sentence that is punctuated correctly. Since there is already a comma after the final parenthesis, that's the only one you'll need. Inside the parentheses, *for example* is a nonessential phrase that needs to be set off with two commas of its own. (Not *it's* own, by the way.)

**49. Answer: D. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue here is *uses a comparison to emphasize that the weather . . . can be extreme*. Only answer choice **D** both uses a comparison and indicates that the weather is extreme.

**50. Answer: F. E103 Independent Clauses: Period, Semicolon, Comma and FANBOYS**

Though this doesn't look like it's testing independent clause punctuation, it is. Notice that the sentence reads *major storm tracks, and . . .* That's the comma plus and from FANBOYS, which means that you must have two independent clauses. Only **F** is an independent clause.

**51. Answer: B. E102 Commas**

This question is really a punctuation grab-bag. You can see that the comma is correct because it's setting off a nonessential (appositive) phrase. Or, you can know that the parentheses, dash, and semicolon are wrong.

**52. Answer: F. E113 Short and Simple**

Each of these answer choices says essentially the same thing. In situations such as this, pick the shortest and simplest answer. The test will never ask you to pick among choices **G**, **H**, or **J**, because they are essentially identical.

**53. Answer: D. E113 Short and Simple**

Each of these answer choices says essentially the same thing. In situations such as this, pick the shortest and simplest answer. (Also, for the sake of parallelism, the preposition *of* has to work with each noun, which it does.

**54. Answer: H. E111 Word Choice: Correct Word**

This one can be tough to see. What you're looking for is the answer choice that will give you a correct independent clause. Only choice **H** give you an independent clause.

**55. Answer: D. E114 Transition Words/Phrases**

You could easily call this a Short and Simple as well. As long as you know what these transition words mean, you'll be able to see that none of them works. Also note, *however* and *though* are interchangeable on the ACT

**56. Answer: H. E111 Word Choice: Correct Word**

The question you need to answer is *who or what is doing the gripping?* It is the *vehicle that grips*.

**57. Answer: A. E103 Independent Clauses: Period, Semicolon, Comma and FANBOYS**

When you have two independent clauses, you only have three options: period, semicolon, or comma with FANBOYS. **A** is the only option.

**58. Answer: G. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue for this question is *contrasts most directly with the other ways to get involved*. The other ways to get involved are the *educational trips*. What's the opposite of venturing up to a windy summit? *A warm recliner*.

**59. Answer: C. E117 Moving Sentences**

When you're asked to move a sentence, remember to think of puzzle pieces. There is a clue in this sentence: *This information. . .* must connect to the sentence before. The *information* in question is the *data* that is sent to the National Weather Service.

**60. Answer: J. E119 Writer's Goal**

Remember that for big picture questions, including *main point* and *main purpose* questions in the reading section, the wrong answers are typically wrong because the scope is wrong. That is, the wrong answers are typically too broad or too specific. If the main purpose had been to *describe how mountain ranges affect weather patterns*, this passage would fall short. This passage does not discuss mountain ranges generally but one specific observatory on one specific mountain.

**61. Answer: C. E106 Apostrophes: Possessive, Plural, Contractions**

If you know that *that's* means *that is* and *its'* isn't a word in English, and that *its* is possessive (*it's* = *it is*), then you'll be able to see that **C** is the only correct answer.

**62. Answer: G. E102 Commas**

A comma after *named* would make *Elijah McCoy* a nonessential clause, which it is not.

**63. Answer: D. E113 Short and Simple**

Each of these answer choices says essentially the same thing. In situations such as this, pick the shortest and simplest answer. If you read each of the wrong answers, you'll see that each one repeats information already given.

**64. Answer: J. E115 Modification: Dangling Modifiers**

Remember to look for -ing words at the beginning or close to the beginning of a sentence. We have one here: *While working*. . . The question this asks, that must be answered by the noun after the comma, is *who or what is doing the working?* The answer is *McCoy*.

**65. Answer: B. E110 Relevancy: Adding, Deleting, and Replacing Information**

First, read around the place where the sentence would be inserted, and assess if the information in this sentence is absolutely relevant. It appears to be relevant, so then look at the reasons given for choice **A** and **B**. Choice **A** reads that it should be added because it *describes the procedures* McCoy followed. *Procedure* means step-by-step and *responsible for oiling* does not indicate what steps were taken.

**66. Answer: F. E111 Word Choice: Correct Word**

You have several words in these answer choices that indicate an amount: *lessening the frequency*, *subtracting the amount*, and *lowering the amount*. The answer comes down to whether the noun in question is countable or not. *Stops* is countable, so *amount* can't work since it only refers to nouns that are measurable but not countable. **G** should sound wrong.

**67. Answer: B. E120 Parallel Structure**

*Reducing* must be parallel with *making*.

**68. Answer: F. E114 Transition Words/Phrases**

*For example* must be correct because this sentence does, in fact, include an example of something in the preceding sentence. *Factories . . . relied on steam engines* is an example of how McCoy applied his innovation to *other engineering challenges*.

**69. Answer: D. E111 Word Choice: Correct Word**

You need to use your ear here. Only **D** should sound correct, and only **D** gives you a complete sentence.

**70. Answer: F. E104 Nonessential Information: Commas, Dashes, Parentheses**

First, you need to see that the commas are necessary since it is setting off nonessential information. This leaves you with **F** and **H**. You can use your ear, or you can see that **H**, if correct would indicate that McCoy *is* a recognition, rather than the correct answer in which *McCoy* is doing the recognizing.

**71. Answer: C. E110 Relevancy: Adding, Deleting, and Replacing Information**

The clue is in the question: *clearest and most precise information about how the operation . . . changed*. The *how* is important here. Choice states that the machines could be run *continuously*, that's *how*.

**72. Answer: H. E110 Relevancy: Adding, Deleting, and Replacing Information**

This question is asking if *and, as a result, profits* is absolutely relevant. If it is, *how* is it relevant. Since it is relevant, the answer is *no*, don't delete it. It shouldn't be deleted because *profits* is a *positive effect*.

**73. Answer: D. E113 Short and Simple**

This is another one where you need to use your ear. **B** and **C** are too long and should sound awkward. *Do it* is short, but it's too short. Another way to test **A** is to remember that *it* is a pronoun that must clearly replace a specific noun, and there's no noun that *it* clearly refers.

**74. Answer: F. E110 Relevancy: Adding, Deleting, and Replacing Information**

This is really a *Writer's Goal* question in disguise. Scan through the passage and look for the things that are mentioned multiple times. If it's the *main idea*, you'll see it mentioned more than once.

**75. Answer: D. E117 Moving Sentences**

The clue is *The imitators expected* indicates that the sentence before must make clear who the imitators are. *Other innovators inundated the market . . .* Those *other innovators* are the *imitators*.

# Mathematics Test

## 1. Answer: C. M109 Rate & Proportion

$$\frac{6 \text{ servings}}{3 \text{ eggs}} = \frac{x \text{ servings}}{5 \text{ eggs}}$$

$$\frac{6 \times 5}{3} = 10$$

C. 10

## 2. Answer: K. M503 Probability

35 - 3 officers = 32 to pick from

K.  $\frac{1}{32}$

## 3. Answer: B. M205 Exponents & Roots

$$2^{2x+7} = 2^{15}$$

$$2x + 7 = 15$$

$$2x = 8$$

$$\frac{2x}{2} = \frac{8}{2}$$

$$x = 4$$

B. 4

## 4. Answer: J. M214 Functions $f(x)$

$$f(x) = 5x^2 - 7(4x + 3)$$

$$f(3) = 5(3)^2 - 7(4 \times 3 + 3)$$

$$5 \times 9 - 7(12 + 3)$$

$$45 - 7(15)$$

$$45 - 105$$

$$f(3) = -60$$

J. - 60

## 5. Answer: D. M503 Probability

5 \$5, 7 \$10, 8 \$10

$$\text{Total} = 5 + 7 + 8 = 20$$

$$\frac{8}{20} \text{ reduces to } \frac{2}{5}$$

D.  $\frac{2}{5}$

**6. Answer: H. M211 System Word Problems**

ABC \$40 + \$2/book

Easy \$35 + \$3/book

$$40 + 2x = 35 + 3x$$

-2x                      -2x

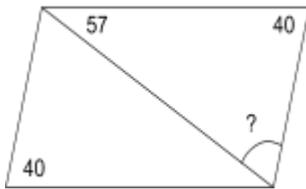
$$40 = 35 + x$$

-35                      -35

$$5 = x$$

H. 5

**7. Answer: D. M303 Quadrilateral**



$$57 + 40 + x = 180$$

$$97 + x = 180$$

-97                      -97

$$x = 83$$

D. 83

**8. Answer: G. M202 Solving Equations**

$$x = \frac{1}{2}$$

$$8\left(\frac{1}{2}\right) - 3$$

$$\frac{4-3}{\frac{1}{2}}$$

$$\frac{1}{\frac{1}{2}}$$

$$\frac{1}{\frac{1}{2}} = 1 \cdot 2 = 2$$

G. 2

**9. Answer: D. M208 Coordinate Geometry & XY-Plane**

(3, 8) (1, -4)

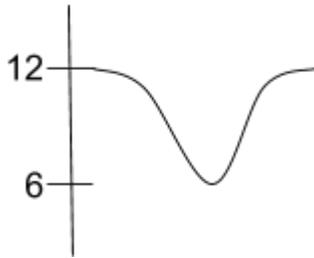
$$\text{Midpoint} = \left(\frac{3+1}{2}, \frac{8+(-4)}{2}\right)$$

$$= \left(\frac{4}{2}, \frac{4}{2}\right)$$

$$= (2, 2)$$

D. (2, 2)

**10. Answer: G. M208 Coordinate Geometry & XY-Plane**



Max = 12, Min = 12  
 Difference = 12 - 6  
 = 6

**G. 6**

**11. Answer: D. M212 Linear Function: Rate**

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 5}{2 - (-2)} = \frac{-6}{4} = \frac{-3}{2}$$

**D.  $\frac{-3}{2}$**

**12. Answer: H. M207 Linear Functions:  $y = mx + b$**

$$\frac{221}{17} = 13$$

$$30 + 13 = 43$$

**H. 43**

**13. Answer: B. M210 Systems of Equations**

$$8x = 12$$

$$\frac{8x}{8} = \frac{12}{8}$$

$$x = \frac{3}{2}$$
  

$$2y + 10 = 22$$

$$\phantom{2y} -10 \quad -10$$

$$2y = 12$$

$$\frac{2y}{2} = \frac{12}{2}$$

$$y = 6$$
  

$$\frac{3}{2} + 6 = 7\frac{1}{2}$$

**B.  $7\frac{1}{2}$**

**14. Answer: H. M501 Mean, Average; M502 Median, Mode**

$$\text{Average} = \frac{420}{5} = 84$$

$$420 - 84 = 336$$

**H. 336**

**15. Answer: D. M204 Absolute Value**

$$\begin{aligned} & ||-8 + 4| - |3 - 9|| \\ & ||-4| - |-6|| \\ & |4 - 6| \\ & |-2| \end{aligned}$$

**D. 2**

**16. Answer: K. M205 Exponents & Roots**

$$x^{\frac{2}{3}}$$

When there is a 3 in the denominator of a fractional exponent put 8 in for x. Plug in your own number, then put 8 in for answers.

$$8^{\frac{2}{3}} = 4 \text{ because } \sqrt[3]{8^2} = 4$$

**K.  $\sqrt[3]{x^2}$**

**17. Answer: B. M212 Linear Function: Rate**

$$\begin{aligned} 4x &= 7y + 5 \\ y &= \frac{4}{7}x + \frac{5}{7} \end{aligned}$$

**B.  $\frac{4}{7}$**

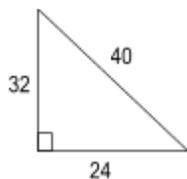
**18. Answer: K. M103 Properties of Integers**

Use 2 and 3 for m & n to eliminate wrong answers.

- F. m = 3, n = 3, 3 + 3 = 6 wrong
- G. m = 3, n = 3, 3 + 3 = 6 wrong
- H. m = 3, n = 3, 3 + 3 = 6 wrong
- J. m = 2, n = 2, 2 + 2 = 4 wrong
- K. m = 3, n = 2, 3 + 2 = RIGHT!

**K. m is an odd integer and n is an even integer**

**19. Answer: B. M302 Triangles**



This is a 3-4-5 triangle! The midpoint of 40 is 20.

**B. 20**

**20. Answer: K. M302 Triangles**

Only given two sides and no angles, the third side cannot be determined.

**K.** Cannot be determined from the given information

**Tip:** "Cannot be determined" is only a correct answer on easy problems. It is NEVER correct after question 30.

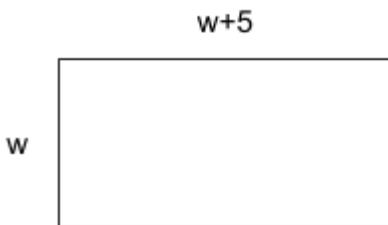
**21. Answer: B. M303 Quadrilaterals**

$$2 \cdot 8 \cdot 10 + 2 \cdot 8 \cdot 15 =$$

$$160 + 240 = 400$$

$$400 - 60 = 340$$

**B.** 340

**22. Answer: F. M303 Quadrilaterals**

$$p = 40$$

$$w + w + (w + 5) + (w + 5) = 40$$

$$4w + 10 = 40$$

$$4w = 30$$

$$w = 7.5$$

**A.** 7.5

**23. Answer: C. M110 Percent; M104 Fractions**

8% of 60 is  $\frac{1}{5}$  of what number?

$$(.08)(60) = \frac{1}{5}(x)$$

$$4.8 = \frac{x}{5}$$

$$(4.5)(5) = \frac{x}{5}(5)$$

$$24 = x$$

**C.** 24

**24. Answer: J. M212 Linear Function: Rate**

How many games must he attend?

$$\frac{\$175}{\$14} = 12.5$$

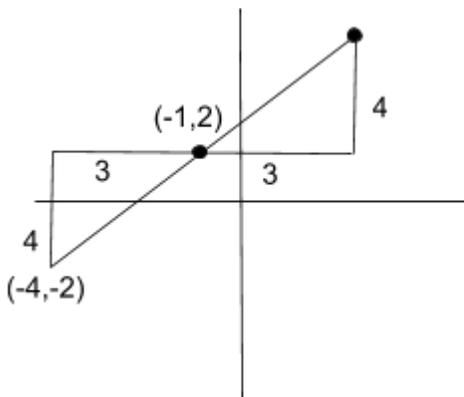
J. 13

**25. Answer: A. M205 Exponents & Roots**

$$\frac{4.8 \times 10^{-7}}{1.6 \times 10^{-11}} = 3 \times 10^{-7 - (-11)} = 10^4$$

A.  $3 \times 10^4$

**26. Answer: H. M208 Coordinate Geometry & XY-Plane; M305 Circles**



To solve: Make a triangle. Find the distance from center x to the x on the circle. Do the same for y and then work backwards.

H.  $(-4, -2)$

**27. Answer: A. M218 Polynomials**

$$x^3 - 64$$

The difference of the cubes  $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

The sum of the cubes  $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

$$x^3 - 64 = (x - 4)(x^2 - 4x + 16)$$

A.  $x - 4$

**28. Answer: H. M501 Mean, Average**

First list:

$$\frac{a+b+c+80}{4} = 90$$

$$a + b + c + 80 = 360$$

$$a + b + c = 280$$

$$\frac{280+90}{4} = 94$$

**H. 94**

**29. Answer: E. M105 Number Line; M205 Exponents & Roots**

$$a = -2.5$$

$$a^2 = (-2.5)(-2.5)$$

$$a^2 = 6.25$$

**E. 6.25**

**30. Answer: J. M104 Fractions**

$$\text{Whole} - \frac{2}{9} = \frac{7}{9}$$

$$\frac{7}{9} \div 3 = \frac{7}{9} \cdot \frac{1}{3} = \frac{7}{27}$$

**J.  $\frac{7}{27}$**

**31. Answer: E. M103 Properties of Integers**

$$1001 = 7 \cdot 11 \cdot 13$$

$$\frac{30030}{1001} = 30$$

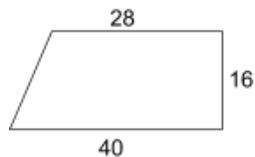
so what we have to do is factor 30

$$30 = 2 \times 3 \times 5$$

Therefore  $30030 = 2 \times 3 \times 5 \times 7 \times 11 \times 13$

**E.  $2 \cdot 3 \cdot 5 \cdot 7 \cdot 11 \cdot 13$**

**32. Answer: G. M303 Quadrilaterals**



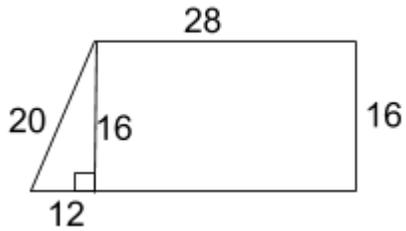
$$\text{Area} = \frac{28+40}{2} \cdot 16$$

$$\text{Area} = 544$$

**G. 544**

**33. Answer: E. M303 Quadrilaterals**

1 in = 1.5 ft



$$\text{Perimeter} = 20 + 28 + 16 + 40 = 104 \text{ inches}$$

$$104 \times 1.5 = 156 \text{ ft}$$

**E.** 156 ft

**34. Answer: H. M110 Percent**

North = 28 in    South = 40 in

$$\frac{40}{28} \times 100\% = 142.857$$

**H.**  $142\frac{6}{7}\%$

**35. Answer: C. M308 Multiple Figures**

BIG rectangle - small rectangle

$$36 \times 30 - 30 \times 24 = 360$$

**C.** 360

**36. Answer: J. M212 Linear Function: Rate**

3 rooms, 3 fans

3 small windows, 1 large window

$$3(52) + 3(39.50) + 2(39.50) = 353.50$$

**J.** 354

**37. Answer: A. M503 Probability**

$$(.2)(.2) = .04$$

Probability Decision Square:

	Rain	Not Rain
Rain	$(.2)(.2) = .04$	$(.2)(.8) = .16$
Not Rain	$(.8)(.2) = .16$	$(.8)(.8) = .64$

Sum of all the possible outcomes = 100%

A. 0.04

**38. Answer: K. M205 Exponents & Roots**

Evaluate each answer choice

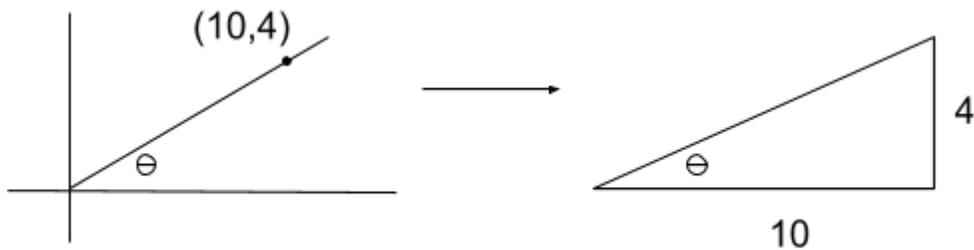
A.  $\frac{\sqrt{2}}{\sqrt{8}} = \frac{\sqrt{2}}{\sqrt{2 \cdot \sqrt{4}}} = \frac{1}{2}$  rational

B.  $\frac{\sqrt{8}}{\sqrt{2}} = \frac{\sqrt{2 \cdot \sqrt{4}}}{\sqrt{2}} = 2$  rational

C.  $(\sqrt{8})^2 = \sqrt{8} \cdot \sqrt{8} = 8$  rational

D.  $\sqrt{2} \cdot \sqrt{8} = \sqrt{2} \cdot \sqrt{2} \cdot \sqrt{4} = 4$  rational

E.  $\sqrt{2} + \sqrt{8} = \sqrt{2} + 2\sqrt{2} = 3\sqrt{2}$  irrational

**39. Answer: D. M400 Trigonometry**

$$\tan = \frac{\text{opp}}{\text{adj}} = \frac{4}{10} = \frac{2}{5}$$

D.  $\frac{2}{5}$

**40. Answer: K. M204 Absolute Value**

$$|2x - 8| + 3 = 5$$

$$|2x - 8| = 2$$

$$2x - 8 = 2 \quad \text{and} \quad 2x - 8 = -2$$

**K.**  $2x - 8 = 2$  and  $-(2x - 8) = 2$

**Tip:** To solve for absolute value, find both the positive and negative values.

**41. Answer: A. M506 Tables**

The keyword here is *cumulative*

65-80 has 13 total students

65-70 has 12 total students

$$13 - 12 = 1$$

**A.** 1

**42. Answer: G. M206 Logarithm**

$$d = 10 \log\left(\frac{1}{k}\right)$$

$$d = 10 \log(1000); \quad \log(1000) = 3$$

$$d = 10 \cdot 3 = 30$$

**G.** 30

**43. Answer: C. M110 Percent; M506 Tables**

$$(1 \text{ pt})(80)(.75) + (2 \text{ pt})(60)(.90) + (3 \text{ pt})(60)(.25)$$

$$60 + 108 + 45 = 213$$

**C.** 213

**44. Answer: F. M214 Functions  $f(x)$ ; M204 Absolute Value**

$$y = |x| \text{ transforms} \rightarrow y = |x - 6|$$

**F.** Translation right 6 units

**45. Answer: A. M300 Geometry**

Volume =  $l \cdot w \cdot h$

To find the volume of an irregularly-shaped object, submerge it and multiply length x width x change in height.

$8 \times 6 \times (6.6 - 4) = 124.8$

**A. 125**

**46. Answer: J. M307 Solids**

Volume of cube =  $18^3$

Volume of cylinder =  $\pi(6)^2(12)$

**J.  $18^3 - \pi(6)^2(12)$**

**47. Answer: B. M303 Quadrilateral**

Area =  $15 \text{ ft} \times 21 \text{ ft}$

Convert to yards by dividing by 3

$\frac{15}{3} \times \frac{21}{3} = 5 \times 7 = 35$

**B. 35**

**48. Answer: G. M505 Charts & Graphs**

To solve, find 5 miles on x-axis and value from y-axis

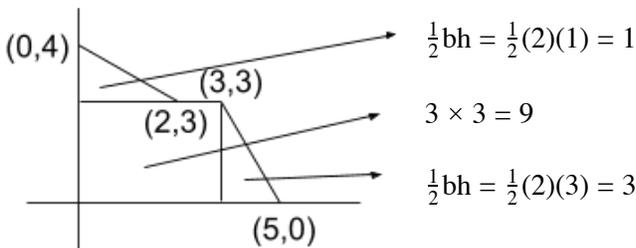
ABC 5 mi = \$12

Tary 5 mi = \$9

**G. \$9**

**49. Answer: B. M208 Coordinate Geometry & XY Plane; M308 Multiple Figures**

To solve, break into triangles and a quadrilateral



**B. 13**

**50. Answer: J. M210 Systems of Equations; M2166 Quadratics & Parabolas**

$$x + y = 151$$

$$x = 19 + \sqrt{y}$$

Substitute

$$19 + \sqrt{y} + y = 151$$

Rearrange

$$y + \sqrt{y} - 132 = 0$$

Factor

$$(\sqrt{y} + 12)(\sqrt{y} - 11) = 0$$

$$\sqrt{y} = 11$$

$$y = 121$$

Solve for x

$$\begin{array}{r} x + 121 = 151 \\ -121 \quad -121 \end{array}$$

$$x = 30$$

$$121 - 30 = 91$$

This is a really hard problem!

J.91

**51. Answer: C. M501 Mean, Average; M502 Median, Mode**

Put numbers in order

15, x=15, y, 30, 35, 41

y must be less than 30 because the median is 25

$$\frac{y+30}{2} = 25$$

$$y + 30 = 50$$

$$y = 20$$

$$\frac{15+15+20+30+35+41}{6} = 20.167$$

A.20

**52. Answer: F. M210 Systems of Equations**

$$y = x^2$$

$$rx + sy = t$$

Substitute, put into quadratic form

$$s(x)^2 + rx - t = 0$$

Use the discriminant  $b^2 - 4ac$  to find two real solutions

$$r^2 - 4(s)(-t) = r^2 + 4st$$

If the discriminant is greater than zero, there are two real solutions.

**53. Answer: A. M106 Sequence**

$$\underline{\quad} \quad \underline{\quad} \quad \underline{13} \quad \underline{18}$$

The common difference is  $18 - 13 = 5$

$$13 - 5 = 8$$

$$8 - 5 = 3$$

3 is the first number in the sequence.

To find the  $n^{\text{th}}$  term, use the formula:

$$A_n = A_1 + (n - 1)d$$

$$A_{50} = 3 + (50 - 1)(5)$$

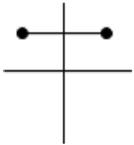
$$= 3 + 245$$

$$= 248$$

**A. 248**

**54. Answer: H. M403 Trig Functions**

$$\sin^2 + \cos^2 = 1$$



**H.**

**55. Answer: E. M403 Trig Functions**

Period of function  $f(x) = \csc(4x)$

Period of  $f(x) = A\sin B(x + h) + k$  is  $\frac{2\pi}{B}$

Have  $B = 4$

$$\frac{2\pi}{4} = \frac{\pi}{2}$$

**E.  $\frac{\pi}{2}$**

**56. Answer: H. M503 Probability**

Multiply probability of heads ( $\frac{1}{2}$ ) by 3 pt =  $\frac{3}{2}$

Add 3 coins' value

$$\frac{3}{2} + \frac{3}{2} + \frac{3}{2} = \frac{9}{2}$$

**H.**  $\frac{9}{2}$

**57. Answer: B. M220 Matrix; M216 Quadratics & Parabolas**

$$\begin{bmatrix} K & 4 \\ 3 & K \end{bmatrix}$$

Determinant is  $k^2 - 12$

$$k^2 - 12 = k$$

Rearrange into quadratic form  $ax^2 + bx + c = 4$

$$k^2 - k - 12 = 0$$

Factor

$$(k - 4)(k + 3) = 0$$

$k = -3$  and  $4$

**B.**  $4$

**58. Answer: F. M219 Complex Numbers**

$$i^n = 1$$

Remember:  $i = \sqrt{-1}$ ,  $i^2 = -1$ ,  $i^3 = -\sqrt{-1}$ ,  $i^4 = 1$

So  $n$  must be a multiple of  $4$

**F.** When  $n$  is divided by  $4$ , the remainder is  $0$ .

**59. Answer: A. M402 Unit Circle**

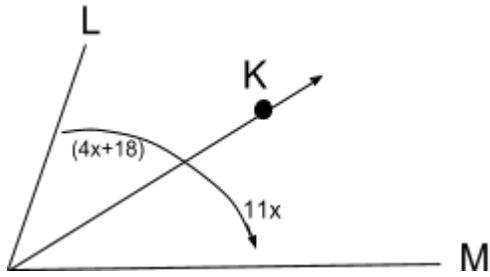
$$|\sin\theta| \geq 1$$

On the unit circle  $\sin\theta = 1$  when  $\theta = \frac{\pi}{2}$  ( $90^\circ$ )

$\sin\theta = -1$  when  $\theta = -\frac{\pi}{2}$  ( $270^\circ$ )

**A.**  $\left\{-\frac{\pi}{2}, \frac{\pi}{2}\right\}$

**60. Answer: K. M301 Lines & Angles**



$$4x + 18 = \frac{1}{2}(11x)$$

$$8x + 36 = 11x$$

$$36 = 3x$$

$$12 = x$$

$$KPM = (4 \times 12 + 8) = 48 + 8 = 66$$

**K. 66**

## Reading Test

### 1. Answer: A. R104 Big Picture

Although this question is phrased as one about the narrator, really it's asking about the main idea of the passage. Read the answer choices; **C** and **D** are clearly incorrect if you read the passage, so you only need to decide between two. **B** is incorrect because it focuses on the events preceding the trial, whereas **A** more accurately emphasizes the swim itself and the many factors (not strictly events) involved.

### 2. Answer: G. R303 Chronology

Remember, *chronologically* refers to the order of events in time, *not* in the narrative structure. In these questions, the answer will almost always be something that was recalled or reminisced about rather than a standard plot point. Although this text is in past tense, there are still distinct anecdotes within it. Which of these answers fits these guidelines? **G**, recalled in paragraphs 4-5.

### 3. Answer: A. R203 Inference/Assumption

This question is a bit more difficult. The reason **A** is correct is that it highlights the significance of the empty room: the narrator had detailed the *energetic* meet he had hoped for just before, so here he **contrasts** that with the reality. Because of this contrast, the reader feels that the narrator did not expect a good time; the conditions weren't right, and the conditions were just described as important to success. You can also approach this question by eliminating **C** and **D** early on, because they are self-disproving (both say there is an explanation here, but neither of the events are explained by the empty room).

### 4. Answer: J. R201 Detail

Go back to the text! Skim for the section of the passage in which he swims the 1,000-yard freestyle, and then read more closely for the detail. Line 37 holds the answer, and is easy to spot because it is the start of a new paragraph.

### 5. Answer: C. R201 Detail

Although multiple answer choices here resemble ideas in the text, note that the question asks specifically for something he understood *for the first time*. If this is not specifically indicated in the text, it cannot be the answer. You may recall from your first reading that **C** is the epiphany in question, but if not you will need to return to the text to confirm your choice.

### 6. Answer: G. R101 Line Number; R301 Main Idea/Function: Passage

Answers **H** and **J** are easily eliminated if you read closely, because you would not think this was not a practice and it had no competitors. Between the remaining answers, which one makes more sense for the passage? Given the importance the narrator placed upon Junior Nationals in the first few paragraphs, it is a natural conclusion that the *end* in question is referring to his last chance to qualify.

**7. Answer: D. R201 Detail**

If you read carefully the first time, you can likely answer this question quickly without having to go back to the text. If you do need to look again, try not to take too long; this one is clearly stated early in the text!

**8. Answer: H. R101 Line Number; R201 Detail**

Look back at the line in question, and you'll see the narrator indicates that this statement is his interpretation of the cheering boy's gesturing.

**9. Answer: C. R203 Inference/Assumption**

When describing the indoor pool, the narrator juxtaposes the *open sky* with the *dank and moldy indoor pool* to emphasize how much less pleasant it was. The other answer choices here are not related to the descriptions given of the indoor pool.

**10. Answer: F. R203 Inference/Assumption**

Although the text does not directly state where the exclamation comes from, the structure of the sentence strongly indicates it is from *that day* when the author jumped for the flags.

**11. Answer: D. R203 Inference/Assumption**

These descriptions share references to size, emphasizing the wide area covered by the forest. Although this may indirectly suggest **A** is the correct answer, it more immediately serves as proof for answer **D**.

**12. Answer: G. R203 Inference/Assumption**

**F** is incorrect because it falsely attributes all domestic apples to one locale. In reality, the Tian Shan mountains' apples resemble those in grocery stores because they are undomesticated ancestors of the domesticated apple crop.

**13. Answer: D. R201 Detail**

Don't try and answer this question without double-checking the text; these answers are confusingly similar for a reason. Skim to quickly locate the detail in question, then confirm the best answer.

**14. Answer: J. R201 Detail**

Unlike the last question, this detail you may remember without having to double check. The answer choices here are distinct, and the three incorrect choices are not tricks; they are just wrong.

**15. Answer: A. R202 Vocabulary in Context**

Don't answer too hastily, because each of these answers could suggest a viable use for the phrase. Instead check the text again and see what the context is. Only one of these questions has the correct context for the answer, but multiple use the term correctly. Because of this, without looking back it is difficult to be certain in your choice.

**16. Answer: G. R202 Vocabulary in Context**

More than one of the word pairs here provide actual synonyms for the words referenced, so you will again need to look at the context to determine which pair is correct. If you are unsure, think about each word of the pairs separately and consider whether it makes sense for apples: they probably were not being *encouraged*, but *cultivated* makes sense.

**17. Answer: B. R203 Inference/Assumption**

Consider why crop diversity is important in itself, and you may be able to answer this question without referencing the text. If you don't know why they're important intuitively, look at the context. Phrases like *breaking point* should point you towards the existence of a problem, and the wording of the question implies crop diversity is the answer; because these fit together, you can safely choose answer **B**.

**18. Answer: H. R104 Big Picture; R304 Both Passages**

Actually, you can find the correct answer using only the first passage. Only one of these answer choices correctly characterizes the first passage: *celebratory*. The word pairs here serve mostly to confuse you by diverting your focus to the words relationship to each other rather than the text.

**19. Answer: A. R304 Both Passages**

Look at the answer choices closely. For each one, determine whether it applies to each passage. Doing so systematically instead of intuitively almost entirely removes the possibility of error. If necessary, you can look back at the text before doing this, but try to avoid repeatedly flipping back and forth—this will eat up lots of your time.

**20. Answer: H. R201 Detail**

You will have to skim the text briefly to find the reference to this quote in passage B, which can be difficult because it is not actually quoted. You may notice, however, that because it is not quoted it is *paraphrased*. This is a strong indicator to the correct answer. Fortunately, this paraphrase comes up at the very beginning of the passage, so you likely will not need much time to skim.

**21. Answer: C. R201 Detail**

If you read the passage, this one should be a freebie. Much of the passage addresses this subject, most notably in paragraph 5.

**22. Answer: G. R203 Inference/Assumption**

This question asks you to assess why the portion in question was included; essentially, what purpose or function it serves. This asks you to evaluate the *rhetoric* of the essay. You can answer in a few ways, but don't be hasty. You can easily rule out answer **J** for its irrelevance, and from the remaining three choices you need to use logic and, if necessary, refer to the text. Although **G** is the most rhetorically simple, it is correct.

**23. Answer: D. R203 Inference/Assumption**

Consider the rhetoric behind each answer, and evaluate how well it fits with the piece. Does the author criticize jazz scholarship, or claim to be more knowledgeable than the scholars? No. But answer **D** is a natural fit for an essay introducing a little-known figure: explaining why and how they are so little-known.

**24. Answer: H. R201 Detail**

The answer is in the text. If you read carefully the first time, you will likely be able to quickly identify the correct choice. Otherwise, go back to the text and skim for the relevant information. A number of the answer choices are directly contradictory to the text, so you should be able to narrow down your options.

**25. Answer: D. R201 Detail**

This is another detail you can simply recall or look back at the text to determine. If you don't remember exactly which answer is correct, you can likely rule a few out, but be careful you don't mistakenly choose answers that *sound right* because they garble the text (like answer C, which uses phrases from another section of the passage).

**26. Answer: F. R202 Vocabulary in Context**

Just because you think you know the answer doesn't mean you're right! There are multiple valid definitions here, but only *one* that makes sense in context. *Go back to the text!* Looking at the context will take you a matter of seconds, and likely guarantee you choose correctly.

**27. Answer: C. R204 Main Idea/Function: Paragraph**

What does this comparison show? What is its purpose in the text? Look at the context: the similarity given is that both salesman and sidemen are relying on using *the best style they could manage* to market *someone else's wares*. Which answer choices are relevant? **A** and **B** are not. Between the remaining choices, which make sense for this text? Considering it is not about hard-working sidemen, we are pointed towards answer **C**, which fits well just following the explanation of Berry's supportive music style.

**28. Answer: J. R201 Detail; R202 Vocabulary in Context**

This question is mostly seeking to test your knowledge of the words used in these answer choices and the text itself. If you know your vocab, you should have no trouble looking back at the text and choosing the most similar answer choice. Be careful you don't mix up which song is being described!

**29. Answer: A. R201 Detail**

There is a good chance you remember this detail, as it was very prominent in the text. If not, try to skim for the keywords. There are hints in the question, too! The word *unique* should stand out, as well indicate that the correct answer should be something specific and singular. This helps easily rule out answers like option **D**, which are vaguely truthful but not correct.

**30. Answer: F. E203 Inference/Assumption**

What does the metaphor in question serve to illustrate? The answer must be something relevant to both sides of the comparison: the solo and the cathedral. Look at the answer choices: which make sense for *both*? If you need to, look back at the description of this solo.

**31. Answer: D. R301 Main Idea/Function: Passage**

Although multiple answer choices include information from the passage, only one adequately summarizes the *main idea*. What is the purpose of this essay? Why was it written? Answer this, and you can determine the correct answer.

**32. Answer: H. R101 Line Number**

For the most part, this question is just a matter of referring back to the text and reading the context to grasp the question. If you need to identify the *problem*, look at the solution given nearby: what does it solve?

**33. Answer: B. R203 Inference/Assumption; R101 Line Number**

Look back at the lines given to you, and make sure you understand the context. Immediately after the reference given, a new paragraph begins with an introduction of the Sagittarius Dwarf. While this could technically be a bizarre transition, it is *reasonably referred* that this is the same galaxy.

**34. Answer: J. R104 Big Picture**

You can answer this question without looking back if you read well the first time. If you don't remember which study is Bailin's, you will want to double check. His study was testing an existing theory, so you can rule out **F**. **G** and **H** are not supported by the text, but **J** is an accurate description of why Bailin's findings matter.

**35. Answer: C. R201 Detail**

Remember the analogy of the figure skaters? If so, you're good to answer this question right away. But don't let the similar answers confuse you! If you need to look back at the text, you should be able to do so quickly by searching for keywords.

**36. Answer: G. R201 Detail**

Don't let the trick answers fool you! The figure in answer **F** appears in the text, but describing something different. If you need to look back at the text, the answer is fortunately quite near the start.

**37. Answer: A. R103 Keyword**

Skim the text for the word *hurricane* if you don't remember where it is. The author calls upon the hurricane image to provide a more accurate analogy than the one used just before: that is, to say *the pizza is not accurate; really it's more of a hurricane*. This helps the reader to understand the flaws of the former description.

**38. Answer: G. R201 Detail**

Be careful! These are all examples from the text, but only one is describing the phenomenon in question. If you read what's being described, you likely won't even need to look back: which answer could be illustrating a warped disk?

**39. Answer: A. R201 Detail**

If you need to look back at the text, just do so quickly. But you may recall the *roughly polar* path described in the text if you read closely the first time.

**40. Answer: J. R201 Detail**

Even if you're a physics whiz and know the definition of angular momentum, you should probably look back at the text. The question wants the *passage's* description, not yours; either way, it is a fairly intuitive answer if you use the context well.

## Science Test

### **1. Answer: C. S310 Bar Chart: Data Point**

The question refers to Figure 1, which is the bar graph on the left, and asks for the mass of cheese remaining at 4 hours. At the 4 hr mark, the top of the white bar reaches just between the 180 and 190 mg lines, which makes the best answer 185 mg.

### **2. Answer: J. S312 Bar Chart: Infer**

The question asks which food would best attract the species in the experiment. According to the bar graph, there was the smallest amount of peanuts remaining. From this, we can infer that the cockroaches preferred the peanuts and that peanuts would make the best bait.

### **3. Answer: B. S312 Bar Chart: Infer; S304 Table: Increase/Decrease**

The question requires looking at the protein column on Table 1 and noticing that the amount of protein increases as we go down the table from cat food to peanuts. On Figure 1, at 28 hours, the amount remaining decreases as we go from cat food to peanuts. Thus, as protein increases, the amount remaining in the experiment decreases.

### **4. Answer: J. S310 Bar Chart: Data Point**

The question is asking whether the quantity of each food decreased between each interval in the experiment. On Figure 1, the bar representing each food is shorter in each subsequent time interval, implying that the cockroaches ate some of each of the 4 foods during each time interval.

### **5. Answer: A. S310 Bar Chart: Data Point**

The question is asking whether the cockroaches ate more cat food or ham during the experiment. According to Figure 1, at the end of the experiment, there is about 168 mg of cat food remaining and about 113 mg of ham remaining, a difference of about 55 mg. Thus, the cockroaches ate approximately 55 mg more cat food than ham, which is the opposite of the student's prediction.

### **6. Answer: G. S306 Table: Infer**

The question asks which food has more than 100 mg of water in 200 mg of the food.  $100 \text{ mg}/200 \text{ mg} = 0.5$ , or 50%. According to Table 1, cat food and ham have greater than 50% water.

### **7. Answer: C. S301 Table; S100 Text**

The question asks which two samples would be the same according to Student 1, who stated that two samples need to have all five properties the same in order to be the same substance. In Table 1, Samples C and D have the same values for all five properties, as do E and F (which is not an answer choice).

### **8. Answer: J. S301 Table; S100 Text**

Student 3 states that two samples are the same if they have the same mass, volume, and density. Each pair of samples is the same material, according to Student 3 and Table 1 (A and B, C and D, E and F, and G and H).

**9. Answer: C. S301 Table; S200 Science Knowledge**

According to Table 1, Sample A has a melting point of 126°C and boiling point of 747°C. Below 126°C, the sample would be solid. Between 126°C and 747°C, the sample would be liquid. The correct answer states that the sample would be liquid at 250°C because its melting point is 126°C.

**10. Answer: J. S106 Text: Agree/Disagree**

Each of the students states the belief that multiple properties must be the same in order for the substances to be the same, and that if one of the required properties is different, than the substances must be different. Thus, none of the students would agree with the given statement.

**11. Answer: A. S301 Table; S106 Text: Agree/Disagree**

According to Table 1, Samples A and B have the same mass, volume, and density, but different melting and boiling points. This fits Student 2's and Student 3's criteria for identical substances.

**12. Answer: F. S106 Text: Agree/Disagree**

Student 2 states that two substances are the same if they have 3 or more properties in common, which fits the statement. Student 3 states if they have different melting points they can not be the same substance, which does not fit the statement.

**13. Answer: A. S200 Science Knowledge; S301 Table**

According to Table 1, Sample D has a boiling point of 885°C, so it will be a gas at 890°C. Gases have lower density than liquids or solids.

**14. Answer: H. S314 XY Graph: Data Point**

In Figure 2, Ni at 30°C created 128 mL gas. In Figure 1, the Ni line passes 120 mL at 0.30 g.

**15. Answer: B. S102 Text: Experimental Parameters; S313 XY Graph**

The description of Experiment 1 states that all metals were tested at the same temperature. In Experiment 2, different temperatures were used, and the XY Graph shows data points at 5 different temperatures.

**16. Answer: J. S101 Text: Experimental Design**

The descriptions of the experiments state that Experiment 1 is done with multiple masses but Experiment 2 is done with the same mass.

**17. Answer: A. S102 Text: Experimental Parameters**

The description of the experiments states that the atmospheric pressure was kept the same (758 mmHg) throughout the entire experiment.

**18. Answer: H. S317 XY Graph: Extrapolate**

In Figure 2, the volume of gas collected increases as temperature increases, and decreases as temperature increases. At 10°C, the Zn line is at 107 mL, so at a lower temperature, the volume would be less than 107 mL.

**19. Answer: A. S206 Figure; S200 Science Knowledge**

In the balanced equation, the coefficient of HCl is 2 and the coefficient of H<sub>2</sub> is 1 (no coefficient = 1), so for every 2 moles of HCl consumed there is 1 mole of H<sub>2</sub> produced. Thus, for every 10 moles of HCl consumed, 5 moles of H<sub>2</sub> are produced.

**20. Answer: G. S313 XY Graph**

According to Table 1, at 0.25 g, the Zn line is at 95 mL. One test tube will hold 60 mL, which would leave 35 mL of gas remaining to fill part of the second test tube. Thus, two test tubes are required.

**21. Answer: C. S314 XY Graph: Data Point**

In Figure 2, the VS line (dashed line) is highest at 275 V.

**22. Answer: H. S313 XY Graph**

In Figure 3, the VL line (dashed line) completes one cycle and returns to voltage where it started after 20 msec. One cycle is represented here by starting at the maximum, going to the minimum, and returning to the maximum, or a complete wave.

**23. Answer: C. S315 XY Graph: Range of Values**

The voltage with the least variation is represented by the line with the smallest range, which is VL (dashed line) in Figure 3.

**24. Answer: H. S313 XY Graph**

In Figure 3, the VL line (dashed line) is always positive when the VC line (dotted line) is negative, and vice versa.

**25. Answer: D. S100 Text; S314 XY Graph: Data Point**

The text states that when the current flows counterclockwise, the current is negative. In Figure 2, the current (I, solid line) is negative after 10 msec and before 20 msec, including at 15 msec.

**26. Answer: J. S307 Table to XY Graph**

In the table, charge increases then decreases from 7 to 13 msec, with a peak at 10 msec. In Figure 2, I only decreases in this interval, but in Figure 3, VS (dashed line) increases and decreases, with a peak at 10 msec, just like charge in the table.

**27. Answer: C. S101 Text: Experimental Design; S301 Table**

According to the first paragraph, His<sup>+</sup> revertants are bacteria that regain the ability to synthesize histidine, and therefore survive on the dish. The greatest number of His<sup>+</sup> revertants would be on the dish with the most colonies, which is Dish 4. According to Table 1, Dish 4 is Substance N.

**28. Answer: F. S101 Text: Experimental Design**

According to the third paragraph, Dishes 2-5 were treated with suspected mutagens, but Dish 1 was not.

**29. Answer: B. S301 Table**

The second paragraph states that the number of His<sup>+</sup> revertants shows how mutagenic the substance is. The number of colonies growing on each substance, from least to most, is Dish 5 (P), Dish 2 (L), Dish 3 (M), and Dish 4 (N).

**30. Answer: F. S304 Table: Increase/Decrease**

The table shows concentration increasing from 10, to 50, to 100, as the number of colonies also increases. Therefore, as the concentration of Substance P increases, the potential to cause mutations also increases.

**31. Answer: D. S101 Text: Experimental Design; S200 Science Knowledge**

The control dish is the dish that didn't contain any treatment (suspected mutagen). All of the dishes contained no histidine to test whether bacteria mutated the ability to make their own histidine. All dishes had nutrient agar. Thus, the control dish had no mutagen or histidine.

**32. Answer: F. S301 Table**

According to Table 1, Dish 2 had substance L and Dish 3 had substance M. On table 2, Dish 3 has 25 colonies, which is about 2 times the number of colonies on Dish 2 (14).

**33. Answer: D. S105 Text: Infer**

The passage states that the scientists were testing substances to see whether they caused genetic mutations in bacteria. From this information, we can infer that the scientists didn't want to use bacteria that would repair the genetic mutations.

**34. Answer: G. S200 Science Knowledge; S105 Text: Infer**

Porous and permeable mean containing holes and allowing substances to pass into it. If researchers want all the water to flow from the box rather than into the box's walls, the box would have to be made of a material that is nonporous and impermeable.

**35. Answer: A. S200 Science Knowledge**

The freezing point of water is 1°C, so -1°C would be below the freezing point, and the water would not have melted.

**36. Answer: J. S314 XY Graph: Data Point**

In Figure 1, the 2.5 line (diamonds) and the 1.0 line (circles) reach 0 at 400 min and 450 min, respectively. Therefore, the wind speeds of 2.5 and 1.0 decrease to zero before 500 min.

**37. Answer: D. S313 XY Graph**

In Figure 2, the greater maximum value was achieved by the layer without sand (white circles). The layer without sand also decreased to zero first.

**38. Answer: J. S320 XY Graph to Bar Chart**

At 200 min on Figure 1, the 2.5 line (diamonds) is the lowest, the 0 line is next (squares), and the 0.5 and 1.0 lines (star and circle) are at the same highest point.

**39. Answer: B. S101 Text: Experimental Design**

In Study 1, the 4 trials differed by wind speed, which is described both in Table 1 and the text. In Study 1, the wind speed was the same, but the presence of sand changed.

**40. Answer: G. S102 Text: Experimental Parameters; S206 Figure**

According to the description of the experiment, the box was filled with 30 cm of sand, which corresponds to the height dimension. The width of the sand layer would be the width of the box, 60 cm, and the length would correspond to the length of the box, 120 cm. Since volume of a rectangular solid is length x width x height, the volume of sand would be calculated as 30 cm x 60 cm x 120 cm.