



**PrepLab36**

**ACT Answer Guide**

**Form 1572**

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## English Test

### 1. Answer: A. *E102 Commas*

The only necessary comma in the underlined portion is the one already there, which serves to separate the leading independent clause from the rest of the sentence.

### 2. Answer: J. *E305 Transition Words/Phrases*

The word “similarly” is incorrect here because the usual six-sided snowflakes are understood well, while the triangular ones are not. We need a transition word to show the contrariness of these ideas. The best option is “however.”

### 3. Answer: D. *E201 Verbs: Agreement/Tense*

The opening clause of this sentence is telling us that something “suggests.” We need to determine how to accurately say *what* they suggest, while also agreeing with the non-underlined portion that follows. **C** does agree with the rest; however, it does not agree with “suggests.” **B** has the opposite problem. Only **D** agrees with both sides of the sentence.

### 4. Answer: H. *E205 Modification: Dangling Modifiers*

The opening clause is a modifier for the the scientists, so the subject should be immediately following the comma. The only answer choice that begins with the scientists is **H**.

### 5. Answer: B. *E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS*

Answers **C** and **D** both offer a second independent clause after the comma, while **A** does this without even a comma. As there is no conjunction, we must have a dependent clause following the comma. Only **B** provides one.

### 6. Answer: J. *E201 Verbs: Agreement/Tense*

We must have a plural verb to match the plural “molecules,” as well as a present-tense verb to match the rest of the passage. Answer **J** provides a plural, present form of “bump.”

### 7. Answer: B. *M302 Is it Relevant: Adding, Deleting, and Replacing Information*

Hopefully answers **C** and **D** immediately stand out as irrelevant to the text, as they clearly do not have to do with the underlined portion. **A** is incorrect because it is not actually an explanation, but merely the mention of a step, as in **B**. **A** is also inaccurate, in that it mentions a transition from liquid to vapor to solid.

### 8. Answer: J. *E201 Verbs: Agreement/Tense*

The subject for the underlined verb is “snowflakes,” so we need a plural conjugation. It also must retain the present tense. There is no need for the wordiness in options **G** and **H**, so **J** is correct.

### 9. Answer: C. *E104 Colons and Dashes*

A colon is correct here because it the sentence, an independent clause until the last word, is leading to present an example. A semicolon is incorrect because “dust” is not an independent clause. “Is” would incorrectly create a new clause by creating a predicate.

**10. Answer: J. E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS**

The underlined portion should only be continuing the subject of the sentence here, not creating a dependent clause. The subject should be “The greater pressure from the wind,” and doesn’t need a comma because the predicate immediately follows.

**11. Answer: B. E203 Adjectives and Adverbs**

Because “form” is a verb, it must be described by an adverb. The word “than” following soon after indicates comparison while also ruling out “most.” Thus, “more quickly” is correct.

**12. Answer: G. E103 Non-Essential Clauses: Commas, Dashes, and Parentheses**

Here we need only include a comma. The “although” at the start creates a dependent clause, ruling out all options other than the comma, which can combine a dependent to an independent clause.

**13. Answer: A. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

Note that the question asks for the most effective way to *conclude* the sentence and the essay. It is best left as-is, because the other options are either too specific, too vague, or irrelevant.

**14. Answer: H. E306 Sentence Order**

The word “this” in our sentence is our clue. We must find out which option has the “growth” referred to by “this.” The only option which makes sense here is **H**.

**15. Answer: D. E308 Writer’s Goal**

Recall that what is important here is not the yes/no answer, but the reasoning. The only answer with supporting evidence that is both *relevant* to the text and *true* is **D**.

**16. Answer: H. E103 Non-Essential Clauses: Commas, Dashes, and Parentheses**

Because the beginning of this sentence is a dependent clause, it does not need a conjunction with the comma. If it was rearranged so the clause before the comma came at the end, it would make sense. Thus, no conjunction is needed, only a comma.

**17. Answer: B. E201 Verbs: Agreement/Tense**

It’s necessary to have the appropriate form of the verb “need” in this sentence. “Will need,” is improperly future tense. “Would have needed” implies that they did not in fact need them. “Need” is present tense. The only past-tense and appropriate option is “would need,” which shows that it was in the past, but came after the currently-narrated portion.

**18. Answer: J. E301 Short and Simple**

It is redundant to restate the information given at the start of this sentence: “We tried to steady ourselves with our walking sticks.”

**19. Answer: C. E201 Verbs: Agreement/Tense**

The past tense of the story immediately eliminates options **B** and **D** for their present-tense verbs. The difference between **A** and **C** is the preposition. “With” is appropriate, because “on” would imply the roof was literally atop the fallen rocks.

**20. Answer: H. E102 Commas**

**G** is quickly ruled out because it creates a new independent clause without conjunction. While **J** is dependent, it does not have a comma. Only **H** provides a dependent clause properly punctuated with a comma.

**21. Answer: A. E303 Word Choice: Correct Word**

“Most of” is the correct modifier for “the route.” **B** is improper because “most” is comparative, and “part” is not in this case. **C** lacks a “the” to make it correct, because “majority” needs to be specified as “the majority” vs “the minority,” as there is only one possible majority. **D** is incorrect because “more” is directly comparative, but there is no other option to which it is compared.

**22. Answer: F. E201 Verbs: Agreement/Tense**

Don’t be thrown off by the clause between the em dashes; it does not impact the rest of the sentence. Because we have a comma and no conjunction, we know we need a dependent clause to match the independent clause before. Only “forming,” which does not add a pronoun to create a new subject, is correct.

**23. Answer: B. E303 Word Choice: Correct Word**

The use of “only” and “able” gives a sense of the author being prevented from doing more. The other options merely state his progress, without answering the question’s request to emphasize “the slowness of the ascent” and how they “did not set their own pace.”

**24. Answer: H. E102 Commas**

Again here we have an inverted sentence structure with a dependent clause leading into an independent. As always in these situations, a simple comma is the best and correct way to punctuate. The other options provided all require beginning with an independent clause, regardless of what follows.

**25. Answer: C. E105 Apostrophes: Possessive, Plural, and Contractions**

Although we don’t know from the context whether there are one or more craters, we can determine our answer from just the first word. “Cliffs” should be plural and not possessive, so there is no need for an apostrophe. Between **C** and **D**, only **C** has a possessive form of “crater,” so it is the only correct option.

**26. Answer: F. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

We can rule out a number of answers. We can eliminate **G** because the idea of waiting was introduced just before. We can eliminate **H** because, necessary or not, it does not contradict anything. We can eliminate **J** because it is not an image at all.

**27. Answer: D. E305 Transition Words/Phrases**

The word which is most appropriate here is “finally,” because the author has just described their waiting. The other options do not relate to this statement of time.

**28. Answer: G. E303 Word Choice: Correct Word**

We can easily disqualify “went over,” because it doesn’t really describe anything. “Smothered” and “squelched” are not very “rugged” words, as the question requests. Only “shattered” bears this violent connotation.

**29. Answer: A. E307 Paragraph Order**

The first paragraph mentions “the other hikers” just as the proposed addition does. It also fits into the chronology of the narrative, as they use flashlights once it is dark.

**30. Answer: F. E308 Writer’s Goal**

If you read the passage (which hopefully you have by now), it should not be difficult to determine which option accurately describes the story. It does not focus on their tools, the rewarding nature, or the beauty—it just mentions them. They are all part of the story which, overall, describes the challenges involved in their journey.

**31. Answer: B. E102 Commas**

There is no need for a comma here. The underlined portion does not separate clauses, list articles, or anything else. The modifier “named Juan Quezada” can immediately follow the modified “boy,” and similarly lead directly into the predicate.

**32. Answer: H. E103 Non-Essential Clauses: Commas, Dashes, and Parentheses**

The fact that two answers use parentheses should be an immediate signal that one of them is using them incorrectly. In this case, the extra comma after “pots” makes it incorrect because it is redundant.

**33. Answer: B. E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS**

The active verb here is “wondered.” Because the root of the sentence, “Quezada wondered,” is not a question, we cannot end the sentence in a question mark. The comma in **C** is also incorrect because, again, nothing is being separated; it is merely stating what is being wondered.

**34. Answer: H. E305 Transition Words/Phrases**

To form a good transition, we want a sentence which includes an idea from the last paragraph and the upcoming paragraph. **H** is the only choice that combines Quezada’s desire to emulate the pots with his experimenting with the clay.

**35. Answer: A. E201 Verbs: Agreement/Tense**

Options **B** and **C** imply Quezada was selling a dedication to teaching and a teacher. As he was not, in fact, selling these, we need a new verb in the underlined sentence, not a subject. “Has taught” is incorrectly present tense, so the past-tense “had taught” is correct.

**36. Answer: F. Is it Relevant: Adding, Deleting, and Replacing Information**

Treat this like a deletion question. What would be lost without this detail? Well, it shows that his pots were so authentic they even fooled an anthropologist. This is an important supporting detail, which is only reflected in answer **F**.

**37. Answer: A. E201 Verbs: Agreement/Tense; E202 Pronouns: Agreement/Case**

The verb for this sentence must match the subject, "his search." "Himself" is a reflexive pronoun, which means something acted upon itself. As "his search" did the acting, it should not be reflexive. "Led him" agrees with the subject and the antecedent.

**38. Answer: F. E303 Word Choice: Correct Word**

The only option which implies delay is "eventual." The others have different meanings, none of which respond to the question accurately.

**39. Answer: C. E202 Pronouns: Agreement/Case**

Although omission is often correct, here it is not. The fact that **C** is much shorter and simpler, though, is a good hint that it's a better option. "Where" is necessary to create a dependent clause, as there is no conjunction.

**40. Answer: J. E301 Short and Simple**

The shortest answer is often correct. Also note that "more then" is never correct, as it should be "more than." The strange pronoun in option **H** makes this a confusing mess. What is the antecedent? Village, money, pottery? **J** is simple and correct.

**41. Answer: C. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

We need a specific answer here. Of course there are more than 400 potters; there are thousands or millions. It is only relevant to the text if it is telling how many potters are in Mata Ortiz.

**42. Answer: G. E202 Pronouns: Agreement/Case**

"Which" is not used for people. "Them" would create an independent clause, which is incorrect as there is no conjunction. "Who" does not follow "of." The correct pronoun here is "whom."

**43. Answer: D. E202 Pronouns: Agreement/Case**

"They're" is very wrong; it is the contraction of "they are." **B** incorrectly uses a reflexive pronoun, when the people described are acting upon a separate entity. The word "each" means "her" is correct, not "hers," because it refers to multiple singular people instead of a group. Thus, "his or her" is the correct way to use possessive pronouns in this sentence.

**44. Answer: J. E306 Sentence Order**

The reference to "each artist" should point us in the direction of a sentence discussing the artists. The only option which does this is **J**.

**45. Answer: C. E308 Writer's Goal**

This piece is not one of historical information, but a biographical story of one artist in particular. Although it does mention things in the other options, none of them are the focus of the essay.

**46. Answer: J. E105 Apostrophes: Possessive, Plural, and Contractions**

This is an important thing to learn for the test. The apostrophe stands in for the missing letter "I" in "It is." This sentence needs a possessive, so there should not be an apostrophe.

**47. Answer: D. E102 Commas**

There should not be a comma here! Nothing needs to be separated in the underlined portion. The correct verb is “fill,” because “filling” would create a modification instead of a predicate, leaving the sentence as a fragment.

**48. Answer: H. E305 Transition Words/Phrases**

Because the information being presented after the transition word is contrasting the information before it, “however” is the correct word. The others do not imply this contrast, but rather causation or reinforcement.

**49. Answer: B. E206 Modification: Moving Modifiers**

We cannot create a new clause here. We instead must modify the “architecture buffs” by describing them as “there to admire.” The pronouns offered are all incorrect, and the closest, **D**, creates a new independent clause without conjunction.

**50. Answer: F. E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS**

Would a period work here? Yes! On the ACT a semicolon is just a period. If it is ever an option, substitute a period and see if it is correct. Here we have two independent clauses, separated correctly by a semicolon.

**51. Answer: D. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

Options **A** and **C** are easily eliminated because they have such weak reasoning, but **B** is a tempting choice. The evidence is true, because it does provide this context. This answer is incorrect because this detail is not relevant to the focus of the essay, as option **D** points out. By reading through all the answers, you will realize this once you reach **D**.

**52. Answer: J. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

Omission is very often correct, and the fact that the other answers here are so similar should clue you in. The color of the building is irrelevant here and has already been mentioned two lines above.

**53. Answer: A. E103 Non-Essential Clauses: Commas, Dashes, and Parentheses**

Although this is an odd way to punctuate this sentence, it is more correct than the options presented. **B** and **C** incorrectly create dependent clauses separated by a period. **D** creates an independent clause with a comma and no conjunction, which is just as wrong.

**54. Answer: F. E201 Verbs: Agreement/Tense; E203 Adjectives and Adverbs**

As “chandeliers” are being described by “elegant,” it should remain an adjective, not an adverb. As “chandeliers” is plural, we must have the plural “illuminates.”

**55. Answer: B. E304 Word Choice: Formal/Informal Tone**

**A** and **D** are dull and without any implications, while **C** is a very negative portrayal. **B** is positive and accurately mimics the style of the architecture.

**56. Answer: G. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

The other options do not sufficiently justify their claims. **F** is outright false, **H** misidentifies the essay's claim, and **J** incorrectly assumes the purpose of the sentence.

**57. Answer: C. E307 Paragraph Order**

At point **C** the paragraph shifts from exterior to interior focus, which is exactly what is sought by the question.

**58. Answer: F. E305 Transition Words/Phrases**

None of these transitions are appropriate in this location, so they are better off foregone.

**59. Answer: D. E301 Short and Simple**

All options here are redundant, as the "adding" implication is already present in the word "enhancing."

**60. Answer: G. E308 Writer's Goal**

**F** and **J** incorrectly claim the passage focuses on a number of buildings and styles, despite the clear focus on the Lyceum Theatre's Beaux Arts influence. **H** is easily ruled out if you've read the passage, as it does not focus on the sets.

**61. Answer: C. E303 Word Choice: Correct Word; E203 Adjectives and Adverbs**

The preposition "with" signals that we need a noun here. "Inaccuracies" is the noun option, and as such it must be modified by the adjective form "factual," not the adverb "factually."

**62. Answer: G. E104 Colons and Dashes**

The colon here is used properly, in that it follows an independent clause and leads into an example or extrapolation.

**63. Answer: D. E201 Verbs: Agreement/Tense**

Because the subject here is "untruths," despite the clause between dashes, the verb must be plural to match. "Matter" is the correct plural, present option.

**64. Answer: F. E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS**

"For" is a conjunction which, with a comma, allows us to combine two independent clauses. This is correct as-is. Do not be tempted to pick the period or semicolon; the conjunction makes the clause dependent! Also note that if two options use a period and semicolon in the same way, they must both be wrong because they are functionally the same on the ACT.

**65. Answer: C. E305 Transition Words/Phrases**

The words "rather" and "instead" are signal transition words which should immediately catch your eye. Between **C** and **D**, only one leads into the thesis of the essay as a whole. Consider reading ahead and coming back to this to determine just what that topic is.

**66. Answer: H. E105 Apostrophes: Possessive, Plural, and Contractions**

This sentence contains a singular-possessive and a plural (“movement’s” and “advocates” respectively). Although it can be confusing to see both, this is a straightforward question if you don’t rush through it.

**67. Answer: D. E102 Commas**

There is no need for a comma here, as “She herself” is not a clause, but only the subject of this sentence.

**68. Answer: G. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

Remember, the only important part of the answer is the evidence. In this case, the incorrect answers disregard the importance of this detail in creating character, while **G** supports why the detail is important.

**69. Answer: D. E101 Joining and Separating Sentences: Period, Semicolon, Comma, and FANBOYS**

Don’t know how to use a semicolon? Use a period! Both separate independent clauses, and are functionally the same on this test.

**Tip:** On the ACT, a period and semicolon are interchangeable.

**70. Answer: J. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

The only answer which is relevant to the text is **J**. It is important to read the passage well, and if necessary go back into the text. Without the context, questions like this are very difficult.

**71. Answer: A. E302 Is it Relevant: Adding, Deleting, and Replacing Information**

It’s important to read the answers carefully, because some will try and trick you. Obviously the comparison is not unrelated, nor is it repeated, but **B** may tempt you because she may well have cared for her workers in that way. **A** is the best answer, though, because this metaphor is central to the text.

**72. Answer: F. E104 Colons and Dashes**

Note that colons must follow an independent clause. The following clause is an example, so a colon is appropriate. The other options are convoluted and incorrect. It is important to learn how, where, and when colons are acceptable, or, at the very least, when nothing else is.

**73. Answer: B. E305 Transition Words/Phrases**

The only transition word here which implies causation, as the text would imply, is “because.” The others would imply she was contrary to the workers, or a similarly incorrect relationship.

**74. Answer: H. E105 Apostrophes: Possessive, Plural, and Contractions**

“Their” is the form which refers to possession by a plural. “Behalf” does not need to be transformed in any way, and the strange apostrophe in **J** should be reason enough to ignore it.

**75. Answer: D. E308 Writer's Goal**

**D** is correct because it supports its claim with evidence true to the text, which does focus on Mother Jones. The other answer choices reference either her or the labor movement, but not both, as required by the prompt.

# Mathematics Test

## 1. Answer: D. M503 Probability

Type A or AB

$$67 + 6 = 73$$

D.  $\frac{73}{150}$

## 2. Answer: H. M501 Mean, Average

$$\frac{370+310+380+340+310}{5} = 342$$

H. 342

## 3. Answer: E. M109 Rate & Proportion

$$\frac{1}{2} \text{ in} = 18 \text{ miles}$$

$$\frac{5}{18} = \frac{25}{x} \quad \text{*cross multiply}$$

$$.5x = 45 \quad \text{*solve for x}$$

$$\div 0.5 \quad \div 0.5$$

$$x = 90$$

E. 90

## 4. Answer: F. M202 Solving Equations

$$450 = c(10)^3$$

$$450 = 1000c$$

$$\div 1000 \quad \div 1000$$

$$c = 0.45$$

F. 0.45

## 5. Answer: E. M214 Functions $f(x)$

$$f(x) = (3x + 7)^2$$

$$f(1) = (3 \times 1 + 7)^2$$

$$f(1) = 10^2$$

$$f(1) = 100$$

E. 100

## 6. Answer: H. M110 Percent

6% increase

$$(12)(1.06) = 12.72$$

H. \$12.72

**7. Answer: E. M106 Sequence**

1, -3, 9, -27, \_\_\_ \_\_\_ \_\_\_

Geometric means multiple.

Here it is multiply by -3.

$$-27 \times -3 = 81 \quad 5^{\text{th}}$$

$$8 \times -3 = -24 \quad 6^{\text{th}}$$

$$-24 \times -3 = 72 \quad 7^{\text{th}} \text{ term}$$

**E. 729**

**Tip:** You should be familiar with the first twelve squares and first 5 cubes.

Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144

Cubes: 1, 8, 27, 64, 125

**8. Answer: H. M109 Rate & Proportion**

1 box 15 lbs

Fee + Price per pound

$$\$10 + (.65)(15) = \$19.75$$

**H. \$19.75**

**9. Answer: A. M307 Solids**

$$\frac{.32 - 2(.03)}{.02} = 13$$

**H. 13**

**10. Answer: K. M502 Median, Mode**

13, 15, 16, 19, 19, 22 | 25, 25, 26, 27, 28, 29

$$\frac{22+25}{2} = 23.5$$

**K. 23.5**

**11. Answer: C. M207 Linear Functions:  $y=mx+b$**

1. Plug in  $t = 0$ ,  $d = 14$

A.  $14 = 0 + 14$

C.  $14 = 6 * 0 + 14$

Eliminate B, D, E

2. Plug in  $t = 1$ ,  $d = 20$

A.  $20 = 1 + 14$  NO

C.  $20 = 6 + 14$  YES

**C.  $d = 6t + 14$**

**12. Answer: K. M303 Quadrilaterals**

$$l \times w = 54$$

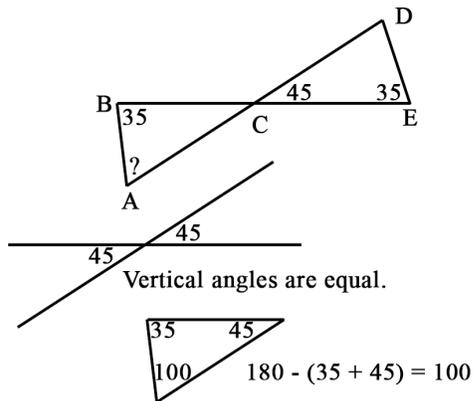
$$\begin{array}{r} 9 \times w = 54 \\ \div 9 \quad \div 9 \end{array}$$

$$w = 6$$

$$2(9) + 2(6) = 30$$

**K. 30**

**13. Answer: B. M301 Lines & Angles; M302 Triangles**



**B.  $100^\circ$**

**14. Answer: H. M306 Sectors & Arcs; M505 Charts & Graphs**

$$\frac{4 \text{ core}}{9 \text{ total}} = \frac{\theta(\text{angle})}{360^\circ}$$

Solve for  $\theta$ .

$$\theta = \frac{4 \cdot 360}{90}$$

$$\theta = 160^\circ$$

**H.  $160^\circ$**

The ACT loves this problem!

**15. Answer: B. M211 System Word Problems**

$$S + L = 70$$

$$\$12L = \$8S$$

How many large:

$$S = 70 - L$$

$$12L = 8(70 - L) \quad \text{distribute}$$

$$12L = 560 - 8L$$

$$\begin{array}{r} + 8L \qquad \qquad + 8L \\ 20L = 560 \\ \div 20 \quad \div 20 \\ L = 28 \end{array}$$

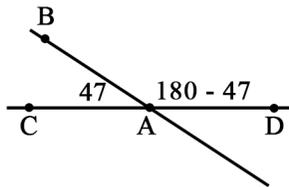
**B. 28**

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

$$\frac{220-88}{3} = 44$$

**H. 44**

**17. Answer: D. M301 Lines & Angles**



$$\angle BAD = 133$$

**B.  $133^\circ$**

**18. Answer: F. M104 Fractions**

$$\frac{1}{2} \quad \frac{5}{6} \quad \frac{5}{8}$$

$$\text{LCD} = 24$$

$$\frac{12}{24} \quad \frac{20}{24} \quad \frac{15}{24}$$

“ascending”

$$\frac{12}{24} < \frac{15}{24} < \frac{20}{24}$$

**F.  $\frac{1}{2} < \frac{5}{8} < \frac{5}{6}$**

**19. Answer: D. M205 Exponents & Roots**

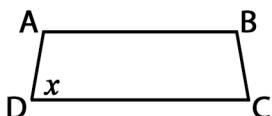
$$\frac{670,000,000}{6.7 \times 10^8}$$

$$\frac{700,000,000}{7.0 \times 10^8}$$

Add  $13.7 \times 10^8$

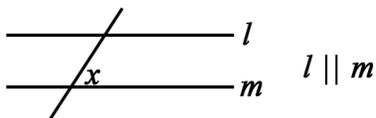
**D.**  $1.37 \times 10^9$

**20. Answer: F. M303 Quadrilaterals**



**F.**  $(180 - x)$

- a lot like 304 Lines & Angles



**21. Answer: B. M110 Percent**

$$(1,000) \left(\frac{80}{100}\right) \left(\frac{60}{100}\right)$$

$$(1,000)(.8)(.6) = 480$$

**B.** 480

**22. Answer: H. M205 Exponents & Roots**

$$a^b = x \quad c^b = y$$

$$x \times y = ? \text{ substitute}$$

$$a^b \times c^b = (ac)^b$$

**H.**  $(ac)^b$

**23. Answer: A. M201 Algebraic Operations**

$$\frac{1}{2}y^2(6x + 2y + 12x - 2y) \quad \text{combine like terms}$$

$$\frac{1}{2}y^2(18x) = 9xy^2$$

**A.**  $9xy^2$

**24. Answer: H. M218 Factoring & FOIL**

$$500p - p^2 = 60,000$$

$$500p = p^2 + 60,000$$

$$0 = p^2 - 500p + 60,000$$

$$0 = (p - 200)(p - 300)$$

H. 200

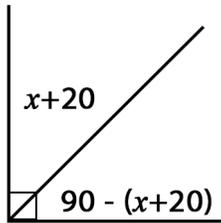
**Tip:** When there is a factoring problem, let the answers give you a clue.

**25. Answer: B. M505 Charts & Graphs**

$$\frac{254}{900} = 0.28\bar{2}$$

B. 28%

**26. Answer: G. M301 Lines & Angles**



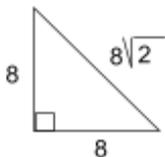
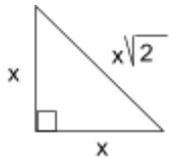
$$90 - (x + 20)$$

$$90 - x - 20$$

$$70 - x$$

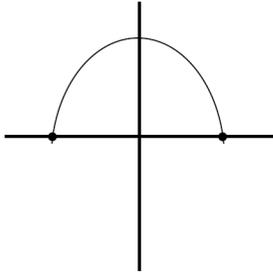
G.  $(70 - x)^\circ$

**27. Answer: E. M302 Triangles**



E.  $16 + 8\sqrt{2}$

**28. Answer: H. M216 Quadratics & Parabolas**



solution is where  $y=0$  or  $x$  intercept

**H.** 1 positive, 1 negative real solutions

**Tip:** "Real solution" means the parabola crosses the  $x$ -axis. If the solution is not real it is imaginary.

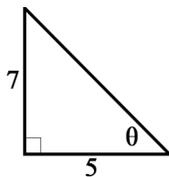
**29. Answer: C. M219 Complex Numbers**

$$\begin{aligned} &(-3i + 4)(3i + 4) \text{ FOIL} \\ &-3 \times 3i - 4 \times 3i + 4 \times 3i + 16 \\ &-9(-1) + 16 = 25 \end{aligned}$$

**C.** 25

**30. Answer: G. M401 SOHCAHTOA**

$$\frac{S}{H} = \frac{O}{H} \quad \frac{A}{H} = \frac{T}{A}$$



**G.**  $\tan \frac{7}{5}$

**31. Answer: D. M503 Probability**

$$750 + 5 \text{ extra} = 755$$

$$\frac{5 \text{ extra}}{755 \text{ total}} = \frac{5}{755}$$

Don't you think the ACT should reduce to  $\frac{1}{155}$ ?

**D.**  $\frac{5}{755}$

**32. Answer: K. M104 Fractions**

Halfway is simply the average.

$$\left(\frac{2}{3} + \frac{3}{4}\right) \div 2 \quad \text{find LCD}$$

$$\left(\frac{8}{12} + \frac{9}{12}\right) \div 2$$

$$\frac{17}{12} \div 2$$

$$\frac{17}{24}$$

**K.**  $\frac{17}{24}$

\*\*\*Note: 33 - 35 are three of the most missed questions!\*\*\*

**33. Answer: B. M109 Rate & Proportion**

$$.25 \text{ inch} = 2 \text{ ft}$$

$$\frac{x}{.25} = \frac{15}{2} \quad \text{cross-multiply}$$

$$2x = 3.75$$

$$\begin{array}{r} +2 \quad +2 \\ 2x = 3.75 \end{array}$$

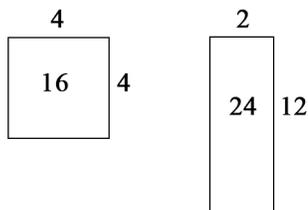
$$x = 1.875$$

**B.** 1.875

**34. Answer: H. M308 Multiple Figures**

Not covered = whole - cabinet

$$\text{Whole} = 12 \times 5 = 180$$



$$180 - (16 + 24) = 140$$

**H.** 140

**35. Answer: D. M207 Linear Functions:  $y = mx + b$**

$$2,150 = 650 + (10)(x)$$

There are 10 cabinets.

$$\text{Price per cabinet} = \frac{2150-650}{10} = 150$$

Twice as many

$$650 + 20 * 150$$

**D.** 3650

**36. Answer: J. M210 Systems of Equations; 203 Inequalities**

$$1 < x + y < 2$$

break a compound into two inequalities

$$1 < x + y$$

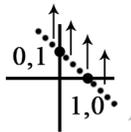
$$x + y < 2$$

graph line in standard form, use intercepts

$$1 < 0 + y \quad (0, 1)$$

$$1 < x + 0 \quad (1, 0)$$

Plot

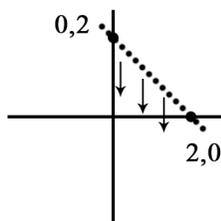


$$x + y < 2$$

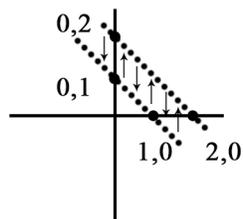
$$0 + y < 2 \quad (0, 2)$$

$$x + 0 < 2 \quad (2, 0)$$

Plot



combined:



90% of students miss this one!

J.

37. Answer: A. M501 Mean, Median; M502 Median, Mode

$$\frac{3+8+10+15}{4} = 9$$

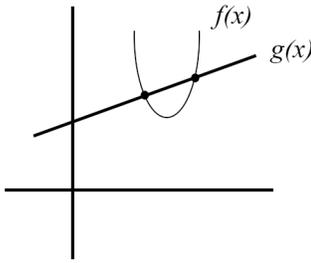
3, 8,   , 10, 15; median = 9

Difference

$$9 - 9 = 0$$

A. 0

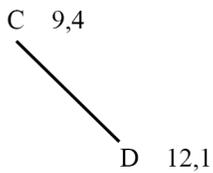
**38. Answer: F. M216 Quadratics & Parabolas; M210 Systems of Equations**



Where do they intersect?  
That is where the functions are equal.

**F.**  $f(x) = g(x)$  for exactly 2 values of  $x$

**39. Answer: B. M208 Coordinate Geometry & XY-plane**

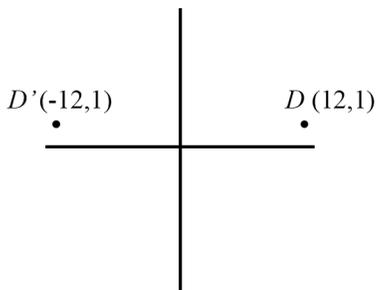


$$m = \frac{4-1}{9-12} = \frac{3}{-3}$$

**B.** - 1

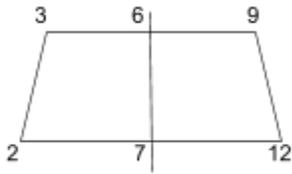
**40. Answer: F. M208 Coordinate Geometry & XY-Plane**

*Reflected over y-axis*



**F.** - 12, 1

**41. Answer: E. M303 Quadrilaterals**



$$\frac{(3+9)}{2} = 6 \quad \frac{(2+12)}{2} = 7$$

$$\frac{(6+7)}{2} = 6.5$$

MIDPOINT! means average

Cut into equal area is midpoints of  $b_1$  and  $b_2$ .

**E. 6.5**

**42. Answer: K. M214 Functions  $f(x)$**

$$f(x) = x - \frac{1}{x}$$

$$g(x) = 1/x$$

$$f(g(\frac{1}{2})) = f(1/\frac{1}{2})$$

$$f(g(\frac{1}{2})) = f(2)$$

$$f(2) = 2 - \frac{1}{2} = \frac{3}{2}$$

**F.  $\frac{3}{2}$**

**43. Answer: D. M201 Algebraic Operations**

$$p = \frac{\frac{1}{2}ay+a}{12y}$$

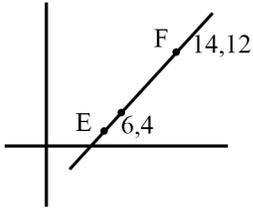
Factor out "a"

$$p = \left(\frac{\frac{1}{2}ry+1}{12y}\right)a$$

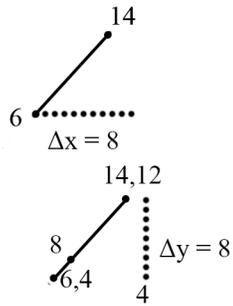
Multiply  $a$  by 2, means balance equation by 2.

**D.  $p$  is multiplied by 2**

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



$$EF = 4 \times (ED)$$



8 is  $4 \times 2$

$$6 + 2 = 8$$

$$4 + 2 = 6$$

**G.** (8, 6)

**45. Answer: D. M220 Matrix**

A matrix can have a coefficient.

Distribute the "a"

$$\begin{bmatrix} 2a & 6a \\ a & 4a \end{bmatrix} = \begin{bmatrix} x & 27 \\ y & z \end{bmatrix}$$

$$6a = 27$$

$$a = \frac{9}{2} \text{ or } 4.5$$

$$2a = x$$

$$2(4.5) = x$$

$$9 = x$$

$$4a = z$$

$$4(4.5) = z$$

$$18 = z$$

$$9 + 18 = 27$$

**D.** 27

**46. Answer: J. M104 Fractions**

$\frac{1}{8}$  of the whole  
 $\frac{1}{8}x + 10 = \frac{3}{4}x$  Solve for  $x$ .

$$10 = \frac{5}{8}x$$

$$x = 16$$

**J. 16**

**47. Answer: B. M108 Ratio**

“Most likely”

$$86 : 255$$

$$18 : 51$$

These are the same “whole”

$$51x = 255$$

$$x = 5$$

$$18 \times 5 = 90$$

10th	11th	12th
86	90	79

Most likely =  $11^{\text{th}} \frac{9}{255}$

**B.  $11^{\text{th}}$**

**48. Answer: G. M104 Fractions; M205 Exponents & Roots**

$$\frac{4}{\sqrt{2}} + \frac{2}{\sqrt{3}} = ?$$

Find LCM

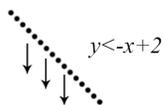
$$\frac{4\sqrt{3}}{\sqrt{2}\sqrt{3}} + \frac{2\sqrt{2}}{\sqrt{3}\sqrt{2}}$$

**G.  $\frac{4\sqrt{3}+2\sqrt{2}}{\sqrt{6}}$**

**49. Answer: A. M210 Systems of Equations, M215 Equation of a Circle, M207 Linear**

**Functions:  $y=mx+b$**

First find the linear inequality.



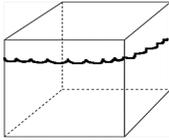
Second, the circle is shaded inside.

Solutions must be less than radius.

$$(x - 1)^2 + (y - 2)^2 < 9$$

**A.  $\{y < -x + 2 \mid (x - 1)^2 + (y - 2)^2 < 9\}$**

**50. Answer: F. M307 Solids**



Volume of water

$$40 \times 30 \times 20 = 24,000$$

It increases by .25

$$40 \times 30 \times 20.25 = 24,300$$

Displacement = Difference

$$24,300 - 24,000$$

**F. 300**

**51. Answer: E. M108 Ratio**

$$x : y = 5 : 2$$

$$y : z = 3 : 2$$

$$(5 : 2)3 = 15 : 6$$

$$(3 : 2)2 = 6 : 4$$

$$x : z = 15 : 4$$

**E. 15 : 4**

**52. Answer: H. M203 Inequalities**

$$-5 < 1 - 3x < 10$$

break into parts

$$\begin{array}{r} -5 < 1 - 3x \\ -1 \quad -1 \end{array}$$

$$\begin{array}{r} -6 = -3x \\ \div 3 \quad \div 3 \end{array}$$

*switch sign*

$$2 > x$$

$$\begin{array}{r} 1 - 3x < 10 \\ -1 \quad -1 \end{array}$$

$$\begin{array}{r} -3x < 9 \\ \div 3 \quad \div 3 \end{array}$$

*switch sign*

$$x > -3$$

**H.  $-3 < x < 2$**

**53. Answer: B. M307 Solids**

$A = 2lw + 2lh + 2wh$

Double each

$2(21)(2w) + 2(21)(2h) + 2(2w)2h$

$81w + 81h + 8wh$

increase by factor of 4

**B. 4**

**54. Answer: K. M212 Linear Function: Rate**

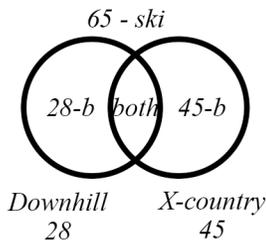
$\frac{(7 \text{ cans})}{(3 \text{ days})}$

$3 + d = ?$

$3\left(\frac{7}{3}\right) + d\left(\frac{7}{3}\right)$

**K.  $7 + \frac{7d}{3}$**

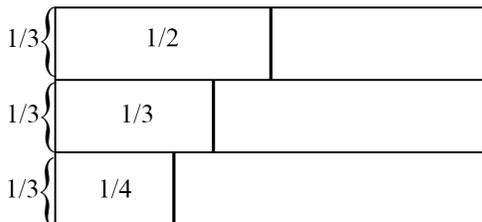
**55. Answer: E. M504 Counting, Permutations, & Combinations**



$28 + 45 - 65 = 8$

**E. 8**

**56. Answer: K. M308 Multiple Figures; M104 Fractions**

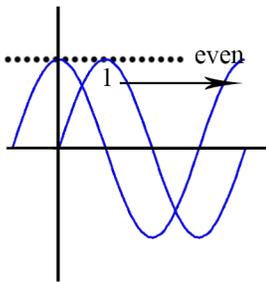


$\frac{1}{3} \times \frac{1}{2} + \frac{1}{3} \times \frac{1}{3} + \frac{1}{3} \times \frac{1}{4}$

$\frac{1}{6} + \frac{1}{9} + \frac{1}{12} = \frac{6}{36} + \frac{4}{36} + \frac{3}{36} = \frac{13}{36}$

**K.  $\frac{13}{36}$**

**57. Answer: A. M403 Trig Function**



1. function translation  
 $f(x) + b$  moves function  $\uparrow$   
 since these two are EVEN  
 $b = 0$

2. This function moves left  
 $f(x-a)$   $a < 0$

$a < 0$  and  $b = 0$

**A.**  $a < 0$  and  $b = 0$

**58. Answer: K. M204 ABS Absolute Value**

$$|x - 5| < -1$$

The smallest value for  $|x - 5|$  is 0!

There CANNOT be a negative ABS.

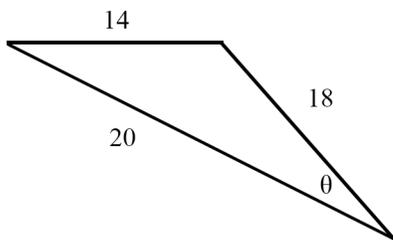
**K.** Empty Set

**59. Answer: E. M503 Probability**

$$\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{81}$$

**E.**  $\frac{1}{81}$

**60. Answer: J. M400 Trigonometry**



Note: The smallest angle is opposite the smallest side.

$$\mathbf{J.} \ 14^2 = 18^2 + 20^2 - 2(18)(20)\cos\theta$$

## Reading Test

### **1. Answer: A. R301 Main Idea/Function: Passage**

Look at the first word of each answer: *explanation, description, argument, and concerns*. Which of these best fits what the author is “going for” in this passage? Likely you can narrow your choices down to just **A** and **B**, from which point it should be clear that **B** is not the purpose of the passage.

### **2. Answer: J. R201 Detail**

If you read carefully, you’ll note that the narrator did *not* want to be like the great photographers; instead, he wanted to do almost the opposite of them, depicting living people instead of grand cityscapes.

### **3. Answer: C. R204 Main Idea/Function: Paragraph**

Make sure you choose an answer *only* relating to the section in the lines specified. Don’t be thrown off by the term “muses over,” which essentially means “considers.” Only one answer choice here is both considered *and* rejected, as the question requires.

### **4. Answer: H. R402 Vocabulary in Context; R101 Line Number**

When you look back at the lines in question, scan for important words and phrases. Special punctuation or formatting is a good indicator of something important: in this case, the italicized “*her*” should stand out. The narrator uses an animate pronoun to refer to the city of Bombay: this is an example of *personification*.

### **5. Answer: B. R104 Big Picture**

A significant amount of the passage is structured around the way the narrator’s parents alternated in taking care of their child. Some of these answers address one parent’s work habits somewhat reliably, but only one shows how *both* parents participated by taking turns.

### **6. Answer: J. R202 Vocabulary in Context; R101 Line Number**

You can only answer this question safely if you go back and double check the line in question. Which of these definitions makes *the most* sense where “sweep” is used? Look at the part of speech: it is being used as a noun in the sentence, so we need a definition that matches. The correct answer “broad area,” which is also the most concrete noun definition provided. Always consider what role the vocab word is filling when choosing a definition, even if you think you know the word; sometimes a new definition will come up, and you will have to use context clues.

### **7. Answer: A. R203 Inference/Assumption; R101 Line Number**

Don’t overthink your answer: this question is quite literal. What do these four lines definitely do? It compares landmarks. It is not important *why* it does this, or what it is trying to accomplish, only that this is the “primary function” of these lines.

### **8. Answer: H. R103 Keyword**

The key words in each answer should be easy to skim for if you go back to the passage, but be careful not to spend too much time rereading for questions that don’t reference specific lines. You may be able to remember the answer anyway, but make sure the other answers do not fit better before choosing.

**9. Answer: B. R202 Vocabulary in Context; R101 Line Number**

In this case, all of the answers fit the same part of speech. Thus, you must read the line carefully and determine which definition fits best; sometimes it helps to substitute the definitions for the word in question and see which makes the most sense. You may notice, though, that the phrase takes a direct object: that is, there is something being acted upon (the list). This may help you choose your answer in some cases, but for this question it is best to simply use reason and context to determine which definition is most logical.

**10. Answer: J. R204 Main Idea/Function: Paragraph; R203 Inference/Assumption**

Look at the first word of each answer. Is the father's purpose to teach, convince, clarify, or illustrate? If you cannot narrow down your list based on this, look at the rest of the answers. While he may be teaching, the rest of answer **F** rules it out because it is clearly *not* related to what he is saying. The quotes in the last passage should catch your attention; they are the father's own words, so they are the best indicator of his intentions. The answer most aligned with what he says is **J**.

**11. Answer: A. R104 Big Picture**

Although the author of this passage comes off as mostly objective, do not mistake this for indifference: the vivid descriptions often refer to the size, majesty, and seemingly impossible features of the topic—note, though, there are no traces of skepticism or true disbelief. Through these many descriptions, it is clear that the author is in “awe and fascination.”

**12. Answer: J. R201 Detail**

Read carefully! Options **G** and **H** both refer to specific points in the text *incorrectly*. The subject of the passage, and the object being nicknamed, is the underground mountain range (which was only mistakenly thought to be a former land bridge).

**13. Answer: C. R204 Main Idea/Function: Paragraph; R102 Paragraph Number**

Answer **C** should grab your attention because it is the only answer that connects the stillness in question to the subject of the passage. The other choices, while perhaps literarily possible, are not relevant to the passage, and as such none could be the choice the ACT wants.

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

This question is entirely answered in the text. If you read carefully, you may remember the answer right away. A quick scan of the passage to find the detail in question should reveal the answer.

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

Look at the key word of each answer choice: this will help you understand what each one actually means, and quickly rule out **C** and **D**. You may think the reasoning behind **A** is possible, but does the text really “describe in detail?” No, but it does *characterize*, and the rest of answer **B** fits the bill.

**16. Answer: H. R204 Main Idea/Function: Paragraph**

The best thing to do when you reach this question is first read the answer choices, then go back and read the paragraph in question. Remember, the question does not ask for details from that paragraph; it asks for a *purpose*. Only one answer here is both supported by the text *and* an appropriate answer to the question: **H**.

**17. Answer: B. R201 Detail; R203 Inference/Assumption**

Lines 30-33 hold the answer to this question, which notably looks for what is “most strongly implied,” because it is never stated outright. You may remember the answer from your first reading, because it is one of the main rhetorical points of that portion of the text.

**18. Answer: F. R202 Vocabulary in Context; R101 Line Number**

Even if you think you know what this phrase means, *go back and read the context*. Often these questions will choose words and phrases with multiple meanings in order to trip you up. The context is: “one naval officer *paid out* eight miles of hemp rope.” Which option makes sense? Even if you don’t know what some of the answers mean, you likely know the meaning of the correct answer, “dispensed.”

**19. Answer: D. R201 Detail**

You may recall this comparison if you read the passage closely, as it is a staggering fact in itself. Either way, if you look to the text you will see that the other options *are* used for comparisons, but not as a comparison of similar land mass.

**20. Answer: F. R201 Detail**

This is yet another question for which you can simply go back through the text to find your answer.

**Tip:** *If skimming for details in questions is taking up too much time, practice looking for the keywords from the question rather than altogether rereading.*

**21. Answer: A. R104 Big Picture; R101 Line Number**

Actually, despite the mention of a specific line number, this question can be answered without referring back to the line. If you read the answer choices, **B**, **C**, and **D** are all simply not true to the essay: Bradbury never talks about walking with old friends in person, never mentions writing about the present, and nowhere is there even a suggestion of other writers teaching him new methods.

**22. Answer: G. R301 Main Idea/Function: Passage**

The text answers this question indirectly: Bradbury says “like every beginner” he thought he could “beat, pummel, and thrash an idea into existence.” Though he writes with distinct style, if you look closely you can find that he’s saying something fairly simple.

**23. Answer: D. R203 Inference/Assumption; R101 Line Number**

The metaphor here may be unclear in meaning at first, but it should be clear that this *is* a metaphor; after all, he does not literally battle the word with weapons. The important part of this metaphor is how it portrays the *struggle* he entered, comparing it to a battle.

**24. Answer: J. R204 Main Idea/Function: Paragraph; R101 Line Number**

It is important, in trying to understand passage A, to realize that the strategy being described is an entirely mental one. He does not have physical objects to remind him of the past; instead he latches onto words in this way. The three incorrect answers here all suggest some sort of physical interaction on his part, when in reality he is only using memory and imagination.

**25. Answer: C. R201 Detail**

This is a bit of a tricky question, because it is not immediately obvious what Bradbury means in the section in question. Thus, there are two parts to the process of answering: find the evidence in the text, and understand it. Do not be fooled by option **D** using the word *borrowed* like in the text: there is no indication that he used John for more than one story. And while **A** is similar in meaning, the text does not actually state that Bradbury grew up in Green Town. The only answer that is entirely supported by the text is **C**.

**26. Answer: G. R203 Inference/Assumption; R102 Paragraph Number**

This is another question in which the answer choices' key words will help identify a correct answer. Looking back at the paragraph in question, Bradbury's descriptions begin like earnest childlike praise but eventually grow to impossible scale, even calling John a god. This over-the-top description is the key to identifying the correct answer, which says he is *exaggerating*.

**27. Answer: C. R302 Organization of the Passage; R101 Line Number**

The image of the cloud is an example of the literary technique *foreshadowing*. That isn't because it's about a shadow, but because it suggests what is about to happen: in this case, the sudden change in weather from sunny to dark *foreshadows* the upcoming shift from carefree friendship to sadness at the news.

**28. Answer: J. R304 Both Passages; R203 Inference/Assumption**

For each option, ask yourself if it fits *both* passages. The narrator is easily checked, and is not consistent. There is nothing to suggest satire in these writings, and his sense of humor only shows in Passage A. Even if there is an allegory to be found here, there is no hint at a philosophical question, especially not in *both*. What remains is **J**, his use of detail and description. This is abundantly clear in Passage B, and looking back at Passage A you can find examples, too (such as lines 43-45).

**29. Answer: C. R304 Both Passages; R301 Main Idea/Function: Passage**

Answering this question requires a good understanding of the method described in Passage A. Hopefully you read it closely the first time and understood, but if not you may need to revisit the text. His method began with a word or phrase, and led to a story written around it by association. If the story in Passage B is one such story, it is very possible the words that led to it were "train ticket," and that **C** is a viable answer. Don't be thrown off by the hypothetical realm of this question; use what you know for sure about each passage to determine a logical conclusion.

**30. Answer: G. R304 Both Passages; R104 Big Picture**

When you first read this question, it is very intimidating. But if you look closely at it, it is another question that rests on your comprehension of the writing method described in Passage A. Look at each answer and evaluate it: **F** is about surprise, which is not relevant. **J** suggests he didn't use life experiences in his writing, which is completely false. The remaining options, **G** and **H**, may be difficult to decide between. The reason **G** is correct is because it is completely supported by the text: while Bradbury may have been emotionally involved as **H** implies, there is simply not enough evidence for this answer in the texts we are given.

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

The key word of the correct answer here is “overview,” because while other answers relate to one part of the passage, all these angles and more are represented in the text. Besides that, each incorrect answer can be individually discounted if you read the passage closely.

**32. Answer: G. R302 Organization of the Passage; R101 Line Number**

You can likely eliminate the last two answer choices quickly, because the tone is not combative and the author does not bring up personal anecdotes. The remaining choices can be difficult to discern, as they involve similar topics (sarcasm often indicates humor). The key is the second part of the answer, describing the passage as either “mostly casual and playful” or “primarily technical.” It should be clear that the passage is a technical one, given the scientific language and factual evidence.

**33. Answer: A. R202 Vocabulary in Context; R101 Line Number**

If you go back and look at the context in the passage, you will see that it refers to the ants’ ability to “penetrate” the “well-defended prey.” Which of the answer choices indicates something that can be penetrated? Only **A**.

**34. Answer: J. R201 Detail**

If you read closely, you likely will not need to double-check the answer here. Recall the comparison to an archer, and the brief explanation of stored energy. If you aren’t sure, skim back through the text to find the answer.

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

This question is asking you to understand an analogy. How are the ants like popcorn? First, look at the answer choices and see which could be related to popcorn at all: really only **A** and **D**. Now which of these also relates to the ants? There is no mention in the text of them generating heat, but plenty of description of their ability to jump. The correct answer is **D**.

**36. Answer: H. R204 Main Idea/Function: Paragraph; R201 Detail**

Look back at the last paragraph. Line 86 says the jumping in question “must have arisen from a different, perhaps accidental kind of behavior.”

**37. Answer: B. R202 Vocabulary in Context; R101 Line Number**

Look at the context! More than one answer choice is a correct definition of “domain,” but only one is relevant to the usage in the text. The introduction of an expert should be a strong clue that the correct answer is **B**.

**38. Answer: J. R201 Detail**

If you do not remember the answer from your first reading, go back through and look for keywords to find this detail. The correct answer is found in lines 49-51.

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

This is another question asking you to find a detail in the text. You may remember **A** from your first reading, but if not you should be careful not to spend too much time reviewing the text, because this question does not give you much to look for. Instead, read the answer choices closely *then* skim the passage, looking for anything related to those answers.

**40. Answer: H. R201 Detail**

Find the part of the text discussing this subject. You may notice the quotation marks around “bouncer defense” in line 73. Looking at the context, a few lines earlier the maneuver is described in detail, indicating how both the ant and the interloper are propelled in opposite directions.

## Science Test

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

On Figure 1, all lines reach zero (x-axis) before 75 days. On Figure 2, only the 5% SY medium (line with circles) does not reach zero before 75 days.

**2. Answer: G. S101 Text: Experimental Design**

The second paragraph of the text states that female flies were used in the experiment. Females alone cannot reproduce, so the birth rate must be 0.

**3. Answer: D. S102 Text: Experimental Parameters**

Both the graph keys and the text state that Study 1 used 15% SY medium and Study 2 used 5% SY medium. The text explains that the percent SY medium refers to the percentage of sugar and yeast. Thus, the two experiments differ by the percentage of yeast in the medium, and Study 2 has a lower percentage.

**4. Answer: G. S306 Table: Infer**

12% falls in between 10% and 15%. The Strain X row of the table shows 10% medium has an average lifespan of 58.6 days and 15% medium has an average lifespan of 55.6 days. Thus, the Strain X flies in 12% medium would have an average life span between 55.6 days and 58.6 days.

**5. Answer: C. S302 Table: Data Point**

The text states that Strain X flies cannot detect odors very well. The prediction states that decreasing odor detection would increase life span. Table 1 shows that Strain X, with less odor detection, has a longer lifespan than Strain N, in every trial, which is consistent with the prediction.

**6. Answer: F. S102 Text: Experimental Parameters**

Study 1 uses 15% SY medium, with normal flies. The question describes the same parameters of Study 1, except for the flies that are unable to detect odors (Strain X).

**7. Answer: A. S101 Text: Experimental Design**

According to the text, only Tube 1 and Tube 4 did not have additional odors or live yeast.

**8. Answer: F. S100 Text**

According to the text of Hypothesis 1, butterflies "first store lipids before they begin their migration" and then "must store lipids again" later, which describes two distinct periods.

**9. Answer: D. S100 Text**

In Hypotheses 1 and 2, the butterflies use energy from stored lipids during migration and Hypothesis 3 states that butterflies use stored lipids for energy during the overwintering period.

**10. Answer: J. S108 Text to Data**

Hypothesis 3 states that "lipid mass continuously increases from the beginning of migration to the end of migration", so the correct graph must have a line with a steady upwards (positive) slope.

**11. Answer: C. S100 Text**

The statement in the question states implies that the mass of stored lipids decreases during migration, meaning that butterflies are converting stored lipids to energy during migration. Hypotheses 1 and 2 state that butterflies use stored lipids for energy during migration.

**12. Answer: F. S100 Text**

Nectar must be present at the overwintering sites if the butterflies are storing lipids during overwintering. Only Hypothesis 1 states that butterflies store lipids during overwintering. Hypotheses 2 and 3 specifically state that the butterflies do not store more lipids during overwintering.

**13. Answer: B. S100 Text**

Hypotheses 1 and 2 state that lipid mass decreases during migration. Hypothesis 3 states that lipid mass increases during migration. Thus, all three hypotheses state that butterflies' lipid mass changes during migration.

**14. Answer: F. S200 Science Knowledge**

Cells use energy from the energy-rich molecules called ATP (adenosine triphosphate).

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

In Figure 2, solar radiation is represented by the dashed line. At 8 thousand years before present (two vertical lines to the right of the 10), the dotted line crosses 500.

**16. Answer: F. S317 XY Graph: Extrapolate**

In Figure 2, if  $\text{CH}_4$  (solid line) had matched the solar radiation line (dashed line), it would've decreased to approximately where the solar radiation line hits the right side of the graph, which is definitely less than 550.

**17. Answer: B. S319 XY Graph: Correlation**

In Figure 2,  $\text{CH}_4$  (solid line) decreases then increases from 11 thousand years ago to 0 thousand years ago. The only graph to show a decrease then increase is B.

**18. Answer: H. S202 Science Math: Average; S313 XY Graph**

In Figure 1, the average (which can be estimated by the middle) of solar radiation (dashed line) is around 480.

**19. Answer: B. S314 XY Graph: Data Point**

In Figure 1, the length of time from one maximum (highest point) to the next maximum for solar radiation (dashed line) is slightly more than 2 vertical lines, which is slightly more than 20 thousand years (between 15,000 and 35,000 years).

**20. Answer: J. S200 Science Knowledge**

Radiation enters the atmosphere from the sun and is absorbed through the sun. The Earth radiates the heat back outwards at a longer (weaker) wavelength, where it is unable to escape the atmosphere because it is blocked by greenhouse gases ( $\text{CH}_4$ ,  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ).

**21. Answer: D. S200 Science Knowledge**

Friction acts in the direction opposite to movement, so if a block is pulled towards the east, friction acts to the west.

**22. Answer: F. S314 XY Graph: Data Point**

In Figure 2, the 2.00 kg block reaches 15 first, then the 2.50 kg block, and then the 3.00 kg block.

**23. Answer: B. S201 Science Math; S200 Science Knowledge**

Acceleration is the rate of change of velocity/speed, or  $\text{Acceleration} = (\text{final velocity} - \text{initial velocity})/\text{time}$ . For the 3.00 kg block,  $\text{Acceleration} = (15.00 - 0)/3.00 = 5.0$ .

**24. Answer: J. S205 Science Math: Pick Linear Function**

The final point on Figure 1 has a pulling force of 20 and a mass of 4. The only equation that fits these numbers is J.

**25. Answer: B. S314 XY Graph: Data Point**

For each point in Figure 2, the blocks with greater mass moved with lower speed (more slowly). For example, after 3.00 seconds, the 2.00 kg block was moving at 30.00 m/sec but the 3.00 kg block was moving at 15.00 m/sec. Thus, as block mass increased, block speed decreased.

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

In Figure 1, when the pulling force was 10.00 N, the block mass was 2.00 kg. When the pulling force is doubled to 20.00 N, the block mass is also doubled to 4.00 kg. Thus, if the pulling force were tripled to 30.00 N, the block mass would also triple, to 6.00 kg.

**27. Answer: A. S101 Experimental Design**

The text and Table 2 both state that Experiment 2 was done with solutions that had a known pH, whereas the text states that Experiment 3 was done with solutions of unknown pH.

**28. Answer: J. S105 Text: Infer**

The liquids of all colors would be easiest to see on a white plate.

**29. Answer: C. S306 Table: Infer**

In Table 1, curcumin is the yellow for all liquids, so the transition must be at a pH of greater than 7. In Table 2, curcumin is orange at a pH of 8 and red for all other solutions, so the transition is at a pH of around 8 (7.4-8.6).

**30. Answer: F. S306 Table: Infer**

In Table 1, indigo carmine is blue at both 1 and 6, so could not be used to distinguish between the two solutions.

**31. Answer: B. S306 Table: Infer**

According to the question, propyl red has a transition around 5. In Table 1, resorcin blue has a transition around 5-6.

**32. Answer: G. S301 Table**

Solution III is red with resorcin blue. In Table 1, resorcin blue is red for a pH of 4 or lower, so Solution III must have a pH of 4 or lower.

**33. Answer: D. S306 Table: Infer**

In Table 1, metanil yellow is orange at a Ph of 2 and yellow at a pH of 3 or greater. Solution IV is orange in metanil yellow, whereas the others are yellow, so solution IV must have a pH of 2 and the others must have a pH greater than 2.

**34. Answer: J. S200 Science Knowledge**

At noon, incoming solar radiation is the most intense.

**35. Answer: A. S101 Experimental Design**

In the study, type of vegetation and density of vegetation cover are both held constant, so the only variable is the amount of DM sprayed.

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

In Figure 1, the lines for all three plots take a sharp turn down between July 25 and July 27. This fits the scenario in the question in which there is a measurement taken on July 25, no measurement taken on July 26, and then a lower measurement taken on July 27.

**37. Answer: B. S102 Experimental Parameters; S201 Science Math**

In the paragraph at the top of the second column, the text states that the sensor records data every 5 sec. Since there are 60 sec in a min, the sensor records data 12 times per minute.

**38. Answer: F. S314 XY Graph: Data Point; S101 Experimental Design**

In the last paragraph of the first column, the text states that albedo is calculated for each cloudless day. Figure 1 has no data points on July 20, so it must not have been a cloudless day.

**39. Answer: D. S316 XY Graph: Increase/Decrease**

Plot 1 (line with circles) had no DM and Plot 3 (line with triangles) had the most DM. In Figure 1, Plot 1 always has higher albedo than Plot 3, so albedo decreases with DM. In Figure 2, Plot 1 is always lower than Plot 3, so temperature increases with DM.

**40. Answer: J. S108 Text to Data; S314 XY Graph: Data Point**

In Figure 1, the albedo on August 3 at Plot 2 (line with squares) was around 0.20. According to the text, albedo is the proportion of radiation reflected, so 20% of radiation was reflected. This leaves 80% of radiation NOT reflected.