ANSWER KEY

English Test

1. B	21. A	41. B	61. D
2. G	22. F	42. H	62. G
3. C	23. D	43. A	63. A
4. J	24. F	44. J	64. J
5. A	25. B	45. C	65. C
6. G	26. F	46. J	66. J
7. B	27. D	47. A	67. B
8. J	28. G	48. G	68. J
9. B	29. A	49. A	69. B
10. F	30. F	50. H	70. F
11. D	31. D	51. A	71. D
12. J	32. F	52. H	72. G
13. A	33. A	53. D	73. D
14. G	34. H	54. H	74. H
15. C	35. A	55. A	75. A
16. G	36. F	56. J	
17. A	37. A	57. B	
18. J	38. J	58. F	
19. B	39. D	59. A	
20. F	40. F	60. J	

Mathematics Test

1. C	21. A	41. D
2. J	22. H	42. G
3. C	23. E	43. A
4. G	24. J	44. F
5. B	25. C	45. D
6. H	26. K	46. G
7. C	27. C	47. D
8. G	28. G	48. F
9. B	29. A	49. D
10. J	30. H	50. J
11. C	31. D	51. E
12. F	32. K	52. H
13. D	33. D	53. D
14. G	34. F	54. G
15. B	35. B	55. E
16. G	36. J	56. K
17. E	37. E	57. D
18. J	38. G	58. F
19. C	39. C	59. B
20. F	40. H	60. H

Reading Test

1. B	21. B
2. F	22. H
3. C	23. A
4. F	24. H
5. D	25. D
6. H	26. H
7. A	27. A
8. G	28. J
9. A	29. D
10. J	30. G
11. B	31. A
12. G	32. J
13. D	33. D
14. F	34. G
15. C	35. C
16. F	36. H
17. C	37. B
18. G	38. F
19. D	39. C
20. J	40. J

Science Reasoning Test

1. B	21. C
2. H	22. H
3. D	23. C
4. F	24. J
5. A	25. C
6. J	26. F
7. B	27. A
8. F	28. G
9. B	29. B
10. J	30. G
11. A	31. A
12. H	32. J
13. C	33. A
14. F	34. G
15. C	35. C
16. J	36. G
17. D	37. C
18. H	38. J
19. B	39. C
20. J	40. J

SCORING GUIDE

Your final reported score is your COMPOSITE SCORE. Your COMPOSITE SCORE is the average of all of your SCALE SCORES.

Your SCALE SCORES for the four multiple-choice sections are derived from the Scoring Table on the next page. Use your RAW SCORE, or the number of questions that you answered correctly for each section, to determine your SCALE SCORE. If you got a RAW SCORE of 60 on the English test, for example, you correctly answered 60 out of 75 questions.

Step 1 Determine your RAW SCORE for each of the four multiple-choice sections:

English _____

Mathematics _____

Reading _____

Science Reasoning _____

The following Raw Score Table shows the total possible points for each section.

RAW SCORE TABLE	
KNOWLEDGE AND SKILL AREAS	**RAW SCORES**
ENGLISH	75
MATHEMATICS	60
READING	40
SCIENCE REASONING	40
WRITING	12

Multiple-Choice Scoring Worksheet

Step 2 Determine your SCALE SCORE for each of the four multiple-choice sections using the following Scoring Worksheet. Each SCALE SCORE should be rounded to the nearest number according to normal rules. For example, 31.2 ≈ 31 and 31.5 ≈ 32. If you answered 61 questions correctly on the English section, for example, your SCALE SCORE would be 29.

English _____ (RAW SCORE) × 36 = _____ ÷ 75 = _____

− 2 (*correction factor)

_____ (SCALE SCORE)

Mathematics _____ (RAW SCORE) × 36 = _____ ÷ 60 = _____

+ 1 (*correction factor)

_____ (SCALE SCORE)

Reading _____ (RAW SCORE) × 36 = _____ ÷ 40 = _____

+ 2 (*correction factor)

_____ (SCALE SCORE)

Science Reasoning _____ (RAW SCORE) × 36 = _____ ÷ 40 = _____

+ 1.5 (*correction factor)

_____ (SCALE SCORE)

*The correction factor is an approximation based on the average from several recent ACT tests. It is most valid for scores in the middle 50% (approximately 16–24 scale composite score) of the scoring range.

The scores are all approximate. Actual ACT scoring scales vary from one administration to the next based upon several factors.

If you take the optional Writing Test, you will need to combine your English and Writing scores to obtain your final COMPOSITE SCORE. Once you have determined a score for your essay out of 12 possible points, you will need to determine your ENGLISH/WRITING SCALE SCORE, using both your ENGLISH SCALE SCORE and your WRITING TEST SCORE. The combination of the two scores will give you an ENGLISH/WRITING SCALE SCORE, from 1 to 36, that will be used to determine your COMPOSITE SCORE mentioned earlier.

Using the English/Writing Scoring Table, find your ENGLISH SCALE SCORE on the left or right hand side of the table and your WRITING TEST SCORE on the top of the table. Follow your ENGLISH SCALE SCORE over and your WRITING TEST SCORE down until the two columns meet at a number. This number is your ENGLISH/WRITING SCALE SCORE and will be used to determine your COMPOSITE SCORE.

Step 3 Determine your ENGLISH/WRITING SCALE SCORE using the English/Writing Scoring Table on the following page:

English _____

Writing _____

English/Writing _____

Step 4 Determine your COMPOSITE SCORE by finding the sum of all your SCALE SCORES for each of the four sections: English only (if you do not choose to take the optional Writing Test) *or* English/Writing (if you choose to take the optional Writing Test), Math, Reading, and Science Reasoning, and divide by 4 to find the average. Round your COMPOSITE SCORE according to normal rules. For example, $31.2 \approx 31$ and $31.5 \approx 32$.

_____	+	_____	+	_____	+	_____	=	_____
ENGLISH *OR* ENGLISH/WRITING SCALE SCORE		MATHEMATICS SCALE SCORE		READING SCALE SCORE		SCIENCE SCALE SCORE		SCALE SCORE TOTAL

_____	÷	4	=	_____
SCALE SCORE TOTAL				COMPOSITE SCORE

ANSWERS AND EXPLANATIONS

English Test Explanations

PASSAGE I

1. **The best answer is B.** In this sentence, the word "obsessed" is most appropriate to describe the action taking place. The word "obsessive" can be used as an adjective. The participle "obsessing" is not appropriate, and "obsessioned" is not a word, so answer choices C and D can be eliminated.

2. **The best answer is G.** Answer choice G is the most clear and concise, because it simply uses the verb "pay." As it is written, the sentence is wordy and redundant. Answer choice H, "paying money," sounds awkward and is grammatically incorrect in conjunction with the phrase that precedes it, "is willing to." Answer choice J is written in the past tense while the rest of the sentence is written in the present tense and, therefore, must be eliminated.

3. **The best answer is C.** Answer choice C is grammatically correct and makes sense idiomatically. Answer choices A and B indicate that natural redheads actually want to possess brunettes, which does not make sense. Answer choice D does not make sense and is not correct for standard written English.

4. **The best answer is J.** The first part of the sentence and the second part of the sentence are independent clauses that refer to different hairstyles. Answer choice J, "and," makes most sense here. Answer choice G, "however," requires punctuation to fit in the sentence (normally between commas). Answer choice F implies that teenagers enjoy experimenting with their hair as a result of men and women cringing at the sight of gray hair. Answer choices G and H imply that the two phrases negate each other.

5. **The best answer is A.** The correct preposition to use here is "of." The phrase "result of" is idiomatic.

6. **The best answer is G.** This answer choice correctly precedes the verb "mixing" with its modifier "rapidly."

7. **The best answer is B.** The sentence does not have a natural pause at this point in the sentence, so a comma is inappropriate. In addition, you can eliminate answer choices A and D. A colon should be used after a complete statement to introduce directly related information, such as a list or an example, so answer choice C should be eliminated.

8. **The best answer is J.** The word "was" makes the most sense in the sentence, because it clearly and simply indicates the past tense. The phrase "could of become" can never be correct. "Could of been" is not appropriate in standard written English. Some people incorrectly use "could of" when they should use "could've," which is the contraction of "could have."

9. **The best answer is B.** The sentence is composed of a main clause ("The monthly highlighting went well") followed by a subordinator ("except for"), then an extended noun phrase ("those times when my hair turned out a little too subdued, making me look partially gray instead of brunette."). Especially as it is preceded by a subordinator, such a lengthy component of the sentence calls to be offset by a comma.

10. **The best answer is F.** The sentence as it is written makes the most sense in context. It sufficiently indicates that, despite some setbacks, the author's experience with highlights has been mostly positive. Answer choice G implies that the author was making some sort of list regarding her and her feelings towards her highlights. Answer choice H indicates some sort of contrast that is simply not present in the paragraph. Answer choice J suggests that the hairdresser's mistakes pleased the author.

11. **The best answer is D.** Sentence 5 follows from the information in Sentence 3. Likewise, Sentence 4 relies on Sentence 5, and also creates a good transition into the next paragraph.

12. **The best answer is J.** To maintain parallel tense in the sentence, since Donna "was" surprised at the author's request, the simple past tense of the verb "gather" also needs to be used. The sentence is written in the present tense; therefore answer choice F can be eliminated. Answer choices G and H are not in the parallel tense.

13. **The best answer is A.** The coordinating conjunction "and" is the most concise choice; it joins two functionally parallel elements within the

sentence—here, two nouns: "tears" and "laughter." The phrases "along with" and "as well as" serve a similar function to the coordinating conjunction "and," but they are awkward and neither clear nor concise. Answer choice C is incorrect because "or" does not make sense in this context with "seesawing."

14. **The best answer is G.** Since the preceding sentence does not summarize the essay or relate to the introduction, answer choices F and H can be eliminated. This sentence is specifically about the narrator ceasing her crying, which is not the purpose of the essay. Eliminate answer choice J. The realization of her vanity puts her situation in perspective; therefore, answer choice G is the best answer.

15. **The best answer is C.** The passage simply discusses the narrator's experiences in dyeing her own hair. It is unlikely that the author's decision to change her hair color would ease the apprehension of others who were considering dyeing their hair. The fact that dyeing her hair gave her a bald spot would probably deepen the fears of those who were feeling anxious about dyeing their hair. Eliminate answer choice A. Answer choice B can also be eliminated; the passage only discusses the author and other "mature" women dyeing their hair. Answer choice D is incorrect because the passage as a whole is neutral and does not attempt to influence people regarding changing hair color.

PASSAGE II

16. **The best answer is G.** Answer choice G is a common phrase, and sounds the best in the context of this sentence. It is appropriate to use "American" as an adjective to describe the noun "heritage." The other answer choices are grammatically incorrect. Also, answer choice J suggests that the "heritage" belongs to only one "American," which does not fit the context of the paragraph.

17. **The best answer is A.** To state that Walker Lee "still practices" is clear and concise. Answer choices B and C are wordy and redundant in saying that Lee "still continues to practice" and "continues to still practice." Answer choice D is awkward.

18. **The best answer is J.** This passage is written in the past tense. "Began" is the simple past form of the verb "begin," therefore answer choice J is correct. Answer choice F is written in the past perfect tense, and therefore does not maintain the parallel between verbs. Answer choices G and H use "begun," the past participle of "begin," and can therefore be eliminated.

19. **The best answer is B.** The phrase "that being iron" does not make sense. The rest of the answer choices correctly use parentheses or commas in setting off their respective appositive phrases.

20. **The best answer is F.** The word "lugging" is the most descriptive word. It signifies carrying or pulling something heavy. None of the other answer choices addresses the effort it took to move the anvil from Pennsylvania to Michigan.

21. **The best answer is A.** The phrase "get started" in answer choice A clearly indicates that Lee was just beginning his career in blacksmithing. The other answer choices suggest that his career had already started.

22. **The best answer is F.** In the context of the sentence, "its" is in the possessive form; therefore, no apostrophe is necessary. "It's" means "it is." "Its"' (note the apostrophe *at the end*) does not exist in English beacuse "it" is a singular pronoun.

23. **The best answer is D.** Omitting the underlined portion of the sentence is the best choice in this instance. In any form, the information provided in this sentence is distractive—not related to the main topic of the essay—and is therefore unnecessary.

24. **The best answer is F.** Answer choice F provides a logical and relevant introduction to the topic of the paragraph. Answer choice H is incorrect because the paragraphs preceding and following this sentence have nothing to do with moving equipment. Answer choices G and J can be eliminated because neither has anything to do with the construction of Lee's first blacksmith shop, the subject of the paragraph.

25. **The best answer is B.** This answer choice is correct because it is the only one that is grammatically proper and makes sense. Answer choice A does not make sense because "but" is used to introduce a contradictory element; a "crude" structure standing "only nine years" appears to be instead a correlational relationship. Answer choice C is ungrammatical and D violates tense agreement with "was."

26. **The best answer is F.** If two adjectives modify a noun in the same way, they must either be separated by a comma or joined with the word "and" with no comma.

27. The best answer is D. The phrase "at a family event" is a descriptive phrase that must be set off by commas. Answer choice C is incorrect because subject and verb must not be separated by a comma. Similarly, in B, a comma makes an incorrect division of a compound.

28. The best answer is G. The act of proclaiming took place during the event, so it is a completed action and should be in the past tense.

29. The best answer is A. The information given in Sentence 2 merely describes the knife from the preceding sentence, and has nothing to do with the creation of Lee's first object.

30. The best answer is F. No specific person or point in time is mentioned, and the remainder of the sentence is written in the present tense. Thus, the present tense of the verb "watch" must be used.

PASSAGE III

31. The best answer is D. Using the past tense verb "began" makes the most sense because the narrator is recalling what *happened* when she *heard* the story.

32. The best answer is F. Answer choice F correctly places a comma following the clause that begins with the subordinator "As," which describes what happened that caused the narrator's eyes to pop out of her head and her jaw to drop. Answer choice G creates a run-on sentence. Answer choices H and J incorrectly place commas following the word "could," which creates awkward and ungrammatical sentences.

33. The best answer is A. An easy way to figure out the answer to this question is to look at the preceding sentence. In that sentence, the narrator says, "I could." To maintain verb parallelism in the paragraph, the phrase "I could" should be repeated.

34. The best answer is H. In this sentence, the word "that" is unnecessary, because the normal clause-introducing function of the word "that" is satisfied by "how." Answer choice G is wrong because "because" does not make sense after "about." Answer choice J lacks a clause-introducer.

35. The best answer is A. This question tests your ability to maintain parallel structure in a sentence. Each verb in the sequence of events is written in the past tense. Since the sister's husband "*threw* back the bedcovers" and "*began* beating the dreaded thing with a broom," he would have to have "*flushed*" it down the toilet.

36. The best answer is F. This part of the sentence requires a verb, so you can eliminate answer choice J. The adjective "deadly" is used to describe the scorpions. If the word "deadlier" is used, the word "more" cannot precede it; therefore, answer choice G can be eliminated. The comma before "and" indicates the phrase preceding it must be an independent clause, meaning one that contains a verb phrase that could stand alone in a sentence. The gerund ("-ing") form violates this test.

37. The best answer is A. This answer choice gives a logical explanation for why Diana would not seek professional help as the condition of her arm continued to worsen. The remaining choices are not supported by the context.

38. The best answer is J. This question tests your ability to express yourself clearly and simply. Because the sentence states that scorpions will sting anyone they *accidentally* encounter, using the word "inadvertently" would be redundant and unnecessary. The word "crawl" is the clearest and most concise choice.

39. The best answer is D. This question tests your ability to accurately create the possessive form of words. In this case, the narrator is talking about the homes of many scorpions instead of the home of one specific scorpion. The plural possessive form of scorpion, "scorpions'," must be used. To make a plural word possessive, you must place an apostrophe after the pluralizing "s."

40. The best answer is F. Answer choice G is awkward because its components are not written in logical order. Answer choice H places an unnecessary comma after the word "species." Answer choice J is ambiguous as to whether the "ninety species" in question constitute all the world's scorpions or just those native to the United States.

41. The best answer is B. In this part of the sentence, the word "which" introduces a clause descriptive of the noun that precedes it, "the Bark Scorpion."

42. The best answer is H. This question tests your ability to discern which details are important to the subject of an essay. In this case, the author previously mentioned that scorpions can be found in the home, and it is obvious that they still live outside. The underlined portion reinforces the notion that scorpions can be found both inside the home and outside the home.

43. The best answer is A. This sentence follows a standard verb pattern for hypothetical situations. "If" begins a clause in simple present tense, which precedes a clause in the imperative (command) form. For example, "If you *swim* today, *apply* sunscreen."

44. The best answer is J. This question requires you to put things in logical order, and to decide whether the underlined portion is relevant to the paragraph. In this case, it is best to omit the underlined portion because it does not add any necessary information to the paragraph; it is an irrelevant detail. The rest of the sentences are already in the most logical order.

45. The best answer is C. Answer choices A and B can be eliminated immediately because the simple answer to the question is no. This essay does not provide professional advice on the treatment of scorpion stings. The essay is merely a recollection of a time when the narrator's sister was stung by a scorpion and the narrator is offering advice based solely on personal experience and opinion.

PASSAGE IV

46. The best answer is J. Answer choice F is incorrect because dashes should only be used to place special emphasis on a certain word or phrase in a sentence, which is unnecessary here. Answer choice G is incorrect because the preceding phrase is not an independent clause, thus must not be separated by a semicolon. Answer choice H is incorrect because it creates a run-on sentence. Answer choice J correctly identifies the fact that the word "if" begins a clause that must be separated from the rest of the sentence by a comma wherever the clause ends. In this case, the second clause clearly begins with repetition of the subject "you."

47. The best answer is A. This is the most clear and concise answer choice. The others are awkward. Answer choice C is incorrect because "always" modifies "accompany" and must, in this case, precede it. Answer choice D does not include the word "always," which causes the sentence to lose a key detail.

48. The best answer is G. "Non-compliance" describes the wrong each side feels the other committed, thus the lawsuits assert "non-compliance on both sides." This eliminates all answer choices except answer choice G.

49. The best answer is A. Answer choice B uses an unnecessary comma. Answer choices C and D can be eliminated because they are incorrect as idiomatic phrases.

50. The best answer is H. In this case, the word "promised" is used as an adjective. Thus, answer choices F and G can be eliminated. Answer choice J is an adjective, but the definitions of "promised" and "promising" differ. The reward was assured, or promised, to Helga. It was not likely to develop nor did it show potential, both aspects of the definition of "promising," thus answer choice J can be eliminated.

51. The best answer is A. Answer choice B creates an incomplete sentence, so it can be eliminated. Since the action was continuously occurring in the past, you would say that she "had been living."

52. The best answer is H. Answer choice J can be eliminated because the underlined portion is preceded by the article "a." The article "the" must precede the word "greatest." Since "reward" serves correctly as a noun in this sentence, answer choices F and G can be eliminated. A "great reward," answer choice H, is the best and most reasonable choice.

53. The best answer is D. Sentence 1 explains how Helga became interested in the contest, so it must be first. This eliminates answer choice C. It makes sense that the requirements would be listed next and that the comments about the bicycle skirt would follow. The last sentence, Sentence 4, explains why Helga decided to make the journey despite the embarrassment of wearing a bicycle skirt.

54. The best answer is H. The actions of Helga and her daughter should be written in the simple past tense in order to maintain verb parallelism throughout the paragraph. Answer choice J is in the past tense, but it is wordy. "Have," in any form, is not necessary to this phrase.

55. The best answer is A. This answer choice is the clearest and most concise. The other choices are wordy and awkward.

56. The best answer is J. "Nowhere to be found" is a common idiomatic phrase, making it the most clear and concise choice. The other answer choices are awkward.

57. The best answer is B. Answer choice A indicates that the following sentence is a result of what comes before. In this case, the phrases are not causally connected, so answer choice A is incorrect. Answer choice C is awkward and answer choice D is wordy. The phrase "in fact" is not necessary to

this passage. Answer choice B is the clearest and most concise choice.

58. The best answer is F. The words "leaving only" begin a descriptive clause, which must be set off by a comma. Answer choice G creates a run-on sentence. Semicolons must be used to separate two independent clauses; therefore, answer choice H is incorrect. Answer choice J uses a comma incorrectly, separating "only" from the phrase it modifies.

59. The best answer is A. Answer choice A gives a specific reason as to what Helga intended to use the $10,000 prize for. The passage clearly states that without this prize money, the Estby farm would face foreclosure. Answer choice B simply restates the fact that Helen wanted the $10,000 she would win if she completed the cross-country walk, but does not explain what she would use the money for. Answer choice C is incorrect because no logical connection between the prize money and the children's diphtheria is made in the passage. Answer choice D is outside the scope of the passage as well; there is no mention of Clara gaining experience anywhere in the passage.

60. The best answer is J. Answer choices F and G are incorrect because the writer should not make this addition to the passage; it is irrelevant. Answer choice H identifies an unimportant detail of the great-great-grandson's story as the reason the sentence does not belong.

PASSAGE V

61. The best answer is D. Appositives, like "particularly via airplane," must be separated from the sentence by commas. They are easily identified because they can be omitted from the sentence without rendering the sentence ungrammatical.

62. The best answer is G. Because the author wishes to add more detail, the best answer choice will be the one that includes the most descriptive language. Answer G is the best alternative because it includes the explanatory detail "also known as jet lag" and correctly sets it apart with commas.

63. The best answer is A. The sentence identifies jet lag as a "sleeping disorder," but the word "although" indicates that what follows are mitigating factors. First, jet lag is a "temporary condition" and second, jet lag is "not as serious" as other sleeping disorders. Answer choice B appears to define correctly the lack of seriousness, but is missing the critical first "as" to make a comparison.

64. The best answer is J. Before a term is defined, its relevance to the passage must be stated. Furthermore, among the other answer choices, circadian rhythms are not specifically mentioned.

65. The best answer is C. While the sentence as it is written may be grammatical, its use of punctuation is excessive. Answer choice C provides a fluid, concise transition to the details of the human "sleeping and waking" cycle.

66. The best answer is J. This sentence elaborates on the statement from the previous sentence by citing an example. It does not provide supplementary (Answer choice F: "In addition"), parallel (G: "Likewise"), or opposing (H: "Instead") evidence.

67. The best answer is B. It is appropriate to use the plural possessive pronoun "our" when referring to the inner clocks of human beings.

68. The best answer is J. The sentence introduces a factor adversely affecting circadian rhythms, which does not require additional transition words. Answer choices F and H create incomplete sentences.

69. The best answer is B. "Well-tuned" stands by itself as a satisfactory idiomatic expression meaning "optimized." Introducing "high" or "highly" makes the sentence unnecessarily wordy.

70. The best answer is F. Answer choices G and H may be eliminated for their wordiness. Answer choice J may be eliminated because it makes too strong an assertion about the link between long air travel and headaches. Answer choice F correctly uses "Often" to define the frequency of passengers' headaches.

71. The best answer is D. As it is written in the passage, this verb phrase is wordy, as it is written in passive voice ("being"). This same principle eliminates answer choice B. Answer choice C may be eliminated for its unnecessary use of commas.

72. The best answer is G. When adjectives modify a noun in a similar way, they are separated from each other with commas or "and," just as in a list. Therefore, there must be a comma between "dry" and "pressurized." It is not necessary to include a comma after "pressurized," because it is followed directly by the noun that is being modified (atmosphere).

73. The best answer is D. Using a comma to join independent clauses creates a comma splice. The other

choices present several acceptable ways to separate independent clauses.

74. The best answer is H. This answer choice mentions the body's "new environment." Logical places for the sentence, thus, would be after the technique cited for acclimating to eastbound travel (before Sentence 4) and after the technique cited for acclimating to westbound travel (after Sentence 5). Choice H corresponds to the latter location, "before Sentence 6."

75. The best answer is A. This sentence would provide a reason why understanding ways to correct jet lag—which is the focus of the essay—is important. It follows that the sentence would be placed after the assertion that jet lag is considered a minor sleep disorder.

Mathematics Test Explanations

1. **The correct answer is C.** To find the total distance in miles that Shannon walked, add $1\frac{2}{3}$ and $2\frac{3}{5}$. To add mixed numbers, find the least common denominator. The least common denominator of 3 and 5 is 3×5, or 15. To convert $\frac{2}{3}$, multiply by $\frac{5}{5}$ (*hint:* $\frac{5}{5} = 1$, and multiplication by 1 does not change the value of a number). The result is $\frac{10}{15}$. To convert $\frac{3}{5}$, multiply by $\frac{3}{3}$. The result is $\frac{9}{15}$. To add $1\frac{10}{15}$ and $2\frac{9}{15}$, first add 1 and 2 and then $\frac{10}{15}$ and $\frac{9}{15}$. The result is $3\frac{19}{15}$, which reduces to $4\frac{4}{15}$.

   Answer choice A is the most popular incorrect answer and comes from adding the whole numbers and then adding the numerators and the denominators separately.

2. **The correct answer is J.** To find an equivalent expression, multiply the constants ($4 \times 3 \times 2 = 24$), combine the x terms ($x^3 \times x \times x) \rightarrow x^{3+1+1} \rightarrow x^5$, and combine the y terms ($y^2 \times y^2 \rightarrow y^{2+2} \rightarrow y^4$). The result is $24x^5y^4$.

   The most common incorrect answers are F and H, which come from multiplying the exponents of the x and y terms instead of adding them. If you chose G, you probably added the constants instead of multiplying them.

3. **The correct answer is C.** To find Mr. Wilk's pay per day, divide his annual salary, \$33,660, by the total number of days he works, 180. His pay per day is $\frac{33{,}660}{180}$, or \$187. When Mr. Wilk takes a day off without pay and the school pays a substitute \$85, the school district saves the difference in these amounts, 187−85, or \$102.

   Answer choice E, the most common incorrect answer, is simply Mr. Wilk's pay per day and not the difference between his pay and a substitute's pay.

4. **The correct answer is G.** To find the score on the fifth 100-point test that will yield an average score of 80, first calculate the total of the four scores already obtained: $63 + 72 + 88 + 91 = 314$. To obtain an average of 80 on 5 tests, the total score of all 5 tests must be 80×5, or 400. The score needed on the last test is equivalent to $400 - 314$, or 86.

   Answer choice A is the average of the 4 scores, rounded to the nearest whole point.

5. **The correct answer is B.** To find the oxygen saturation level, divide the current number of milligrams per liter by the capacity milligrams per liter: $\frac{6.4}{9.5}$. Convert the result (0.6737) into a percent by multiplying by 100: 67.37% is approximately equal to 67%.

6. **The correct answer is H.** To find the length of fence needed to surround a rectangular lot 125 feet by 185 feet, calculate the perimeter. The formula for perimeter of a rectangle is 2 times the sum of the length and width, or $P = 2(l + w)$. Calculate the perimeter as follows: $2(125 + 185) = 2(310)$, or 620.

7. **The correct answer is C.** To find an equivalent expression, simply distribute the a, as follows: $ab - ac + ad$. Remember to keep track of the negative sign.

8. **The correct answer is G.** To solve for x in the equation $6x - 3 = -5x + 7$, add $5x$ and 3 to both sides of the equation, which results in the equation $11x = 10$. Divide both sides by 11, which results in $x = \frac{10}{11}$.

9. **The correct answer is B.** These four numbers will form an arithmetic sequence, a sequence in which each pair of successive terms differs by the same number. To find the difference, define d as that difference, 13 as the first term, and 34 as the fourth term. By definition, the second term is $13 + d$. The fourth term, 34, can also be written as $(13 + d + d) + d$. Using that expression, obtain the equation $34 = 13 + d + d + d$, or $34 = 13 + 3d$. After subtracting 13 from both sides, divide by 3, which results in $7 = d$. The difference is 7. Thus the second term is $13 + 7$, or 20, and the third term is $20 + 7$, or 27.

10. **The correct answer is J.** To calculate the value of $x^2 + \sqrt{x}$, first solve $x^3 = 729$ for x. The solution is the cube root of 729, which is 9. Substitute 9 into the original expression, arriving at $9^2 + \sqrt{9}$. This expression simplifies to $81 + 3$, or 84.

11. **The correct answer is C.** To find the volume, substitute $\frac{4}{3}$ for r in the equation $V = \left(\frac{4}{3}\right)\pi r^3$ as follows:

$$\left(\frac{4}{3}\right)\pi\left(\frac{4}{3}\right)^3$$

$$= \left(\frac{4}{3}\right)\pi\left(\frac{64}{27}\right)$$
$$= \left(\frac{256}{81}\right)\pi$$

Recall that π = approx. 3.14, so $\left(\frac{256}{81}\right)(3.14)$ is about 9.92, or 10 when rounded to the nearest cubic inch.

12. The correct answer is F. The probability that the gumball chosen will NOT be green when there are 6 yellow gumballs, 5 green gumballs, and 4 red gumballs is the number of favorable outcomes (the number of times a yellow or red gumball can be chosen) divided by the number of total outcomes (the total number of gumballs). The number of favorable outcomes is 10 because there are 6 yellow gumballs and 4 red gumballs. The total number of outcomes is 6+5+4, or 15. Thus the probability of the gumball NOT being green is $\frac{10}{15}$, which can be reduced to $\frac{2}{3}$.

Answer choice G is incorrect because it is the probability that a chosen gumball *will* be green.

13. The correct answer is D. To find the number of sports awards earned, multiply the number of participants in each sport by the ratio for that sport, and then add these 4 products. This is a matrix multiplication, as shown below:

$$[25\ 30\ 50\ 80]\begin{bmatrix}0.2\\0.5\\0.3\\0.4\end{bmatrix}$$
$$= 25(0.2) + 30(0.5) + 50(0.3) + 80(0.4)$$
$$= 5 + 15 + 15 + 32 = 67$$

14. The correct answer is G. To find the average number of students per section enrolled in US History, find the total number of students in all sections and divide by the number of sections. Add 25+29+24 to get 78, then divide by 3. This results in an average of 26 students enrolled per section in US History.

If you selected answer choice F, you found the median, or middle number (which is not always the average), of 24, 25, and 29.

15. The correct answer is B. The total number of books available is $(30-3)+(30-5)$, or $27+25$, which is 52. To find the class periods for which there are not enough books, find the total number of books needed for each period, as given in the table below.

PERIOD	1	2	3	4	5
BOOKS NEEDED	23	49	56	50	27

The only entry in the table with more than 52 is 56 for period 3.

If you selected answer choice E, you probably used 60 as the number of available books and did not take into account the 8 missing books.

16. The correct answer is G. Because the sum of each row is equivalent, the sum of row 1 is the same as the sum of row 2.

Row 1: $(-4x) + 9x + 2x = 7x$
Row 2: $7x + ? + (-3x) = 4x + ?$

The question mark must represent $3x$, because $7x = 4x + 3x$. You could also perform these calculations using the sum values in column 1 and column 2.

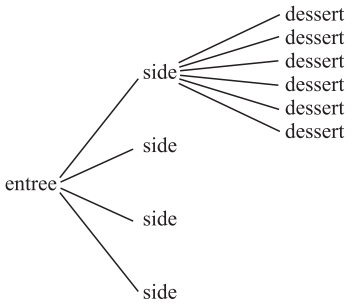
If you selected answer choice K, you may have thought that each sum must be 0 and found that $-4x$ would make the sums of row 2 and column 2 equal 0.

17. The correct answer is E. The x-coordinate is positive if A is to the right of the y-axis. The y-coordinate is positive if y is above the x-axis. The table below shows the sign of x and the sign of y in the four quadrants.

QUADRANT	SIGN OF	
	x	y
I	+	+
II	−	+
III	−	−
IV	+	−

Thus the signs are the same in Quadrants I and III only.

18. The correct answer is J. To find the number of distinct complete meals that Reggie can make from 5 different entrees, 4 different sides, and 6 different desserts, multiply the quantities in the 3 different groups together. Thus, there are (5)(4)(6), or 120 distinct meals that Reggie can make. The figure below shows that for each meal, there are 4 sides, and for each side there are 6 desserts.



19. The correct answer is C. To find the number of liters of carbonated water needed to produce 750 bottles of soda, set up a proportion with ratios of liters of carbonated water to bottles of soda, as follows:

$$\frac{10{,}000}{3{,}000} = \frac{x(\text{liters carbonated water})}{750}.$$

Cross-multiply and solve for x.

$$3{,}000x = 7{,}500{,}000$$

$$x = 2{,}500$$

20. The correct answer is F. To find the length of the diagonal, apply the Pythagorean Theorem; the sides of the rectangle are the legs of a right triangle and the diagonal of the rectangle is the hypotenuse of the right triangle. Thus $c^2 = 20^2 + 48^2$, and $c = 52$.

21. The correct answer is A. To find an equivalent expression for $\frac{a}{c}$, either multiply or divide both the numerator and denominator by the same value. Because the question asks for all positive integers a, b, and c, and you are looking for an expression that is equivalent to $\frac{a}{c}$, multiply $\frac{a}{c}$ by $\frac{b}{b}$ to get $\frac{(a \times b)}{(c \times b)}$, answer choice A.

22. The correct answer is H. The slope-intercept form of the equation of a line states that $y = mx + b$. To find the slope-intercept form of the equation $6x - 2y - 4 = 0$, you must isolate y on the left side of the equation, as follows:

$$6x - 2y - 4 = 0$$

$$-2y - 4 = -6x$$

$$-2y = -6x + 4$$

$$y = 3x - 2$$

If you selected answer choice J, you probably forgot to switch the signs when dividing by -2. It is crucial to multiply all terms on both sides of the equation to arrive at a correct answer.

23. The correct answer is E. To solve the quadratic equation $x^2 + 25x = 0$ for x, factor out an x on the left side of the equation: $x(x + 25)$. Now, apply the zero product rule: $x = 0$ or $x + 25 = 0$. If $x + 25 = 0$, then $x = -25$, which is answer choice E.

24. The correct answer is J. To find tan B in ΔABC, take the ratio of the length of the opposite side to the length of the adjacent side: AC to $BC = c$ to a, or $\frac{c}{a}$.

Answer choice F is cos B; answer choice G is cot B; answer choice H is sec B; answer choice K is sin B.

25. The correct answer is C. To find the radius, use the right triangle shown in the diagram. Half of the length of the chord is 4 inches, which is the length of one leg. The other leg is 3 inches long, and the hypotenuse is r inches long. (Note: this is a right triangle because the distance between a point and a line is measured perpendicular to the line.) Use the Pythagorean Theorem, as follows: $r^2 = 3^2 + 4^2 \rightarrow r^2 = 9 + 16 \rightarrow r^2 = 25 \rightarrow r = 5$ inches.

If you selected answer choice E, you probably used 8 and 3 for the leg lengths and got $r^2 = 73$, which makes r equivalent to about 8.5 inches.

26. The correct answer is K. To find the force F (in newtons) corresponding to the spring length, L, of 0.23 meters when the relationship is given by the equation $L = \left(\frac{2}{3}\right)F + 0.05$, first substitute 0.23 for L to get $0.23 = \left(\frac{2}{3}\right)F + 0.05$. Next, subtract 0.05 from both sides to get $0.18 = \left(\frac{2}{3}\right)F$. Finally, multiply by $\left(\frac{3}{2}\right)$, since dividing by a fraction is equal to multiplying by its reciprocal, to arrive at $0.27 = F$.

27. The correct answer is C. To find the uniform depth, use the formula for volume, V, of a rectangular prism with the height h, length l, and width w, $V = (l)(w)(h)$. Substitute the given values for the variables and solve for h: $12{,}000 = (62)(85)(h)$, or $12{,}000 = 5{,}270h$. Thus $h = \frac{12{,}000}{5{,}270}$, or about 2.277, which is between 2 and 3.

28. The correct answer is G. To find the length of the segment LM in ΔLMN, where the length of the hypotenuse is 22 and the cosine of angle L is

$\frac{3}{4}$, use the definition of cosine, which is the ratio of the length of the adjacent side to the length of the hypotenuse. In ΔLMN, the cosine of angle L is the ratio of the length of segment LM to the length of the hypotenuse. Substitute the length of the hypotenuse and solve for LM, as follows:

$$\frac{3}{4} = \frac{LM}{22}$$
$$4 \times LM = 22 \times 3$$
$$LM = \frac{66}{4}, \text{ or } 16.5, \text{ answer choice G.}$$

29. The correct answer is A. To find the fraction of apples grown in Appleton, divide the number of apples grown in Appleton by the total number of apples grown. The table below shows the conversion of apple symbols to numbers for the 4 cities, as well as the total number of apples grown.

CITY	NUMBER OF APPLES GROWN
Golden Hills	4,500
Red Falls	3,000
Appleton	2,500
Shady Acres	2,000
All Cities	12,000

The fraction of apples grown in Appleton is $\frac{2{,}500}{12{,}000}$, or $\frac{5}{24}$.

If you selected answer choice D, the most common incorrect answer, you probably used the number grown in Appleton divided by the total number of apples from the other 3 towns only.

30. The correct Answer is H. You are given that the length of AC is 19 units and the length of BD is 14 units. In addition, points are along segment AD as shown in the problem. Segment BC is the intersection of segment AC and segment BD. Therefore, the sum of the lengths AC and BD is the same as the sum of the lengths AD and BC. Substitute the actual lengths in $AC + BD = AD + BC$ as follows: $19 + 14 = 25 + BC \rightarrow 33 = 25 + BC \rightarrow 8 = BC$.

31. The correct answer is D. To find the x-coordinate where the lines with equations $y = -2x + 7$ and $y = 3x - 3$ intersect, set $-2x + 7$ equal to $3x - 3$ and solve for x:

$$-2x + 7 = 3x - 3$$
$$-5x + 7 = -3$$
$$-5x = -10$$
$$x = 2$$

32. The correct answer is K. To solve the equation $S = 4T - 7$ for T, add 7 to both sides to get $S + 7 = 4T$, and divide by 4 on both sides to get $\frac{(S+7)}{4}$.

33. The correct answer is D. The area for a parallelogram with base b and corresponding height h is $(b)(h)$. For parallelogram $ABCD$, segment AD is the base, with length $5 + 15$, or 20 inches, and the corresponding height is 12 inches. Therefore, the area is (20)(12), or 240 square inches.

The most common incorrect answer is E, which is the result of multiplying the two side lengths: $(5 + 15)(13) = 20(13)$, or 260.

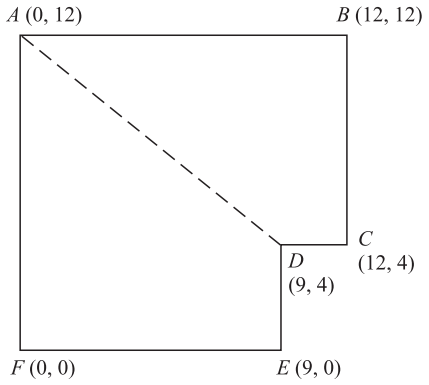
34. The correct answer is F. To find $(a - b)^4$ given $b = a + 3$, substitute $a + 3$ for b, as follows:

$$(a - (a + 3))^4$$
$$= (a - a - 3)^4$$
$$= (-3)^4, \text{ or } 81.$$

If you get stuck on this one, you can try choosing a specific value for a, such as 2. Then $b = 5$ and $(a - b)^4 = (2 - 5)^4 = 81$.

If you selected answer choice K, you might have gotten -3 for $(a - b)$, but solved $-(3^4)$ instead of $(-3)^4$, thus arriving at an answer of -81. Remember that when you have an even numbered exponent, you can eliminate negative answer choices.

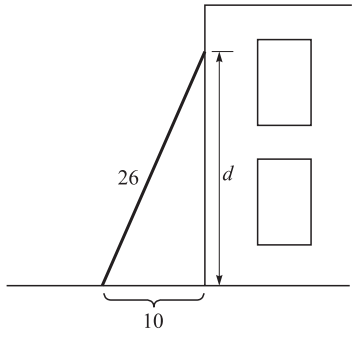
35. The correct answer is B. To find the location of the park office located halfway between points A and D, it makes sense to give coordinates to the points in relation to an origin (see diagram below). In this case it makes sense to choose point F as the origin because it is in the bottom left of the figure. The first coordinate is the number of miles east of the origin, and the second coordinate is the number of miles north of the origin.



The park office is at the midpoint of the segment *AD*, and so the midpoint formula applies. For points with coordinates (x_1, y_1) and (x_2, y_2), the midpoint has coordinates $\left[\frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2}\right]$. For *A* (0,12) and *D* (9,4), the midpoint is $\left(\frac{[0+9]}{2}, \frac{[12+4]}{2}\right)$, or $\left(\frac{9}{2}, 8\right)$. However, the problem asks you to relate the location of the office to its distance and direction from point *A*. To do so, subtract the coordinates of point *A* from the coordinates of the midpoint: $\left(\frac{9}{2} - 0, 8 - 12\right)$, or $\left(\frac{9}{2}, -4\right)$. Thus, the location of the office relative to point *A* is $4\frac{1}{2}$ miles east and 4 miles south.

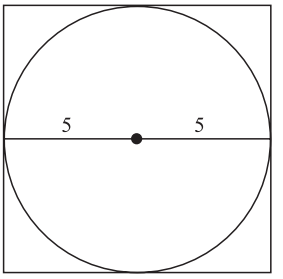
36. The correct answer is J. A simple way to solve this problem is to let the larger number be *y*. Therefore, you know that $y = 3x + 4$, and that $2y + 4x = 58$. Substitute $3x + 4$ for y in the last equation to arrive at $2(3x + 4) + 4x = 58$. This equation allows you to solve for x.

37. The correct answer is E. To find out how far a 26-foot ladder reaches up a building when the base of the ladder is 10 feet away from the building, it is useful to draw a picture, as shown below:



As you can see, the ladder forms the hypotenuse of a right triangle with a length of 26, and the base of the ladder is 10 feet away from the building. Using the Pythagorean Theorem, $26^2 = 10^2 + d^2$, where d is the distance up the building. Simplifying, you get $676 = 100 + d^2 \rightarrow 576 = d^2 \rightarrow 24 = d$.

38. The correct answer is G. Recall that the area of a square with side s is s^2. Finding the diameter of the circle, as shown below, it is clear that the side of the square is equal to the diameter of the circle, or $2(5) = 10$. Thus the area of the square is 10^2, or 100 square feet.



39. The correct answer is C. To find the length of the longest side of the second triangle, use ratios of corresponding sides of each triangle. For example, $\frac{9}{7} = \frac{x}{13}$, where x is the longest side of the second triangle. Cross-multiply to arrive at $117 = 7x$. Divide by 7 to get $x =$ about 16.7.

If you selected answer choice B, the most common incorrect answer, you might have noticed that the difference in lengths of the smallest sides was 2 and then simply added 2 to the longest side of the first triangle to get 15 for the longest side of the second triangle.

40. The correct answer is H. To find the measure of angle *CDB* in the figure, it is helpful to recognize that the sides *BC* and *AD* are parallel (definition of trapezoid) and are connected by the transversal *BD*. Angles *CBD* and *ADB* are alternate interior angles, and thus are equal and both measure 25°. Because *A*, *D*, and *E* all lie along the same line, angle $ADE = 180°$. Because angle *ADE* is made up of angles *ADB*, *CDB*, and *CDE*, the measures of these three angles add up to $180° : 25° + CDB + 100° = 180°$, thus the measure of angle *CDB* is 55°.

41. The correct answer is D. This figure has 10 sides, but the lengths are given for only 7 sides. Those lengths add up to 36 inches. The perimeter is greater than this because of the missing 3 sides

so you can eliminate answer choices A and B. To solve this problem, use the information given to find the missing sides; based on the figure, you can see that the sum of right-facing sides equals the sum of left-facing sides, and the sum of top-facing sides equals the sum of bottom-facing sides. It is easy to see that the bottom-facing sides will equal the top-facing side, which has a length of 14. Since we have the values for all of the left-facing sides ($5 + 4 + 3 = 12$), the right-facing sides also have the sum of 12. Thus the perimeter is $14 + 14 + 12 + 12$, or 52.

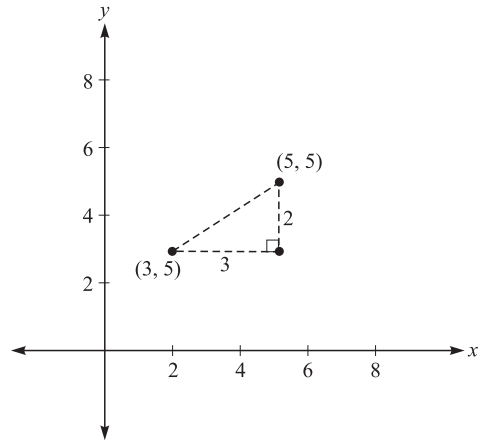
42. The correct answer is G. To find out how many of the 517 seniors in Brighton High School are going to a state college, first find how many are going to college. You are given that $\frac{4}{5}$ of the total number of graduating seniors (517) will be attending college: $\frac{4}{5}$ of $517 = 413.6$, which can be rounded up to 414. Now, calculate the number of those 414 seniors who are going to a state college: $\left(\frac{1}{2}\right)(414)$, or about 207 seniors are going to a state college. This is closest to 200, answer choice G.

43. The correct answer is A. You are given that $x \blacksquare y = (x-2y)^2$ and are asked to solve $5 \blacksquare (-3)$. To do this, simply replace x with 5, and y with -3, as follows:

$$x \blacksquare y = (x - 2y)^2$$
$$5 \blacksquare (-3) = (5 - 2(-3))^2$$
$$5 \blacksquare (-3) = (5 - (-6))^2$$
$$5 \blacksquare (-3) = (5 + 6)^2$$
$$5 \blacksquare (-3) = (11)^2$$
$$5 \blacksquare (-3) = 121$$

44. The correct answer is F. Because 125% of "the number" is 425, then "the number" is $425 \div 1.25$, which equals 340. Calculate 65% of 340: $340 \times 0.65 = 221$.

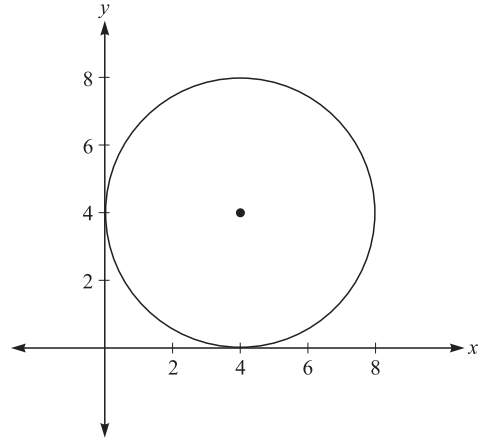
45. The correct answer is D. To find the distance between 2 points in the standard (x, y) coordinate plane, use the distance formula, which states that $d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$. Therefore, the distance is $\sqrt{[(5-2)^2 + (5-3)^2]}$, or $(3^2 + 2^2)$, which equals $\sqrt{13}$.



Another way to look at this problem would be to draw a picture as shown above. Then you can use the Pythagorean Theorem to find the hypotenuse of the triangle that is formed from the given points.

46. The correct answer is G. To find the ratio of the circumference of 2 circles for which the ratio of their radii is 9:16, recognize that both circumference and radius are 1-dimensional attributes of a circle. Because of that, the ratios should be the same, 9:16. Another way is to use the ratio of the radii and let $9x$ and $16x$ be the radii of the two circles. Their circumferences would be $2\pi(9x)$ and $2\pi(16x)$, respectively. When you put them in a ratio you see that the ratio $2\pi(9x) : 2\pi(16x)$ simplifies to 9:16.

47. The correct answer is D. The best approach to this question is to draw a diagram as shown below:



The equation of a circle is $(x-h)^2 + (y-k)^2 = r^2$. One way to find an equation for a circle is by using the coordinates of the center, (h, k), and the radius, r. For this circle, the center is at (4, 4) and the radius is 4. Given center (4, 4) and radius 4, the circle has equation $(x-4)^2 + (y-4)^2 = 4^2$, or $(x-4)^2 + (y-4)^2 = 16$.

If you selected answer choice B, a common incorrect answer, you centered the circle at $(0, 0)$.

48. The correct answer is F. To find an equivalent expression for $\frac{2}{(1-i)} \times \frac{(1+i)}{(1+i)}$, simply perform the calculations, as follows:

$$\frac{2(1+i)}{(1-i)(1+i)} = \frac{2(1+i)}{(1-i^2)}$$

$$\frac{2(1+i)}{(1-i^2)} = \frac{2(1+i)}{2}$$

$$\frac{2(1+i)}{2} = 1+i$$

49. The correct answer is D. One approach to solving this problem is to make a table like the one below, showing the number of rows and the cumulative number of dots.

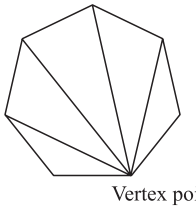
Row	1	2	3	4	5
Number of dots per row	2	4	6	8	10
Cumulative number of dots	2	$2+4$ $=6$	$6+6$ $=12$	$8+12$ $=20$	$10+20$ $=30$

The total number of dots in rows 1 and 2 is 2(2+1); the total number of dots in row 3 is 3(3+1), and so on. You should be able to see that for the nth row, the total is the product of n and $n+1$, or $n(n+1)$.

50. The correct answer is J. You are given that the total number of students is 24. If 21 students play basketball, and 9 students play soccer, there must be some overlap between basketball players and soccer players. The total number of students who play basketball and/or soccer is 21 + 9, or 30; therefore, 30 – 24, or 6 students must play both sports.

51. The correct answer is E. To find the real numbers x such that $x + 2 > x + 5$, subtract x and 2 from both sides. The result is $0 > 3$, and because that inequality is never true, there is no solution for x. The solution set is the empty set.

52. The correct answer is H. As shown below, there are 4 diagonals coming from each vertex point.



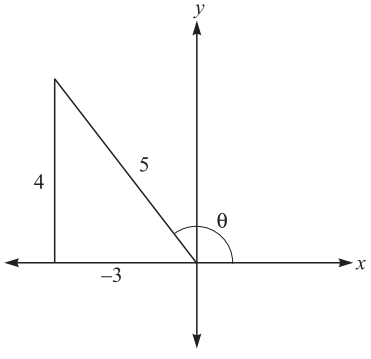
Vertex point

Because there are 7 vertex points, you might be tempted to conclude that there are 7×4, or 28 diagonals. But this method counts each diagonal exactly twice. Therefore, there are $\frac{28}{2}$, or 14 diagonals.

53. The correct answer is D. You are given that 20% of John's friends selected vanilla ice cream as their favorite flavor. This means that 20% of the 360° in the circle will represent vanilla; 20% of 360 is equivalent to (0.20)(360°), or 72°. If you chose one of the other answers, you may have found the degree measure of any of the other flavors.

54. The correct answer is G. One way to find $\tan \theta$ given that $\sin \theta = \frac{4}{5}$ and $\frac{\pi}{2} < \theta < \pi$, is to first find $\cos \theta$, then find $\frac{\sin \theta}{\cos \theta}$, which is equivalent to $\tan \theta$. To find $\cos \theta$, use the identity $\sin^2 \theta + \cos^2 \theta = 1$ and the fact that $\cos \theta < 1$ in Quadrant II $\left(\frac{\pi}{2} < \theta < \pi \text{would place the angle in Quadrant II}\right)$. Use substitution to get $\left(\frac{4}{5}\right)^2 + \cos^2 \theta = 1$, or $\frac{16}{25} + \cos^2 \theta = 1$. After subtracting $\frac{16}{25}$, you get $\cos^2 \theta = \frac{9}{25}$. After taking the square root of both sides, you get $\cos \theta = \pm\frac{3}{5}$. Because $\cos \theta < 1$ is in Quadrant II, $\cos \theta = -\frac{3}{5}$. Substitute this value into $\frac{\sin \theta}{\cos \theta}$ to get $\frac{(4/5)}{(-3/5)}$, which equals $-\frac{4}{3}$.

Another way you could solve this problem would be to construct an angle in Quadrant II with $\sin \theta = \frac{4}{5}$, as shown below.



By virtue of the Pythagorean Theorem, the missing side of the right triangle is 3 units long, and is negative because it is along the negative side of the x-axis. From this triangle, knowing that tangent $= \frac{\text{opposite}}{\text{adjacent}}$, you can get $\tan\theta = -\frac{4}{3}$.

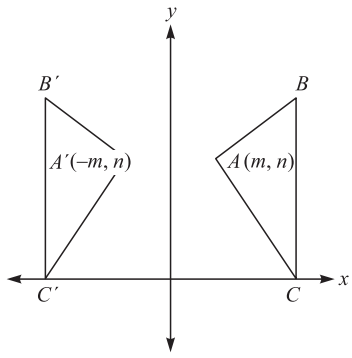
55. The correct answer is E. To find the system of inequalities represented by the shaded region of the graph, first find the equations of the line through $(-1, 0)$ and $(0, 1)$ and the line through $(-2, 0)$ and $(0, -3)$. These are $y = x + 1$ (the y-intercept is 1) and $y = \left(-\frac{3}{2}\right)x - 3$ (the y-intercept is -3), respectively. Pay attention to the coordinating conjunctions, *and*/*or*.

56. The correct answer is K. To find $f(x + h)$ when $f(x) = 2x^2 + 3$, substitute $(x + h)$ for x in $f(x) = 2x^2 + 3$, as follows:

$$f(x + h) = 2(x + h)^2 + 3$$
$$2(x + h)^2 = 2(x^2 + 2xh + h^2) + 3$$
$$2(x^2 + 2xh + h^2) = 2x^2 + 4xh + 2h^2 + 3$$

57. The correct answer is D. The equation $y = \frac{x^2 + 3x}{x}$ can be simplified to $y = \frac{x(x + 3)}{x}$. Therefore, the graph of this seemingly complicated equation actually looks like a line, not a parabola, so eliminate answer choices A and B. This is equivalent to $y = x + 3$ except when $x = 0$. When $x = 0$, the original equation is undefined. So the correct graph is $y = x + 3$, with a point removed where $x = 0$.

58. The correct answer is F. To find the coordinates of vertex A after it is reflected across the y-axis, remember that a reflection across the y-axis does not change the sign of the y-coordinate but does change the sign of the x-coordinate. Therefore, you can eliminate answer choices G, H, and J. You might sketch a figure like the one below.



The reflection of $A\ (m, n)$ across the x-axis is $A'\ (-m, n)$. The most popular incorrect answer is J, which gives the reflection of A over the line $y = x$.

59. The correct answer is B. To obtain an expression for y in terms of x when $x = 3r - 4$ and $y = 3r + 2$, first solve $x = 3r - 4$ for r as follows:

$$x = 3r - 4$$
$$x + 4 = 3r$$
$$\frac{x + 4}{3} = r$$

Substitute that expression for r into $y = 3r + 2$, and solve for y:

$y = 3\left[\frac{x + 4}{3}\right] + 2$, which simplifies to $y = (x + 4) + 2$, or $y = x + 6$.

60. The correct answer is H. To find $\cos\frac{\pi}{12}$ using $\cos(\alpha - \beta) = (\cos\alpha)(\cos\beta) + (\sin\alpha)(\sin\beta)$ given that $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$, you can first substitute $\frac{\pi}{3}$ for α and $\frac{\pi}{4}$ for β and get $\cos\left(\frac{\pi}{3} - \frac{\pi}{4}\right) = \left(\cos\frac{\pi}{3}\right)\left(\cos\frac{\pi}{4}\right) + \left(\sin\frac{\pi}{3}\right)\left(\sin\frac{\pi}{4}\right)$. Using the table of values to substitute into that equation, you get $\cos\frac{\pi}{12} = \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) + \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{2}}{2}\right)$, or $\frac{(\sqrt{6} + \sqrt{2})}{4}$.

Reading Test Explanations

PASSAGE I

1. **The best answer is B.** The passage takes place on a ship, the *Nellie*, and the narrator is one of the crew members. He uses words like "we" and "us" when referring to the crew, implying his membership to this group. The other answer choices are not supported by the passage.

2. **The best answer is F.** Although the passage states, "for some reason or another we did not begin that game of dominoes," it is reasonable to assume that it was because they were too tired from the use of the words "lazily" and "meditative." The other answer choices are not supported by the passage.

3. **The best answer is C.** The passage states that "the Lawyer ... had, because of his many years and many virtues, the only cushion on deck," indicating that since he was the eldest crew member and had the other crew members' respect, he was afforded the comfort of the cushion. The other answer choices are not supported by the passage.

4. **The best answer is F.** The definition of "placid" is "not easily excited or upset; calm." Since the men on the ship were feeling "meditative" and seemed not to have an abundance of energy, it makes sense that they simply wanted to sit calmly. The other answer choices are not supported by the context of the passage.

5. **The best answer is D.** In the fifth paragraph the narrator is describing how Marlow is unlike most sailors: "The yarns of seamen have a direct simplicity, the whole meaning of which lies within the shell of a cracked nut. But Marlow was not typical ... and to him the meaning of an episode was not inside like a kernel but outside ..." This is to say that typical sailors tell simple, uncomplicated tales, while Marlow tends to tell stories that are layered and complex. This best supports answer choice D.

6. **The best answer is H.** Since Marlow states that the episode which he is about to recount "seemed to somehow throw a light on everything about (him)," we can assume that this experience had a profound effect on him. The other answer choices are either not supported by the passage or are beyond the scope of the passage.

7. **The best answer is A.** The passage states that, "The Director of Companies was our captain and our host. We four affectionately watched his back as he stood in the bow looking toward the sea. On the whole river there was nothing that looked half so nautical. He resembled a pilot, which to a seaman is trustworthiness personified." This best supports answer choice A.

8. **The best answer is G.** There are clues in the passage to indicate that the narrator, as well as the other crew members, were not thrilled when Marlow began to speak. Marlow's very first comment was "accepted in silence" and "no one took the trouble to grunt even." In the next paragraph the narrator begins to realize that the crew was "fated, before the ebb began to run, to hear about one of Marlow's inconclusive experiences." Since resigned means "accepting that something can not be avoided" and tolerance means "patience," making G the best answer.

9. **The best answer is A.** In the third paragraph the passage states that the men's mutual interest in the sea created a bond between them capable of "holding (their) hearts together through long periods of separation," "making (them) tolerant of each other's yarns," and making them accepting of each other's "convictions." Answer choice A is not mentioned in the passage.

10. **The best answer is J.** The passage states that the crewmen watched him "affectionately," meaning "showing fondness or liking." The captain is also described as "trustworthiness personified," indicating that the other crew members have the utmost faith and trust in him. This best supports answer choice J.

PASSAGE II

11. **The best answer is B.** As stated in the passage, "in the past 30 years, known supplies have dwindled from almost 300 TCF to around 150 TCF," or known supplies have decreased by about 50 percent. Answer choice A is incorrect because the passage states that at predicted rates of consumption, the United States' natural gas supply would be exhausted in approximately five years. Answer choice C is incorrect because natural gas provides for roughly 25 percent of America's energy needs, which has nothing to do with the decrease in supply. Answer choice D is incorrect because the passage states that it is extremely difficult to obtain natural gas from other countries, not from within the US.

12. **The best answer is G.** At the end of the passage, the author states that "consumers and business leaders should not rely on liquid natural gas to solve America's energy needs." This can also be inferred from the point that natural gas is currently only supplying approximately 25 percent of the nation's energy needs, and even at this level there is much concern over whether supplies will run out. Answer choice H may appear to be correct, but the passage merely states that countries such as Japan and China will also be searching for fuel sources, including liquid natural gas, outside of their own countries in the future.

13. **The best answer is D.** This question can be difficult if you do not read the answer choices carefully. The third paragraph is devoted to a discussion on the limited availability of liquid natural gas, and the expense of processing the gas, which makes answer choice D the best selection. Answer choice A may appear to be correct; however, the passage focuses on the supply and use of liquid natural gas around the world. The passage does not discuss the supply and use of any other energy sources. Answer choice B was mentioned briefly in the passage, but is not a main idea. Answer choice C is beyond the scope of the passage.

14. **The best answer is F.** As stated in the second paragraph, it is predicted that "liquid natural gas imports will increase by almost 500 percent in a few short years." Although America may be reluctant to import liquid natural gas, it is necessary for the nation to do so in order to relieve and/or avoid shortages. Answer choice H may appear to be correct; however, the author states that even though transportation costs have been substantially decreased due to new technology, importing liquid natural gas "is still often uneconomical." Answer choices G and J are beyond the scope of the passage.

15. **The best answer is C.** According to the passage, "Currently, Canada is the largest liquid natural gas supplier for the United States." Japan and China, two countries in Asia, are providing competition in attaining liquid natural gas.

16. **The best answer is F.** The first sentence of the third passage states "One of the largest misconceptions about liquid natural gas is that it is an abundant source of natural gas." While the passage goes on to discuss the expense of creating new processing facilities and prices making liquid natural gas uneconomical, the only misconception mentioned is the fact that liquid natural gas is an abundant source of natural gas. The other answer choices are not supported by the passage.

17. **The best answer is C.** The context surrounding the word *phenomenal* discusses the surprisingly large growth expected in natural gas demand and the huge impact that such growth will have on depletion of the resource. This context clearly indicates that the demand is increasing at "phenomenal," or extraordinary, rates. The other answer choices are not supported by the context of the passage.

18. **The best answer is G.** Answer choice G is the only reason that America is choosing liquid natural gas; consumers are demanding it so America must provide it. Answer choices F and H express current problems with choosing liquid natural gas; transportation and processing are both very costly relative to other fuel sources. Answer choice J is a potential problem. Liquid natural gas is inherently expensive due to its transportation and processing costs. If natural gas prices are low, the market for liquid natural gas will plummet, making liquid natural gas an uneconomical choice for consumers.

19. **The best answer is D.** As stated in the paragraph, "natural gas demand is increasing at phenomenal rates" and its consumption is expected to grow from 22 trillion cubic feet per year to 32 trillion cubic feet per year in less than a decade. Answer choice C may appear to be correct; however, the passage simply states that Canada is the largest liquid natural gas supplier for the United States alone. The passage does not compare Canada's liquid natural gas exports to those of any other country; therefore, we do not know whether or not Canada is the world's largest exporter. Likewise, the other answer choices are not supported by the passage.

20. **The best answer is J.** In the paragraph, the *vessel* in question is described as something that the liquid natural gas is injected into for transportation. It does not make sense that a liquid would be injected into a "process," "source," or "facility" for transportation. Answer choice J, "container," is the most logical choice.

PASSAGE III

21. **The best answer is B.** Throughout the passage, the author talks about the prevalence of the word "good," further discusses several different meanings and methods for interpreting the word, and suggests that there is no one specific denotation for the word "good." The other answer choices are not supported by the context of the passage.

22. The best answer is H. As stated by the author, babies are so young and powerless ("this elementary life has not yet acquired positive standards or measurement"), that they can only be judged in negative terms, "a failure to disturb." Answer choice G may appear to be correct; however, the "anxious mother" is still able to judge whether her baby has been good by what the baby did or did not do—in this case, cry.

23. The best answer is A. The author states that "we employ the word or some synonym of it during pretty much every waking hour of our lives. Wishing some test of this frequency, I turned to Shakespeare." In simpler terms, the author is asserting that we use the word "good" or some form of it constantly, and he believed that the works of Shakespeare would provide a good test of this notion. In other words, if Shakespeare used forms of the word "good" as often as the author predicted, the author's theory on use of the word would be proven true. This best supports answer choice A.

24. The best answer is H. The author writes "goodness always has reference to something outside itself, and is measured by its performance of an external task." The author goes on to write, "The knife is good for cutting and the day for business . . . To be bad or good implies external reference." This best supports answer choice H.

25. The best answer is D. The author describes a quote by Shakespeare's Portia as being spoken "lucidly," and goes on to analyze and apply Portia's quotation. The author does so in a positive light, thus eliminating answer choices A and B. It does not make sense that Portia's quote was "enthusiastic," or excited. Answer choice D makes the most sense within the context of the passage; "coherently" means "logically and meaningfully."

26. The best answer is H. When discussing the knife, the author states, "Its goodness always has reference to something outside itself." Although the passage mentions cutting wood, the author never says that a knife is good *only* if it cuts wood. Answer choices G and J are not supported by the context of the passage.

27. The best answer is A. The author begins by discussing the goodness of a clear, tangible object—a knife. The author then moves on to discussing the goodness of the weather—something "not so *palpable*." Answer choice A, "apparent," makes the most sense. The goodness of an intangible thing, such as the weather, is not nearly as "evident or clear" as that of a tangible object. The goodness of the weather is not less "complicated" than that of the knife; likewise, it does not make sense that the goodness of the weather would be less "powerful" or "drab" than that of the knife.

28. The best answer is J. The author states, "We must have some respect or end in mind in reference to which the goodness is compared." In other words, in order to understand what "good" means, you must know specifically what is being referred to as "good" before interpreting the definition of "good." Answer choice G may appear to be correct, but the passage states that "good always means good 'for;'" thereby asserting that the two are actually identical concepts.

29. The best answer is D. Throughout the passage the author refers to the actual application of the word "good," and that the word "must be useful for something." This best supports answer choice D.

30. The best answer is G. According to the author, goodness in life "attends all our wishes, acts, and projects as nothing else does, so that no estimate of its influence can be excessive." The author furthers this point by adding that every action we take is in hopes of achieving something good. In simpler terms, the author is saying that because our pursuit of goodness has such a huge impact on our lives, there is no way we could overestimate or over-emphasize the influence this has on us. Answer choice F is incorrect because it is the opposite of what the author is trying to say. Answer choices H and J are beyond the scope of the passage.

PASSAGE IV

31. The best answer is A. At this point in the passage, the defense mechanisms of armadillos are being discussed. If tanks were strengthening their positions, they would be improving their safety and increasing their level of protection from enemies. Therefore, if armadillos "often scurry under thorn bushes, rather like tanks strengthening their positions," they are giving themselves better protection against their predators. This best supports answer choice A.

32. The best answer is J. The first paragraph states that armadillos look "far more awkward than most animals." The passage then goes on to describe the armadillo as an "alien creature," which suggests that the armadillo's awkward appearance is what

makes it an alien creature. The other answer choices are not supported by the passage.

33. The best answer is D. According to the passage, the armadillo is "safer than most animals who wander the Texas roads" because its shell protects its from predators. Answer choices A through C are beyond the scope of the passage and, therefore, are incorrect.

34. The best answer is G. The author's statement that "if chased into their burrows, they are able to arch their armor against the burrow walls making them nearly impossible to dislodge" suggests that the armadillo curves its back against the burrow walls, wedging itself into the burrow. The other answer choices are not supported by the passage.

35. The best answer is C. Information in the passage indicates that "The nine-banded armadillo is the only species of animal in which this remarkable trait occurs," which is speaking in reference to their ability to have four identical offspring emerging from the same egg. This best supports answer choice C.

36. The best answer is H. According to the passage, most Texans feel the armadillo is a "pest" when it destroys crops and other plants that are low to the ground; however, most Texans also see that armadillos provide "benefits" as well, such as its eating harmful insects and aiding in medical research. This best supports answer choice H.

37. The best answer is B. Although the passage mentions both opossums and farmers, neither are identified as predators of the armadillo. Both dogs and cars are acknowledged as predators of the armadillo; however, the passage explicitly states that "In addition to threats of being eaten by an opportunistic predator, the armadillo must also endure a more severe danger: automobiles." Therefore, automobiles are more dangerous to armadillos than are any other predator. This best supports answer choice B.

38. The best answer is F. The passage states that, "Texans see the armadillo as a pest, since they have a tendency to ruin corn by eating the parts of the plants which are low to the ground." This suggests that armadillos are damaging crops. The other answer choices are not supported by the passage.

39. The best answer is C. According to the passage, armadillos "are born fully-formed with their eyes open" so it makes sense that they would be able to see. The other answer choices contradict statements made elsewhere in the passage, or are unsupported by the passage.

40. The best answer is J. The only scientific name mentioned, *Dasypus novemcincts*, is directly defined as being the name for the nine-banded armadillo. The other choices are similar species of armadillo, but not mentioned in reference to that specific scientific name.

Science Reasoning Test Explanations

PASSAGE I

1. **The best answer is B.** Based on the data in all three tables, the highest average speed was recorded in Table 3, which shows the results of Study 3. Therefore, the highest average speeds resulted from using studded, hard rubber wheels, answer choice B.

2. **The best answer is H.** The average speed recorded in Table 1 is 3.28 feet per second. This speed is not greater than the speed recorded in Trial 2 (3.33 ft/s); likewise, it is not less than the speed recorded in Trial 1 (3.28 ft/s); eliminate answer choices F and G. The speed recorded in Trial 2 (3.23 ft/s) is less than the average speed recorded in Table 1 (3.28 ft/s), so answer choice H must be correct.

3. **The best answer is D.** To answer this question, you must remember that Table 1 is associated with deeply treaded hard rubber wheels, Table 2 is associated with soft rubber wheels lacking treads, and Table 3 is associated with studded, hard rubber wheels. When you compare the average recorded speed, you will see that the average speed of a car with studded, hard rubber wheels (6.44 ft/s) is approximately twice the average speed of a car with deeply treaded hard rubber wheels (3.28 ft/s) answer choice D.

4. **The best answer is F.** Since the passage indicates that all three of the studies were, "conducted indoors in a temperature controlled room," you can eliminate answer choices G and H. The studies also dealt with different types of wheels, and the traction they would provide, so the most likely reason for the highest average speeds is greater friction, answer choice F.

5. **The best answer is A.** During which of the following Trials did the car travel most slowly?

   A. Study 2, Trial 1 = 57 seconds
   B. Study 2, Trial 2 = 56.4 seconds
   C. Study 3, Trial 1 = 11.3 seconds
   D. Study 1, Trial 2 = 23.2 seconds

   Because it took the car in Study 2, Trial 1 longer to travel the constant distance of 75 feet, that car must have been traveling more slowly than the cars in each of the other answer choices.

PASSAGE II

6. **The best answer is J.** The two scientists are discussing how the planet Pluto should be classified: as a planet, or as some other celestial object. Scientist 1 believes it Pluto should retain its status as a planet, while Scientist 2 believes Pluto would be more accurately categorized as a Kuiper Belt comet. This best supports answer choice J.

7. **The best answer is B.** Scientist 2 explains that currently two categorizations of planets exist: rocky and gaseous. The scientist then goes on to say that Pluto does not fit into either of these categories because it is composed of an icy material. This best supports answer choice B.

8. **The best answer is F.** The questions asks for the identification of the characteristic that does *not* differentiate Pluto from asteroids and comets. Neither Pluto nor asteroids and comets can generate heat through nuclear fission, so this is not a differentiating characteristic, making this answer choice the best.

9. **The best answer is B.** Scientist 2 maintains that Pluto is not like the other planets due to its icy surface. If the ice melted and revealed that Pluto's surface was similar to Mars, Scientist 2's argument would be significantly weakened.

10. **The best answer is J.** Both scientists mention the irregularity of Pluto's orbit in their respective arguments. Scientist 1 states, "Pluto's orbital path is irregular as compared with the other planets of the solar system, and Scientist 2 also makes note of the "eccentricity of Pluto's orbit."

11. **The best answer is A.** One of the arguments that Scientist 1 makes for Pluto not being a comet is that Pluto is far too massive. If a comet were discovered with a diameter of 1,500 miles, it would be even larger than Pluto, which has a diameter of 1,413 miles. This would nullify the scientist's argument that Pluto cannot be a comet because comets are much smaller than Pluto.

12. **The best answer is H.** One reason that Scientist 2 offers to support the argument for Pluto to be a Kuiper Belt object is that both have strange, atypical orbital patterns.

PASSAGE III

13. **The best answer is C.** The question asks you to look at the overall trends of the data sets for each substance. A good way to measure the degree to which data varies would be to find the range, meaning subtract the lowest value from the highest value for each individual substance. In this problem it is clear that NaCl varies the least with temperature.

14. **The best answer is F.** In this question you are asked to look at the trends of the substances, especially at how their concentrations change with increasing temperature. In the data set, some substances become more soluble with increasing temperature, while some become less soluble. The graph represents the solubility curve for a substance that gets less soluble with increasing temperature. Looking at the possible answer choices, HCl is the only logical choice.

15. **The best answer is C.** It is clear from the table that each substance reacts differently in its solubility depending on the temperature. However, each substance does show a clear trend in whether it gets more or less soluble with increasing temperature.

16. **The best answer is J.** According to Table 1, HCl has a concentration of 55 g/100 g H_2O at 60°C, and a concentration of 48 g/100 g H_2O at 80°C. Therefore, at 70°C it would likely have a concentration of $55 + 48 \div 2 = 51.5$ g/100 g H_2O.

17. **The best answer is D.** By looking at the trend in concentration for NH_4Cl, 50g are dissolved between the 40°C and 60°C measurements. The logical answer choice would then be 50°C.

PASSAGE IV

18. **The best answer is H.** As shown in Table 1, the estimated mineral volume of the oldest salt pan (21 million years old) is 12,150,000 cubic kilometers; the estimated mineral volume of the youngest salt pan (4.5 million years old) is only 2,000,000 cubic kilometers. The deposits were formed as collected water evaporated, so the much larger volume of minerals in the oldest basin suggests that more water has collected and evaporated there.

19. **The best answer is B.** As Table 1 shows for Study 1, there is a direct, positive relationship between mineral volume and age of the salt pans. As the age increased, the mineral volume is also shown to increase in each of the four cases. This direct relationship is shown in the graph in answer choice B.

20. **The best answer is J.** There is no information contained within either Study 1 or Study 2, or in either of the tables that makes reference to the quantity of plant fossils. The only references to plant fossils are that they were found in each salt pan, that the ages were similar, and that the flooding was thought to cause plant extinction. Plant species is not shown by the data to influence quantity of fossils.

21. **The best answer is C.** Since there is a direct, positive relationship between salt pan age and mineral volume, if a salt pan were to have formed before the oldest salt pan in the study, then it would likely contain a greater volume of minerals than that pan is shown to contain. Since the oldest pan in the study contained 12,150,000 cubic kilometers of minerals, a pan older than that would have a higher mineral value.

22. **The best answer is H.** Since the ages of the fossils are stated in Study 2 to be similar to the ages of the salt pans, a fossil that is 9.7 million years old would be closest in age to Salt pan C (10.8 million years old) and, therefore, would most likely be found in a similar salt pan.

PASSAGE V

23. **The best answer is C.** As shown in Table 1, the temperature of gasoline is between 40 and 70°C, which makes it greater than 20°C. Despite this being the lowest temperature for petroleum gas, it is still correct as the choices of less than 40 and greater than 70°C exclude gasoline completely.

24. **The best answer is J.** Figure 1 shows a diagram of the fractioning tower, which places residue as the first substance to be condensed and drawn off. Additionally, the passage states that the vapor rises through the tower and cools, condensing at the appropriate points—this means that the substance with the hottest condensation temperature would be first.

25. **The best answer is C.** Within the passage is says that, "this process is called fractional distillation, whereby the crude oil is heated . . ." Gasoline, residue, and gas oil are all products that result from the process of fractional distillation. The passage clearly discusses crude oil in the context of a raw material.

26. **The best answer is F.** A condensation point of 90°C would place naptha in Table 1 between gasoline (40–70°C) and kerosene (100–120°C), as it is above the upper end of gasoline and below the lower end of kerosene.

27. **The best answer is A.** Within the passage it is discussed that "the crude oil is super-heated in the boiler to about 600°C, which vaporizes the crude oil." Since this is the temperature at which crude oil vaporizes, answer choice A is correct.

28. **The best answer is G.** As the passage states, "the vapors rise in the tower to certain levels where

they cool and condense, according to their chemical structure." The condensation temperature would continuously decrease then as the vapor moves up the fractionating tower.

PASSAGE VI

29. The best answer is B. As stated in the passage, "if the paths of the X-rays are not bent in any way, it is assumed that the star lacks any planets." Since Table 1 shows there to be no X-ray distortion for Star 2 over a ten day period, it can be assumed then that Star 2 has no planets.

30. The best answer is G. Since the passage states that "a circular orbit produces increasing or decreasing distortions of the same level" and Table 1 shows that Star 1 has distortions increasing by 0.75, and Star 3 has distortions decreasing by half, both of those stars are likely to have planets with circular orbits.

31. The best answer is A. Since Table 1 shows that there is indeed a decrease in X-ray distortion for Star 3, and the note instructs that there are no other objects that could affect the X-rays, it is reasonable to believe that Star 3 is orbited by at least one planet. The passage further states that X-ray distortion is caused by the pull from planets. This best supports answer choice A.

32. The best answer is J. According to the table, every three days the X-ray distortion for Star 1 increases by 0.75 meters. Since 4.00 is an increase of 0.75 over the 3.25 meters measured on day 10, 4.00 is the likely predicted distortion on day 13.

33. The best answer is A. According to the passage, the X-rays are distorted by the force of gravity, which best support answer choice A.

34. The best answer is G. The passage indicates that when "the pattern of bending is random, as in a bending of 5 meters the first day, 3 meters the second day, 0 meters the third day, and 7 meters the fourth day, then the planet's orbit is elliptical." Table 1 shows the X-ray distortion for Star 4 to go from 0.20 meters to 0.10 meters to 0.11 meters and to stay at 0.11 meters; this bending pattern can be considered random when compared to the example within the passage and thus indicates a planet with an elliptical orbit.

PASSAGE VII

35. The best answer is C. Five of the nine bacteria listed in Table 2 can be classified as mesophiles, given their stated minimum, optimum, and maximum growth points. No other type of bacteria appears as frequently within the table.

36. The best answer is G. *Listeria monocytogenes* is a bacteria with a minimum growth point of 1°C, which would make it appear to be a psychrophile; however its optimum growth point is 34°C, which is far above the maximum growth range for psychrophiles. For that reason it cannot be precisely classified.

37. The best answer is C. Since the question states that human body temperature is 40°C, a bacteria with an optimum growth point close to 40°C would grow most successfully in the human body. *Escherichia coli* has an optimum growth point of 37°C, which is two degrees closer to 40°C than that of *Clostridium perfringens* at 45°C.

38. The best answer is J. Thermophiles are shown by Table 2 to reproduce best, that is to have an optimum growth point, between 50° and 60°C. A bacteria that reproduces at 55°C would likely be classified there. Further, if the bacterium does not show any new growth above 65°C, that also fits within the range of maximum growth points for thermophiles of between 60° and 90°C.

39. The best answer is C. The growth range of *Streptococcus pneumoniae* is between 25°C at the minimum and 42°C at the maximum, for a total range of 17°C. *Listeria monocytogenes* has the greatest range of the bacteria choices at 44°C. *Micrococcus cryophilus* is next with 30°C of growth range, and *Streptococcus pyogenes* is next smallest with 20°C.

40. The best answer is J. Table 1 shows that maximum growth point of *Listeria monocytogenes* is 45°C, which means that 45°C is the temperature "beyond which the bacteria will not reproduce at all," as stated in the passage.