ANSWERS AND EXPLANATIONS

To The

2012-2013 Preparing for the ACT Student Bulletin
Sample Test

Prepared By

LEARNING SYSTEMS
HOUSTON, TEXAS

Note: This material is made available to schools/districts currently offering, conducting, or presenting LEARNING SYSTEMS' "Tactical ACT Strategies" ACT preparation course. It may be, at the discretion of the school or district, photocopied and distributed, free of charge, to students taking our ACT prep course. The answers and explanations to questions herein are derived using the tactics and strategies found in our published ACT textbooks or in the content of our course. In many cases, the way we get an answer may be contrary to what is taught in the classroom.

Please Distribute To All Authorized "Tactical ACT Strategies" Presenters!

Use of this document, by anyone not trained by Learning Systems, or not enrolled in the "Tactical ACT Strategies" preparation course, is prohibited.
English Test – Section 1

1. B The comma must come after snake, separating the main sentence from the participial phrase that ends it.

2. J Choice J would change the meaning of the sentence by suggesting the path was already paved.

3. D The pronoun they has no antecedent. The non-specific and plural word people is what’s required instead.

4. F No change.

5. B The answer is self-explanatory.

6. J All of the other choices, including the original sentence, contain comma splices [two independent sentences joined only with a comma].

7. D The use of the phrase purrs softly suggest the wheelchair is like a cat or beloved pet.

8. F No change.

9. A No change.

10. H The adverb gently is needed to modify the verb bounce. The commas is unneeded.

11. A No change.

12. H The original sentence is a run-on. The other two choices would create comma splices.

13. D No punctuation is needed between or after these words.

14. G The apostrophe is needed to show possession.

15. B Choice B is the only one that makes an accurate statement about the passage as a whole.


17. C The only way to join the two independent clauses among the choices is with a colon. A colon can be used here because the second clause elaborates on the first.

18. G The answer is self-explanatory.

19. D The information in the underlined portion is redundant and should be deleted.

20. E No change.
21. B  The pronoun *that* has no antecedent. The pronoun *it* is called for here.

22. J  The name of the engineer is essential because there is nothing else to clarify which engineer it is. Essential phrases are not separated from the sentence with commas.

23. C  The adjective *innovative* is needed to modify *engineering* instead of the noun *innovation*.

24. F  No change.

25. C  No colon is called for here.

26. G  The sentence contains a comma splice as written. The pronoun *whom* is needed here, rather than *who*, because the word is the object of *of* rather than in the subject position.

27. A  No change.

28. G  Only choice G suggests the magnitude and size of the system.

29. C  The technique referred to is “cut and cover,” which is immediately before Point C.

30. J  Only the word *revived* suggests that the practice had been in decline.

31. B  It is the “elite galleries” that are catering to the upper class. Only choice B suggests this.

32. J  Choice J provides the only logical order for the sentence to convey the intended meaning.

33. D  The underline portion is redundant and, therefore, should be deleted.

34. H  The word *as* completes the idiomatic expression, “as __________ as.”

35. B  The word *many* is needed as the sentence is referring to multiple frescoes.

36. H  As written, the sentence is a fragment. The period needs to be changed to a comma, and the capitalization removed.

37. C  As the subject is *empowerment*, the singular verb *was* is needed here. Choice D would create a fragment, so only Choice C remains.

38. E  No change.


40. J  The coordinating conjunction and is needed to join the two independent clauses. The word *when* would inappropriately subordinate the second part of the sentence.

41. B  The simple present tense form of the verb is all that is necessary here.

42. F  Answer is self-explanatory.
43. B Only choice B makes a clear, complete sentence.

44. J The word *however* is unnecessary as there is no contrast in the sentence that follows.

45. A No change.

46. J Choice J would create a run-on sentence.

47. C The word *though*—like the word *however* would be—is considered an interrupter here. Interrupters are separated from the rest of the sentence by commas.

48. F No change.

49. B The subject form, *who*, is required here rather than the object form, *whom*.

50. F No change.

51. B Sentence 2 only makes logical sense after sentence 3.

52. J The information is the underlined portion is redundant, and, therefore, should be deleted.

53. D Although *shone* is a word, *shoned* is not.

54. H Answer is self-explanatory.

55. A No change.

56. H As written, the original sentence places the *field* atop the *rabbit hutch* as opposed to the *rabbit hutch* in the *field*.

57. B Choice B is the only choice that makes a nonsensical sentence.

58. H Choice H is the only choice that makes a nonsensical sentence.

59. A No change.

60. G Placing this sentence at the end of paragraph two establishes the separation of the narrator and Joan and serves as an appropriate end to the first part of the passage. Therefore, it’s the most logical place to place it.

61. A No change.

62. H The conjunction *and* is needed to prevent a run-on sentence.

63. A No change.

64. H Only choice H mentions a *myth*, which is how *Orion* is later described.

65. D Answer is self-explanatory.
66. G The word *overseers* has a different meaning that does not fit the context.

67. A No change.

68. J The original sentence is too colloquial and doesn’t fit the tone of the rest of the selection. The other two incorrect choices both inappropriately bring in second person point of view (*you*).

69. A No change

70. G The plural form *have* is needed here as the subject is *stars*.

71. D The comma after *mythology* is incorrect; however, one is needed after Africa to separate the series of opening prepositional phrases from the rest of the sentence.

72. J Only choice J makes logical sense.

73. C Choice C provides the correct form needed here: *there*.

74. G The sentence as written contains a commas splice, which is corrected by the addition of the conjunction *and* in choice G.

75. D Sentence 6 is the last sentence with a reference to a specific culture’s view of the three stars.

**Math Test – Section 2**

1. (A). A good MNL question to begin this section. Make $v = 2$ and $p = 3$. If the cost per vehicle is $20 each, then 2 vehicles would cost a total of $40. If the cost per person is $10 each, then 3 persons would cost a total of $30. Adding $40 and $30, we get $70. So, we ask ourselves, “Which answer is $70 when $v = 2$ and $p = 3$? Only Answer (A) fits. Obviously, another way to do this one is to “see” that the expression needed would be 20 times the total number of vehicles ($v$) plus 10 times the total number of persons ($p$). Either way, we get answer (A).

2. (F). Just “plug-in” what is give and first note that the correct answers MUST be a negative number. This eliminates (K), (J) and (H) immediately. Be sure to write the numbers down! The expression $(r + b – g)(b + g)$ becomes $(9 + 5 – (-6))(5 + (-6))$ or $(20)(-1)$ or $-20$. Answer (F) is correct. This is a good one to show you that thinking will help eliminate answers before actual work is begun.

3. (E). A “wordy” question and possible “time bandit” for some students. Again, let’s think before doing anything else. From the question, we learn that the total run time for the first machine is 8 minutes and the total run time for the second machine is 6 minutes. The first machine makes 60 copies per minute, so $8 \times 60$ or 480 will be the total copies this machine will make in 8 minutes. The second machine makes 80 copies per minute, so $6 \times 80$ or 480 will be the total copies this machine will make in 6 minutes. Both machines together will make $480 + 480 = 960$ copies total.
4. (J). Key Word: **must**. To maintain *exactly* the current average, the total score *must* equal the average of the first 5 games. The total of the first 5 games is 1200 or an average of 240 \((1200 ÷ 5 = 240)\). Thus, the score needed for the 6th game is 240.

5. (C). Several ways to get this one, here is how we did it. $7.50 times 40 hours in one week equals $300. This eliminates answers (E) and (A) immediately. She worked two overtime hours or a total of 3 regular hours pay for these two overtime hours \((1.5 x 2 = 3 \text{ regular hours of pay})\). 3 times $7.50 = $22.50. This is added to $300.00 to get $322.50. Answer (C) is correct.

6. (K). **Eat The Sandwich** on this one. “A number, \(x\), squared is” is written as \(x^2 =\). The second bite is “39 more than…product of 10 and \(x\)” which is written as \(39 + 10x\). Putting this all together, we get \(x^2 = 39 + 10x\) which is answer (K).

7. (E). First, multiply \(9(x - 9) = -11\) to get \(9x - 81 = -11\). Next, add 81 to both sides to get \(9x = 70\) or \(x = \frac{70}{9}\). Answer (E) is correct.

8. (H). If the discount tickets are $4 each and a total of $60 was spent, then 15 tickets were bought \((\$60 \text{ spent} ÷ \$4 \text{ per ticket} = 15 \text{ tickets bought})\). If the total regular price of the tickets was \($97.50 \text{ (} \$60 + \$37.50 = \$97.50\)\), then the regular price per ticket would be \($97.50 ÷ 15 \text{ tickets} = \$6.50\). Answer (H) is correct. Our calculator helped us speed up the computations on this one.

9. (A). Using just the \(3x\) in both expressions, we can eliminate answers (E) and (D) when we multiply these quantities together to get \(9x^2\). By multiplying \(-4y^2\) times \(+4y^2\) we get \(-16y^4\). This eliminates answers (C) and (B). Answer (A) is correct.

10. (J). **Draw It and FOF**. Draw this one and put the facts on the figure (FOF). Since the area of this rectangle is 32, we immediately conjure up the following rectangle…it is the first one that pops into our head!

![Rectangle Diagram]

This rectangle has an area of 32 \((4 \times 8 = 32)\) and a perimeter of 24 \((4 + 8 + 4 + 8 = 24)\). This happens to fulfill the requirements of the figure given in the question, so we **ATQA** and mark (J). ☺

11. (D). The sum of the measures of the angles in a triangle is 180°. If two of the angles measure 47°, then the remaining angle would be 180° - 47° = 133°. Answer (D) is correct.

12. (K). The total number of possibilities is equal to the product of the number of choices available. In this case, this would be 3 sandwiches x 3 soups x 4 salads x 2 drinks or \(3 \times 3 \times 4 \times 2 = 72\). Answer (K) is correct.
13. (B). Use the **P-I Tactic**. Start with (E) and triple the last number given. In answers (E) and (D), it can quickly be seen that tripling the second number exceeds the amount given in the question (79), so we can eliminate them. In answer (C), tripling 21 yields 63, but when 20 is added to it, it exceeds 79. In answer (B), tripling 20 yields 60 and adding 19 to it gives us 79. Answer (B) is correct.

14. (F). In this question, we can see that \( x = -3 \) and when this is squared, it will be a positive 9. This +9 is then multiplied by \(-8\) to give us \(-72\). Answer (F) is correct.

15. (C). **Key Words: must be true**. If \( 3^x = 54 \), then we need to think about the exponent \( x \). If \( x \) is 3 then \( 3^3 = 27 \). If \( x = 4 \), then \( 3^4 = 81 \). Since 54 is between 27 and 81, we deduce that \( 3 < x < 4 \). Answer (C) is correct.

16. (J). There are a couple of ways to get this one, but we used the **P-I Tactic** and our calculator. But first, we eliminated answers (H), (G) and (F) because we could see that 70, 60 and 50 would not divide evenly into them. You can confirm this with your calculator, if you like. Since the question asked for the “least” common multiple, we plugged 2100 into our calculator and divided it by 60 and 50 to see if these numbers would divide evenly into it. They did. We did not try 70 because it was obvious it would divide into 2100 evenly. Answer (J) is correct.

17. (B). First of all, a **rectangular prism** is nothing more than a rectangular solid like a brick. Since the dimensions of length (45) and width (30) are given along with the total volume, all we need to do to find the height is divide the total volume (81,000) by the product of 45 and 30 (which is 1350). \( 81,000 \div 1350 = 60 \). Answer (B) is correct.

18. (J). **Draw It and Eat The Sandwich** on this one. Draw the circle and put the information on it, one step at a time. When you are finished, your circle should look like the one below.

![Circumference = 15](image)

Don’t worry about the figure being drawn to scale, just note the location of the letters on the circle. Now, ATQA. The order of the letters, starting with A and going clockwise is A, C, D, E. Answer (J) is correct.

19. (D). The key to this one is finding the value of \( 2^5 \) which is 32. If we multiply 16 times 32, we will get the answer. Without doing this, however, we can see that the answer **must** end in the number 2. How many answers end with the number 2? Answer (D) is correct.
20. (J). On this one, we drew a couple of rectangles and labeled them according to the information given in the question and used a modified MNL to complete our drawings.

\[
\begin{array}{cc}
6 & 2 \\
\hline
x & x
\end{array}
\]

From our drawing, we can see that the area of the large rectangle is \(6x\) and the area of the smaller rectangle is \(2x\). This means that the area of the larger rectangle is 3 times the area of the smaller. Mark (J).

21. (E). We used the MNL and Starting with (E) to get this one quickly. Let \(a\), \(b\), and \(c\) equal 1, 2, and 3. Plug these values into the given expression to get \((1 + 4 + 9) - (4 + 12 - 15)\) or 14 – 1 or 13. Which answer equals 13 when \(a = 1\), \(b = 2\), and \(c = 3\)? Go to answer (E) to get –3 –8 + 24 or 13. We are through, how about you? Mark (E).

22. (G). Time for good old OH, AH, OA. We can see from the figure that side \(c\) is the hypotenuse of the right triangle. Since the question asks for \(sin\), we know that \(sin = \frac{O}{H}\). From this, we can see that only answers (H) and (G) have side \(c\) as the bottom value in \(sin = \frac{O}{H}\). Next, we note that side \(a\) is opposite of the angle \(\theta\). Answer (G) is correct.

23. (B). This question has a simple reasoning solution. But, it would be helpful to draw a circle and put five “players” on it as we did below.

\[
\begin{array}{cccc}
& B & & A \\
& C & D & E
\end{array}
\]

This can be a “Time-Bandit” question if we are not careful; note that it is 8 lines of text. If we use what is given and let the starting player be “A” then we can see that “A” can only pass the ball to C or E. Let’s say that C receives the ball. C can only pass to D. D can only pass to B. B can only pass to E and E can only pass to A. The passes are as follows:

A ----> C, C ---->D, D ---->B, B ---->E, E ---->A. From this, we can see that A becomes the receiver on the 5\textsuperscript{th} pass. Answer (B) is correct.
24. (H). This question is the classic \( y = mx + b \) equation in disguise. The equation for line \( p \) is given as \( y = 0.12x + 3,000 \). In this case, the slope is 0.12. For the other line in the question, it is stated that the slope is 0.1 greater than the slope of line \( p \). To find the slope of line \( n \), simply add 0.12 and 0.1 to get 0.22. Answer (H) is correct.

25. (A). This question reviews the laws of exponents. Just be careful and you can get this one in a few seconds. Our first step is to multiply: \(-8x^3(7x^6) = -56x^9\). This eliminates answers (E), (D) and (C). Next, we can see that multiplying a minus (-8) times a (-3) gives us a +24 and only answer (A) has this. Answer (A) is correct.

26. (G). An absolute value question. This one requires us to remember that we work within the vertical bars \( \text{first} \) and then multiply. \( |-6 + 8| \) becomes +2 and \(-3 \times +2 = -6\). Mark (G).

27. (B). First, this figure is definitely not drawn to scale, so measuring things is out. It is nice of the test-maker to give us a hidden 3-4-5 right triangle to work with. If \( BC \) is 5, and it is because we have found the hidden 3-4-5 Pythagorean right triangle, then the length of \( BC (\text{which is 5}) \) represents one-fourth of the length \( AC \). Since triangle \( ACE \) is also a right triangle similar to triangle \( BCD \), the length of length of \( BD \), which is 3, represents one-fourth of the length of \( AE \): 3 is one-fourth of what? Multiply 3 x 4 to get 12. Answer (E) is correct.

28. (H). From the chart given, we can see that for each second that passes, the number of feet (\( y \)) increases by 5. For example, from 0 to 1 second, the number of feet increases from 14 to 19 and from 1 to 2 seconds the number of feet increases from 19 to 24. The cart is, therefore, traveling at 5 feet per second. Since the beginning point is at 14 feet (we are curious as to why they chose this), the data would be best represented by multiplying the time elapsed (\( t \)) times 5 and adding 14. Only answers (H) and (F) add 14 so we eliminate all the other answers. Since the rate of travel of the cart is 5 feet per second, we look to see which remaining answer has a 5 in it. Mark (H).

To test if (H) is correct, we choose at random, 3 seconds of elapsed time to plug into our equation of \( y = 5t + 14 \) and get \( y = 5(3) + 14 \) or \( 15 + 14 = 29 \). From the chart, we see this works. Ta-dah!

29. (E). This one takes a little work. First, we express the inequality given by making \( 6(x + 2) > 7(x - 5) \) become \( 6x + 12 > 7x - 35 \). Next, we subtracted \( 6x + 12 \) from both sides to get \( 0 > x - 47 \) or, by rearranging the expression, \( 47 > x \) or \( x < 47 \). This is answer (E). Mark (E).
30. (K). **Draw It. Put the facts on the figure!**

Since the \( x\)-axis is 2 and the width of the square is 3, it is **possible** for the lower right corner (vertex) if the square to have the coordinates of \((5, 0)\). This is answer (K). Mark (K).

31. (E). Another hidden 3-4-5 Pythagorean right triangle. Well, we made it one anyway because on side is given as 4 meters. This means we can easily make side \( FG \) (labeled \( x \) in the figure) equal 3 and side \( HG \) (labeled \( y \) in the figure) equal 5. From \( a^2 + b^2 = c^2 \) we can see that to obtain \( y \) (which is \( c^2 \)) all we have to do is take the square root of \( x^2 + 4^2 \) or look for \( \sqrt{x^2 + 16} \). This is answer (E).

32. (G). While there are several ways to get this one, we used the **PI Tactic** to solve it quickly. Since the bottom number of the fraction given is 5, we reasoned that the total number of marbles needed would have to be divisible by 5. This eliminates answers (K) and (J) because 32 added to 40 and 32, respectively, is 72 and 64. Neither is divisible by 5. When we added 28, answer (H) to 32, we got 60 (which is divisible by 5) but with the added red marbles (28) to the existing red marbles (12) being a total of 40, this would give us a fraction of 40/60 or 2/3. Eliminate answer (H). When we added 18 red marbles, we got a total of 50 marbles, 30 of which would be red. This is \( 30/50 \) or \( 3/5 \). Answer (G) is correct.

33. (D). **Put the Facts on the Figure!** This is another \( y = mx + b \) question. The equation given is \( 4x - 2y = 8 \). We put this back into standard form to get \( 2y = 4x - 8 \) or \( y = 2x - 4 \). From this, we can see that the \( y \)-intercept is \(-4\). We take this to the figure given and mark an appropriate spot on the \( y\)-axis at about \(-4\). Since the line has a positive slope of 2, we know it runs from left to right in an upwards direction, so we sketch a line like that.

From all this, we can see that the quadrants of the plane that contain the equation \( y = 2x - 4 \) are I, III and IV. Mark (D).
34. (F). What’s with all these “graph” questions in a row? In this question, simply substitute the value of \( x = 1 \) (from the coordinates given as \((1, 2a)\)) into the equation of \( y = -5x^2 + 9 \) to get \( y = -5(1^2) + 9 \) or \( y = -5 + 9 \) or \( y = 4 \). If the \( y \) coordinate equals 4 this means that \( 2a \) would have to equal 4 or, in this case, \( a = 2 \). Mark (F).

35. (D). A “Working With Fractions” question! Let’s find a common denominator that will be easy to work with for this one. Both \( \frac{1}{2} \) and \( \frac{1}{3} \) will easily go into 6, so let’s divide the sandwich into sixths. Jerome ate one-half of the sandwich, or \( \frac{3}{6} \). Kevin ate \( \frac{1}{3} \) of the sandwich or \( \frac{2}{6} \). This leaves Seth only \( \frac{1}{6} \) of the sandwich. Answering the question asked, the ratio of Jerome’s share to Kevin’s share to Seth’s share is the numerator of these fractions: 3:2:1. Answer (D).

36. (F). The equation given, \((x – 5)^2 + y^2 = 38\) is really nothing more than the standard description of a circle more commonly known as \( x^2 + y^2 = r^2 \). Thus, the radius of the circle would be \( \sqrt{38} \). This eliminates all answers except (J) and (F). The center of the circle would be at \( (x – 5) \) or \( x = 5 \). Answer (F) is correct.

37. (B). From the figure, we can see that the radius of the circle (adding the left and right semicircles to make one full circle) would be 4 cm. The circumference of this circle would be calculated by \( C = 2\pi r \) or \( C = 2\pi(4) \) or \( C = 8\pi \). Adding this to the two straight portions of the figure (both are 8 cm) we get \( 16 + 8\pi \). Mark answer (B).

38. (G). Let’s get this one quickly and move on. Draw a straight line from \( F \) to \( E \). Note that we now have two non-shaded triangles and six shaded triangles. This means that we have \( \frac{1}{3} \) of the area not shaded. We look for an answer that is 1:3. Mark (G).

Now, to prove this, if you wish, you can use the MNL as follows:

![Diagram](image)

Using the numbers we have assigned to the figure, we can calculate that the area of each formed smaller triangle is 1.5. Check it and see, if you are not sure. Using \( A = \frac{1}{2}bh \) we can calculate that each small triangle an area of 1.5. This means that the non-shaded triangles have an area of 3 and the shaded region has an area of 9. 3 to 9 is 1 to 3. The trap would be comparing the non-shaded area (3) to the total area of the figure (12). This would be trap answer (H).

39. (C). To find the \( x \)-coordinate of the midpoint of the line given, simply add the two \( x \) coordinates given and divide that result by 2. In this case, it would be \([(-4) + (14)]/2 \) or \( 10/2 = 5 \). Answer (C) is correct.
40. (G). The area of one face of the given cube would be $8 \times 8 = 64$. Since a cube has 6 faces, the total surface area of the 8” cube would be $6 \times 64 = 384$. Mark (G).

41. (B). We just used a bit of math and reasoning to get this one. Since both equations show to equal $c$, we set them equal to one another as follows: $ay + bx = ay - bx$. We subtracted $ay$ from both sides to get $+bx = -bx$ and reasoned that (1) more than one line was represented. This made Statement III false (recall that we go backwards through Statements when they are given), so we eliminated answers (E) and (C). Since $+bx = -bx$, we reasoned that the lines were not parallel. This validates Statement II and eliminates Statement I. This eliminates answers (D) and (A) and leaves us with answer (B). Mark (B).

42. (F). We got this one by thinking a little. To find the distance from the boat to the dock, we need a viewpoint where we could see both the boat and the dock (or a laser range finder we could use from either the boat or the dock). Not having a range finder handy, we resort to trigonometry, which is what they wanted us to do. We reasoned that if we stood at the lighthouse, we could see the boat and the dock at the same time. We see the given angle between the boat and the dock is $52^\circ$ and that the adjacent length from lighthouse to the dock is 30 miles. To find the length of the line opposite us (boat to dock), we employ the tangent definition ($\text{opposite over adjacent}$). We know the adjacent length is 30 and the angle is $52^\circ$, so we can calculate the distance required by using $30 \tan 52^\circ$. Mark (F).

An interesting sidelight to this question: We noticed that this right triangle is probably a 30-40-50 one (10 times the classic 3-4-5). So we estimated the distance asked for at about 40 miles. From this, we found only two answers, (K) and (F) that came close to our estimate. And, we know that the testmaker likes to hide the answer in a cluster most of the time, so we had already assumed our best guess would be (F) because of the cluster of the first three answer choices.

43. (D). This question has a lot of words but can be solved quickly. The total of the pie chart is 100%. The age range designated is 25-35 and is indicated by the black area of the pie chart. This is 42%. Based on this, the number out of the age range is 58%. Thus, the odds of calling a person in the age range would be 42/58 which reduces to 21:29. Mark (D).

44. (H). This is a “tricky” question. The trap answer is (K). In geometry, a line of symmetry is a line that divides a figure into two congruent parts, each of which is the mirror image of the other. Answer (H) is correct because there are eight “points” seen in the figure and each could be folded straight across to the opposite side.

45. (A). **Write the Formula!** $A = \pi r^2$ finds the area of the stained-glass panel. Since the figure shows a radius of 1, the area would be $A = (3.14)(1^2)$ or 3.14. Only answer (A) is close to this. Mark (A).
46. (J). Since the given panel is 2 feet in diameter, we have to find what 75% of this is and add it to the original 2 feet to get the answer to this one. We multiply 2 x .75 to get 1.5 and add that to the original 2 feet to get 3.5 feet. Mark (J).

Note: These last two questions, when compared to several previous ones, should dispel the myth that the ACT is a “power test.”

47. (C). This one takes two things: **Put The Facts on The Figure** and **Draw it!**

![Diagram](image)

First, we extended the lines $AB$ and $CD$ to the left, as show above. Next, we labeled the figure with the facts. If the measure of angle $BAC$ is $82^\circ$ and it is bisected by line $AE$, this gives us two pieces of information. First, the angle inside the top of the triangle is $41^\circ$ and the angle that is formed when we extended the top line is $98^\circ$. Since the lines are parallel, this means we can now determine that angle $ACD$ is $98^\circ$ (alternate interior angles are congruent). Since $CE$ bisects this angle ($98^\circ$), this means the two angles formed by doing so are both $49^\circ$. This gives us two angles within the triangle: $49^\circ$ and $41^\circ$ which total $90^\circ$. This means the remaining angle, $AEC$, must be $90^\circ$. Mark (C).

48. (H). There is a complicated way to do this one, but since the two angles, $QST$ and $RTS$, both appear to be $30^\circ$ (they are, we will show why later) this means angle $TPS$ is $120^\circ$. Since line $TPS$ is a straight line, this means that angle $RPS$ is $60^\circ$. Minor arc $RS$ therefore represents $60/360$ or $1/6$ of the circle. $1/6$ of $360^\circ$ is $60^\circ$.

**Note:** To prove the two base angles of the triangle $TPS$ are both $30^\circ$, all you have to do is draw three (dotted) straight lines on the figure as we did below:

![Diagram](image)

This gives us a perfectly good rectangle with four $90^\circ$ corners, of which, the angle indicated is $30^\circ$. From this, you should be able to label the rest of the angles to see our solution above.
49. (B). If we triple the top equation given, we get the bottom equation: $2x - y = 8$ becomes $6x - 3y = 24$. In the bottom equation, 24 is represented by the testmaker as $4a$. This means $4a = 24$ or $a = 6$. Answer (B) is correct.

50. (F). Wow, another question of paragraph length that covers 3 total questions! In the question, we are given the coordinates of (9,2). Label these $x$ and $y$ just to keep things straight. Based on the graph, the coordinates of (9,2) means that the (Key Word) minimum number of large frames would be 2 (see the y-axis) and the minimum number of small frames would be zero (0). Only answer (F) fits the horizontal line segment given. Answer (F) is correct.

51. (C). From the information given in the general information for these questions, we know that Marcia will spend 12 hours making the large frames mentioned in this question (4 large frames x 3 hours per frame = 12 hours) and 4 hours making the small frames (2 small frames x 2 hours per frame = 4 hours). This is a total of 16 hours of charity work. At $3 per hour, she will donate a total of $48 for that week ($3 x 16 hours = $48). The total dollars she makes for the week is equal to $30s + 70l$ (given in the set up for the question) or $30(2) + 70(4)$ or $60 + 280$ or $340$ total. Of this $340, she donates $48. To find the closest percent of that week’s profit Marcia donates to charity, simply divide $48 by $340 to get 0.1411 or about 14%. Answer (C) is correct.

52. (J). Look at the graph (y-axis) and find that the maximum number of large frames she can make in a week. This is 8. At $70 each, this means she can make $8 x 70 = 560$. Answer (J) is correct. Some might think this question is flawed because it does not take into consideration the cost of the materials. However, the information given implies that the numbers used represent the “profit” Marcia makes. The only problem we find with this question is the fact that Marcia seems to only work a maximum of 24 hours in a week.

53. (E). It has been a while since we’ve seen a determinant question. We liked this one because we used the PLUG-IT-IN Tactic to get this one in about 10 seconds. $x$ has to be one of the answers given. We start with (E) as we always do, plug in 4 for $x$ to get $ad - cd$ to equal 16 – 32 = -16. Since this worked, we marked (E).

If you don’t remember how these things work, just note that the matrix cross multiplies $a$ and $d$ and $b$ and $c$. Using this pattern for $x = 4$ (answer (E)), we get $(4 x 4) - (8 x 4)$ or $16 - 32 = -16$.

54. (K). There are many ways to manipulate equations. We chose to use the MNL to get this one. The equation given is: $A = P(1 + 0.01i)^n$. We chose to simplify it to this: $12 = 3(2)^2$. This means that 12 represents $A$, 3 represents $P$, 2 represents $(1 + 0.01i)$, and $^2$ represents $n$. To find out what $P$ would equal, we just look at $12 = 3(2)^2$ and ask ourselves what would this equation have to look like for it to equal 3 ($P$)? 3 would equal $12/(2)^2$ or $3 = 12/4$. To put this in terms of what the question gave us, it would be $P \text{ (which is 3)} = A(\text{which is 12})/(1 + 0.01i)(\text{which is 2})^n(\text{which is 2})$ …clarifying this, we see that we have $P = A/(1 + 0.01i)^n$ or answer (K).
55. (C). Use the MNL to solve this one. You will have to recall that raising any number to an even exponent makes it positive…even for negative exponents. If we make $x = 2$ and $y = -2$, this fulfills what is given in the question. We substitute these values into each answer to find which must be true. Beginning with answer (E), $x^{-2} > y^{-2}$ becomes $\frac{1}{4} > \frac{1}{4}$. Since this in not true, we eliminate it. Answer (D) becomes $(2)^2 + 1 > (-2)^2 + 1$ or $5 > 5$. Since this is not true, we eliminate it. Answer (C) becomes $\frac{2}{3} - 5 > -\frac{2}{3} - 5$ or $-\frac{17}{3} > -\frac{19}{3}$. Since this is true, we think we have the answer, but we try answers (B) and (A) just to make sure. Answer (B) becomes $4 > 2$. Hmmm, this seems to work, too. But, what if we changed the value of $y$ to be $-10$ and kept $x = 2$? Then, this answer would be $4 > 10$. This is not true, so we can eliminate it. Answer (A), back to our values of $x = 2$ and $y = -2$, would become $-1 > 1$. Since this is not true, we can eliminate it.

Just to be sure, we go back to our answer (C) and plug in $y = -10$ to see what would result. We get $-\frac{17}{3} > -\frac{19}{3}$. Since this is true, we can be confident that answer (C) is correct. Mark (C).

56. (J). A little logic plus the facts given in the question and its accompanying figures goes a long way here. Since both triangles have two sides, $x$ and $y$, that are equal and the angles between these equal sides are given, we could use trigonometry to solve this one. We think it is called the Law of Cosines, but to cut to the chase, let’s just reason this one out. Both triangles seem to have a lot in common: Two sides that are equal and the sum of the base angles in triangle $ABC$ equals the top angle in triangle $PQR$ while the sum of the base angles in triangle $PQR$ equals the top angle in triangle $ABC$. This is enough evidence for us to conclude that the triangles have the same area. Mark (J).

For Inquiring Minds: The Law of Cosines (also called the Cosine Rule) is very useful for solving triangles like these: $c^2 = a^2 + b^2 - 2ab \cos(c)$. This is provided here for those wishing to spend the time doing the actual math.

57. (E). We got this one by using what was given and noting that only one answer conformed to the Law of Cosines (again!). Answer (E) was the only one that mirrored what was given in the “Note” below the question. We reasoned that the testmaker would not have given us this information for no reason, so we marked (E) and moved on.

For those that just have to know the trig, here it is: Since we know two side lengths and the angle they share and we are being asked to solve for the missing side length opposite the known angle, we can use the Law of Cosines to solve for side $BC$. Letting $a = 12$, $b = 18$, and $C = 40^\circ$. we get $BC^2 = 12^2 + 18^2 - 2(12)(18) \cos 40^\circ$ or $BC = \sqrt{12^2 + 18^2 - 2(12)(18) \cos 40^\circ}$. This is answer (E).

58. (G). There is a nice mathematical way to do this one, but we used the “Cheeseball” method to get it. We’ll show the mathematical way later on. For now, here is what we did.

The difference between the 10th term, 13, and the 6th term, 8, is 5. From the 6th term to the 10th term there four terms. We divided 5 by 4 to get $1\frac{1}{4}$ to get the common difference between each term. Next, we began at term 6 (which was 8) and subtracted $1\frac{1}{4}$ to get the 5th term of $6\frac{3}{4}$. Following this process, we got the 4th term of $5\frac{1}{2}$; the 3rd term of $4\frac{1}{4}$; the 2nd term of $3$; and the 1st term of $1\frac{1}{4}$. The question asked for the sum of the first four terms, so we added $5\frac{1}{2} + 4\frac{1}{4} + 3 + 1\frac{1}{4}$ to get 14.5. This is answer (G).
The mathematical way is as follows: Since the sequence is defined as “arithmetic,” we know that there must be a common difference we add to obtain each subsequent term. In algebraic terms, the pattern defined by an arithmetic sum is linear. Thus, we need to find a linear equation that contains points (6,8) and (10,13) where the value of $x$ is the term number and the value of $y$ is the term value. The slope (common difference) between these two points is $(13 – 8)/(10 – 6)$ or $5/4$ or $1.25$. Using the slope and one of the points in the slope-intercept form $y = mx + b$, we get $8 = 5/4(6) + b$ or $b = 8 – 7.5$ or $b = .5$. Thus, the pattern rule for this arithmetic sequence is $y = (1.25)x + .5$. From here, there are several ways to obtain the sum of the first four terms. The simplest is to substitute 1 through 4 for $x$ and add all the $y$ values together.

For calculator aficionados, if you have an updated graphing calculator such as a TI-84 or TI-Nspire, you can plug in the following partial sum of an arithmetic sequence: $\sum_{n=1}^{4} \frac{5}{4}x + \frac{1}{2}$.

_Much Thanks to our Friend Corey for helping with this one._

59. (C). Since this quadratic equation has only one real solution, it _must_ represent a perfect square of a binomial. It is given that $x = -3$, so we change this to $x + 3 = 0$ and square $(x + 3)$ to get $(x + 3)^2 = 0$ or $(x + 3)(x + 3) = 0$ or $x^2 + 6x + 9 = 0$. Comparing this to the equation given in the question, we can see that $m = 6$. Answer (C) is correct.

60. (F). _Draw It!_ We drew a number line and put the facts on it.

```
-8     -7   -6    -5     -4    -3    -2    -1     0     1     2
    ▼    ▼    ▼
```

From our figure, we can see that 5 units from –3 would be +2 and –8. These would have to be the values of $x$. Plugging these values into the answers given, we can quickly see that only answer (F) is correct: $|2 + 3| = 5$ and $|-8 + 3| = 5$.

_Note:_ In any of the questions in this section, obviously there may be other solutions. We solved these questions using the tactics and strategies that are taught in our ACT class. Sometimes these solutions are not “textbook” or “math class” in origin. However, logic and reasoning coupled with what is given in the question can and does lead to correct answers.
Reading - Section 3

Note: Students should underline the key words in the questions and answer those that refer to line numbers or paragraphs first. The answers to other questions are often found when a student is looking for a line number or paragraph question.

Passage 1

1. (D) In paragraph five, the author says that she and her dad talked about memories of the town as it was twenty or twenty-five years ago. Later the author reflects on the way things are in the town now. Answer D is the only one that mentions both the past and the present.

2. (H) This question requires the students to read the entire passage. No reference to photographs is made in the passage making H the best answer to this EXCEPT question.

3. (B) This question requires the students to read the first three paragraphs. Students can easily eliminate all but answer B because answers D, C, and A are found in those paragraphs. The trap is that although the passage mentions Chicago, no reference is made to the author living there. This makes answer B the best choice to this EXCEPT question.

4. (G) This is a sneaky question. Paragraph seven holds the clues to finding the best answer. Answer J is out because there is no suggestion that the town could be rebuilt to be as it was. Answer H is out because the author list specific changes that have been made. The examples given in the paragraph, such as people now lock their doors as well as the loss of a small farm and a bait shop to make way for gambling, are not signs that the town has improved. This leaves the students with answer G.

5. (B) In paragraph seven, reference is made to the fact that the football field now has a fence around it. The things mentioned in the other answers were things from the past, thus making answer B the best choice to this EXCEPT question.

6. (F) The answer to this “fact” question is also found in paragraph seven. The “tanning salon”, answer F, is given as an example of something relatively new in town. The other answers contain things that are no longer in the town.

7. (C) Students should read lines 76-84. The author says that the cosmonaut returning after a long stay in space will find his country changed. The author supports this by giving examples of an attempted revolution and the ultimate dissolution of the Soviet Union. The reference to his being without a country refers to the fact that the country is not the same as when he left. These examples refer to major political changes that occurred while the cosmonaut was in space. Only answer C contains this idea of political change.

8. (F) Paragraph four specifically says the person she first speaks to has been waiting long enough to beat her dad at cribbage. Therefore her dad must have been at the station. This makes answer F the best choice.
9. (D) Once again the answer to this question is found in paragraph seven. The author says that the changes she mentioned “pale in comparison” to the coming of Las Vegas-style gambling. Hopefully the students know that the phrase “pale in comparison” means that gambling, answer D, was a more significant change than the others given in the answer choices.

10. (H) The answer to this is a fact question is found in lines 87-88. The knees buckling was said to be result of the lack of exercise, answer H.

**Passage 2**

11. (C) This question requires the student to read the entire passage. By answering the other questions first students should be able to answer this question. The passage focuses on a school in a town in the Amazon. This school is trying to reduce the harvesting of endangered trees by teaching students to use the wood from trees that are plentiful. In the school students are taught new ways to make a living in the Amazon thus reducing the destruction of endangered trees. Answer D is out because the passage states that consumers can help prevent deforestation. Answer B is out because the passage focuses on a school that teaches students how to make guitars from the wood of ordinary trees. Shantytowns are mentioned in the passage but their relocation is not given as a way to save the forest, thus eliminating answer A. Answer C therefore is the best answer.

12. (F) Students need to read lines 33-43. In these lines the author makes the distinction between “certified wood” and wood from endangered trees. Since “certified wood” is plentiful, making guitars from it would help preserve these endangered trees. Answer F is the best choice since the phrase “environmentally sustainable” refers to trees that are plentiful.

13. (C) Since the OELA was established to teach students how to use common wood to make instruments and thus reduce the harvesting of endangered trees; the author will not have negative feelings about it. Thus students can mark out answers B and A. Since the passage mentions several obstacles to the success of OELA, paragraph nine, the author does not express confidence that the workshop model could be successfully duplicated, thus eliminating answer D. This makes answer C the best choice. The author clearly supports what the workshop is trying to achieve.

14. (G) The second paragraph highlights some of the problems found in the Amazon. Answer J is out because it is not found in the passage. The Ford foundation is mentioned only in passing thus eliminating answer H. Answer F is mentioned at the beginning of the paragraph, making it a good trap. However, population growth is only one of several problems given in paragraph. Although the paragraph lists the problems facing the Amazon, its purpose is to show that the workshop is giving hope for a solution to some of these problems. This makes answer G the best choice.

15. (D) The fifth paragraph explains the process of finding wood from common trees that can be used to replace the wood from endangered trees. This idea is given in answer D. Answer C is out because it contradicts information the passage. Nothing in the paragraph mentions the limitations of science thus eliminating answer B. Answer A is a true statement but has nothing to with paragraph five.
16. (H) Paragraphs six and seven list the problems of making instruments in the Amazon. Only answer H is not given as a problem.

17. (B) The author states, in the last paragraph, that 80 percent of the students come from regions outside the large city and all will return to their home towns. These students will hopefully take their appreciation of the forest back home and spread what they have learned. This in turn will have a positive effect on the survival of the forest. Only answer B contains this idea. Answer D is a good trap. The paragraph does say that some students may become politicians. However, all the students will spread their knowledge about the forest not just politicians. Answers C and A contain information not given in the passage.

18. (J) This question requires a little math. Paragraph four states that out of the 30 million cubic meters of wood cut annually, 20 million cubic meters are wasted. Hopefully students will see that 20 is more than half of 30. Answer J is the only answer larger than a half.

19. (A) At the end of paragraph five the author list the types of wood that have been used to replace the wood from endangered trees, traditionally used to make instruments. Answer A is the type of wood used as a replacement for the endangered rosewood. The other answers are examples of wood traditionally used to make instruments.

20. (F) In paragraph seven, the author states that when someone "adopts" a student they pay the student’s tuition. Answer F gives the answer to this fact question.

Passage 3

21. (C) This passage is basically the author reflecting on his path to becoming a philosopher. Answers D and A can be eliminated because they are too narrow and do not mention the early steps in the author’s development. Answer B is a good trap. The passage basically follows the chronological events in the author’s early development. However, the passage does not follow the author’s thirty year career as a professor, thus eliminating answer B. This leaves answer C as the best choice.

22. (J) In paragraph three, the author states that he had a passion for butterflies before age ten. Answer J would therefore, be the earliest item in which the author was interested. The other answers contain items that the author was interested in as he grew older.

23. (A) The last paragraph focuses on the impact Mr. Marsh had on the author’s development. Answer D is out because the biographical information is extremely limited. Answer C is out because there is little specific information on the conduct of a typical class. Answer B is a true statement but is not the main purpose of the paragraph. Answer A is the best choice because the bulk of the paragraph describes how Mr. Marsh impacted the author’s development.

24. (J) The answer to this question is found in paragraph two. In lines 23-26 the author states that the picture represents himself at age eighteen pondering a metaphysical question. This information is clearly given in answer J.
25. (C) In paragraph three, the author states that he focused his mental energy on music and stories about drummers. The references to the magazine *Melody Maker* and songs in the top 20 are used as examples of his focus on music as a teenager. Answer D is a good trap because the paragraph mentions the author’s desire to improve his drumming technique. However, this answer is too narrow to be the best answer to the question. Answers B and A are unsupported by information in the paragraph and can be eliminated. Since the references to the magazine and the top 20 songs are used to show things that became the focus of the author’s interest, answer C is the best choice.

26. (F) In the third paragraph the author speaks of the power of mental energy going in search of some object of interest. He says that this mental energy might focus on things that are trivial or sometimes destructive. He then gives examples of things that he focused during his childhood. Answer J is out because the concept of mental energy uniting people is not mentioned. Answer H is out because although the word delicate is used, the author makes it clear that this mental energy is strong and important. Answer F is the best choice because it recognizes the strength of this mental energy while stating it is difficult to channel in a constructive way such as into formal education.

27. (C) In lines 55-56 the author states that getting students to focus their mental energy on formal education is difficult. It is implied that schools need to find ways to “harness” the student’s passion. Answer D focuses on students not the changes that need to be made in education. Answer B is too narrow, since it only includes science. Requiring students to take philosophy is not supported by the paragraph and is too narrow to be the best answer. Answer C is the only answer that focuses on the changes that need to be made by schools.

28. (J) Students should have read most of the last paragraph in answering other questions. In lines 75 through the end of the passage, the author extols the value of the basic tools, pen and paper. Answers H and G are not supported by information in these lines. Answer F is out because it is the opposite of information given in the last lines of the paragraph. Only answer J supports the author view about the value of paper and pen.

29. (A) Students have already read this section of the passage when they answered an earlier question. The lines given present the image of a gloomy day with a man deep in thought. Answer D is out because there is no reference that shows surprise. Answer C is out because the image is not one of peaceful relaxation. Answer B is out because nothing in the image shows bitterness or betrayal. This leaves the students with answer A.

30. (F) Students have already read these lines when answering other questions. The lines given in the question include a series of examples that go from things that are intangible or ordinary to something real, useful or valuable. Answers J, H, and G are examples in keeping with the point the author is making. Answer F is the best choice because it is the opposite of the point being made by the author.
Passage 4

31. (B) This should be the last question answered. Answer D is a true statement but is too specific to be the main idea of the passage. Answer C contradicts information given in the passage. Answer A is not supported by any information in the passage. The last paragraph indicates that much about the eel’s life cycle remains a matter of speculation. This makes answer B the best choice.

32. (H) In the last paragraph the author says the Schmidt’s discovery made it possible for scientist to reach some major conclusions as to where eels breed. This fits the information found in answer H. All other answers are facts found in the passage but they do not answer the question.

33. (D) The fourth paragraph focuses on the period when the eels live in the rivers. This is an easy question since only answer D deals with the period when the eels are living in the rivers.

34. (J) This is a fact question. Students will find the answer to this question in lines 10-13. The sea is set off by strong winds. This fact is given in answer J.

35. (B) The answer to this fact question is found in the last sentence of the first paragraph. The author states that the Bermuda Triangle is part of the Sargasso Sea. This information is found in answer B.

36. (G) This should be the first question a student answers. It is a multi-definition vocabulary question. The word popular as used in line 17 means well known. Answer G, commonly known, best fits the context of sentence.

37. (B) This is the second question students should answer. The context in which the word read is used in line 45, means to study or examine. Since the sentence is describing how scientists figure out the age of an eel, answers D, C, and A are out because they have nothing to do with the process of examining the growth rings. Answer B is the best answer because the word observe fits the process of examining the growth rings.

38. (F) In lines 59-62 the author says that the change in the pupils allows the female eels to adapt to a low light environment. Only answer F refers to the need to adjust to low light.

39. (A) Students will find the answer to this question in lines 62-66. In these lines the author explains that the process of osmosis prepares the eel for the greater pressure they will encounter in the deep ocean. Only answer A contains a reference to the depth of the water.

40. (F) The last paragraph says the size of the eels that Schmidt found were so small, they had to have been born near by. The size of the eels is found in answer F.
Science Reasoning – Section 4

PASSAGE 1

1. (D) Using Figure 2, the highest percent of finches on both Island B and Island C had a beak depth of 10mm. This information is given in answer D.

2. (J) Study 2 found that small seeds were more abundant in wet years. Figure 3 shows that 1984 was a wet year. Therefore answer J, 1984, is the year when small seeds were most abundant.

3. (B) In Study 1, both types of finches were captured. In Study 2, only fortis finches were captured. Beak depths were measured in both studies thus eliminating answers D and C. Fortis finches were captured in both studies thus eliminating answer A. Fuliginosa finches were captured in Study 1 but not in Study 2, making answer B the best choice.

4. (J) This question requires some basic logic. Since the researchers were measuring the depth of the bird’s beaks, they wanted to make sure they were not capturing the same birds. Therefore, tagging was the only way to be sure they were catching different birds. This information is given in answer J.

5. (C) The introduction to the two studies stated that birds with shallower beaks can only crush and eat small seeds. The last few lines of Study 2 states that small seeds were abundant in wet years but were scarce in dry years. Therefore since 1977 was a dry year, birds with larger beaks had a greater chance of survival. This information is given in answer C.

6. (F) The first chart in Figure 2 shows that G.fortis finches showed the greatest variation in beak depth on Island A. This was the only island on which they had to compete with another finch species. Therefore the results support the researcher’s hypothesis. This information is given in answer F.

Passage 2

7. (D) The information given in Figure 2 and Figure 3 shows that the ion given in answer D has the highest wet deposition in February and the lowest in July. Since this is the pattern asked for in the question, answer D is correct.

8. (G) Students are asked to find the average wet deposition for two ions. Using Figure 2, the students should see that the average monthly wet deposition is between 50 and 75. Students do not have to figure out the exact numeric average. By eliminating the high month and the low month, they should see the range given in answer G best fits.

9. (A) Figure 3 shows that the values for the ion were greater in November to April (winter to early spring) than in May to October. This information is given in answer A.
10. (H) The introductory paragraph states that various ions are carried to the Earth by precipitation called wet deposition. Logically, if no wet precipitation occurred in a given month, no wet deposition would take place. This conclusion is given in answer H.

11. (C) According to Study 3, Figure 3, as the distance from the urban area increased, the annual wet deposition of both ions decreased. This fact is given in answer C.

12. (F) Some students may find this to be a difficult question. However, there are two ways to find the answer. The introduction to Study 3 states that measurements will be taken at three locations. Students should see that the only thing that did not change were the locations (sites) where the measurements were taken. If they do not see this they can use the process of elimination to find the answer. Answers J, H, and G changed during the experiment and thus can be eliminated. Therefore answer F must be the best answer.

Passage 3

13. (B) In Figure 1 the dotted line represents the average monthly high cloud cover. The question asks for the average high cloud cover for January 1987. Since each hash mark along the bottom of Figure 1 represents one year, students should see that the high cloud cover for this month was about 13.5%. This information is found in answer B.

14. (H) This question requires the students to read the chart given in Table 1. The number given in the question is not given on the chart. Students should see however, that for each 20,000 particle unit increase, there is a change of .3% of low cloud cover. Since the number given in the question is 20,000 units greater than the last entry on the chart, the percent of low cloud cover should be 29.3%, answer H.

15. (A) Figure 1 shows little correlation between the monthly high cloud coverage and the percentage of RCRF. Figure 3 shows a very close correlation between the monthly low cloud coverage and the percent of RCRF. This information is found in answer A.

16. (G) Figure 1 shows the average high cloud cover to be about 13.5%. Figure 2 shows the average middle cloud cover to be about 20.3%. Figure 3 shows the low cloud cover to be about 28.2%. Therefore the bar chart that correctly represents these numbers is answer G. A faster way to answer this question is to note that the low cloud cover is the highest of the three. The only chart that shows this fact is answer G.

17. (D) The introductory paragraph gives the altitude range for each of the three levels of clouds. Logically, the higher the level of clouds, the lower the air temperature. Therefore, low clouds, 0 to 3.2km, would primarily be composed of water droplets whereas high clouds, 6km to 16km, would primarily be composed of ice crystals. This fits the information given in answer D. It is assumed that students know that 0°C is the same as 32°F.
Passage IV

18. (F). Check Figure 1 for Experiment 1. It helps to label the descending line on the left of the graph “Yellow” and the ascending line “Blue.” The bottom axis of the graph is “volume of titrant added.” The descending line is “yellow” all the way down until the amount of titrant added is 1.0 mL. Thus, of the answer choices given, only answer (F), 0.80 mL of titrant, would result in a yellow solution.

19. (B). Be sure to look at the correct Experiment. This question essentially asks, “When was the solution NOT yellow or blue?” From the graph in Experiment 2, we can see that the color of the solution was green from 0.95 mL to 1.0 mL. This means the solution was not yellow or blue at this point. Only answer (B) falls within the range of 0.95 mL to 1.0 mL.

20. (J). This is a typical question for the ACT Science Reasoning. It requires a conclusion based on an extrapolation of the given data. The amount of titrant given fall outside the graph given. Extend the blue line up and to the right to the point that would equal about 2.30 mL according to the baseline of the graph. Next, look directly left at the “conductivity” side of the graph (on the far left). It can be seen that the conductivity would be in the area of 4.0 kS/cm. Only answer (J) is in this range. Our figure below will help you see how we got this one.

21. (C). From the first sentence in Experiment 1, we read that the sample solution was HCL. From the first sentence in Experiment 2, we read that the sample solution was acetic acid. Only answer (C) indicates acetic acid as the sample solution.

22. (J). Both Experiments clearly show, from the vertical axis of the graphs, that a measurement of conductivity could be taken. This is substantiated by the last sentence of the first paragraph of the passage given.

23. (A). From the last sentence of the second paragraph, we see that the solution is yellow if the pH is less than 6.0 and blue if the pH is greater than 7.0. Looking at the Experiment 2 graph, we can see that at 0.2 mL of titrant added, the color would be yellow (closely stippled dotted line on lower left) with a pH less than 6.0 and on the right at 1.8 mL, the color would be blue (dotted line on right of the graph) with a pH greater than 7.0. The chemist was wrong as indicated by answer (A).
Passage V

24. (H). Student 2 states that Algol B was not part of the original Algol system and states that Algol B and the original system formed in different clouds of gas. Only later, by intersecting orbits did Algol B become a part of the Algol system. The only way this could happen, it is inferred, is by gravitational force. That is, the capturing of Algol B by the system as its orbit intersected the system.

25. (B). The answer to this question comes directly from Fact 4: the majority of the energy comes from the fusion of hydrogen nuclei to make helium nuclei in a shell surrounding its center.

26. (G). Student 2, from what is given, believes that Algol A and C was part of the original Algol system and was formed by/within the same gas and dust cloud and that Algol B was formed elsewhere, thereby possibly being composed of different gas and dust. All answers, except (G), would not be true to this student.

27. (C). See the paragraph immediately below Fact 5. There, it is stated that Algol C is 1.7-solar-mass or 1.7 times the mass of our sun. Our sun has a mass of $2.0 \times 10^{30}$ kg, so 1.7 times this amount would be $3.4 \times 10^{30}$ kg.

28. (G). In Fact 3, it directly states that the star produces most of its energy by fusing hydrogen nuclei (protons). This eliminates answers (J) and (H). High temperature and pressure is necessary because like charges repel one another. This is given in answer (G). Answer (F) incorrectly states that like charges attract one another.

29. (B). Fact 5 key word: massive. Student 1, sentence 2 key word: massive. Student 1 states that Algol B was originally the most massive and thus would be the one to most rapidly evolve into an MS (main sequence) star.

30. (H). See the last sentence of the last paragraph of Student 2. It states, “Algol B was always less massive than Algol A.” Answer (H) just restates this as “Algol A has always been more massive than Algol B.” This is one of the ACT’s favorite ways to confuse. That is, restating something given…backwards.

Passage VI

Note: If a student has his/her test booklet open to both Passage VI and VII, this scene can a little intimidating. We suggest folding the booklet to just one page at a time here. Also note that this passage contains a lot of graph interpretation.

31. (C). Another “outside” the graph question by the ACT. Just extend the Kr line out and up to the right in Figure 2. Look to the left and see that the pressure would exceed 400 torr.

FYI: The torr is a non-SI unit of pressure with the ratio of 760 to 1 standard atmosphere, chosen to be roughly equal to the fluid pressure exerted by a millimeter of mercury, i.e., a pressure of 1 torr is approximately equal to one millimeter of mercury. The torr unit was named after Evangelista Torricelli, an Italian physicist and mathematician who discovered the principle of the barometer in 1644.
32. (G). In both figures, put your pencil on the bottom of the graph at 7 g. and go straight up to intersect the CO₂ line. Figure 1, you should look to the left and see that the pressure is about 1000 torr and in Figure 2, you should look to the left and see that the pressure is about 500 torr. This is answer (G).

33. (A). This question just takes reasoning. If the size of the container is doubled, from 3 L to 6 L, then shouldn’t the pressure of the gas be halved? To prove this, just take a mass of O₂, say 4 g and find what the pressure would be for this amount on both Figures. In Figure 1, 4g of O₂ would have a pressure of about 800 torr. In Figure 2, 4g of O₂ would have a pressure of about 400 torr. The actual numbers are a little less than what we stated, but the concept of doubling the size of the contained halves the pressure of the gas is clearly seen.

34. (J). Answers (G) and (H) can be eliminated immediately because it is clear from either Figure that O₂ has a greater pressure than an equal mass of CO₂. Of the two answers left, only (J) explains the phenomenon of greater pressure. There must be more molecules of O₂ per gram than molecules of CO₂ per gram; thus, the higher pressure.

35. (A). This one takes a bit of scientific knowledge or just plain common sense. When gases are colder, they shrink. When a gas contracts, it exerts less pressure on the container it is in. Only answer (A) describes this phenomenon.

**Passage VII**

36. (G). Look at the curve that represents the “threshold of hearing” for humans. The bottom of this curve (line) is at about (look to the left) 2 x 10^1 or 20. Answer (G) is correct, but we are very curious as to why the number 20 is represented in such a complex manner by the researchers.

37. (A). The question specifies “high frequencies” of sound. Look at the top of each graph given. Figures (D) and (C) show no difference for the threshold of hearing at the higher frequency so they can be eliminated. Figure B indicates that after the hearing loss the frequency for the threshold of hearing increases. This cannot be. Eliminate (B) and mark (A). Figure A shows that the frequency detected is lower after the hearing loss.

38. (F). This question just takes common sense. Water is more dense than air. Thus, the highest intensity would be a sound passing through water. The Figure displays this at the far upper right where water and air are parallel to one another, but the water intensity at S = 100% is greater than that of air.

39. (C). Human hearing is limited to about halfway between 10⁴ Hz and 10⁵ Hz and seen in the graph given. Look at the “threshold of hearing” curve to confirm this. A sound at 10⁵ Hz would be out of the range of human hearing and therefore not painful.

40. (J). In the second paragraph, S is defined as the percent increase in air and water density that accompanies the compression of air and water by sound waves of given intensities. Right above the graph, the “Key” for in air and in water is given. It can be seen from the graph that as the frequency increases, S remains constant for both in air and in water.