SOLUTIONS MANUAL

FOR THE 2016-2017

PREPARING FOR THE ACT TEST

FULL-LENGTH PRACTICE TEST

PREPARED BY

DR. BILL STEWART

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English Test

Passage I: The Triangular Snowflake

1. A – Additional commas are not required.
2. J – The triangular snowflake is contrasted with the six-sided figure, so you need a change in direction in your thinking. "However" provides this change.
3. D – You need a subject and a verb in the clause after the word "suggests".
4. H – You should use the active verb that shows the scientist did the discovering.
5. B – Use the comma to set off the participle. You do not need a subject for "causing".
6. J – Use "bump" to agree with the subject "molecules".
7. B – Since the molecules bypass the liquid phase in going from vapor to solid, this choice would indeed be a detail that would help the reader understand this unusual phase change.
8. J – Verb must agree with the subject "snowflakes" which is plural.
9. C – Since the significant addition is dust, you need to set it apart with a colon.
10. J – Pressure becomes the subject and connects with the verb, "causes".
11. B – "more quickly" is a comparative adverb; thus the modifier of the adverb "quickly" is the comparative "more" because it compares "edge" with "the rest of the snowflake".
12. G – A simple comma is sufficient to separate the prepositional phrase from the main part of the sentence. The higher punctuation is not necessary.
13. A – The passage began with bonding and the simplest way to end the passage is to reference its chemical bonding nature.
14. H – In paragraph 2, the sentence before [C] discusses growth.
15. D – This discovery did not exhibit a violation of the laws of chemistry, but explained how a supposition was incorrect through further analysis

Passage II: Climbing Mt. Fuji

16. H - Separate the initial description phrase from the main part of the sentence with a simple comma.
17. B – The warm clothes would be needed later in the hike. The sentence is in the past tense as this event happened prior to the retelling of this story. "would" is the correct form of the verb.
18. J – Short is sweet and the other options are redundant to previous information.
19. C – The rocks must have been on top of the roof to fit with "unsettled and reassured" which is stated later in the sentence. Concrete must have been used for the overall structure.
20. H – The brand was the proof of the progress along the trail. A simple comma is all that is necessary to set off the final phrase.
21. A – Just like two lanes coming down to one on a highway, the hikers closed lengths as the hiking became more strenuous. "most" is a concise way to capture this observation.
22. F – After they condensed, the phrase beginning with "forming" described the illuminated line.
23. B – Since you are asked to focus on the slowness and the inability to set its own pace, Choice B captures that element of the story more effectively than the other choices.
24. H – You can use the least intrusive punctuation, the comma, to separate the prepositional phrase from the main part of the sentence.
25. C – You need a possessive apostrophe for crater but not for cliffs.
26. F – The goal of the hike was to see the sunrise at the top of the mountain by hiking all night. After working so hard, they were not going to just turn around and start down without enjoying the sunrise.

27. D – Due to the anticipation and the shifting clouds, when the gap occurred, the word "finally" captures the end of the waiting process.
28. G – The key idea is the ruggedness of the landscape and how the light interacted with it. "Shattered over" captures this interaction between the light and the landscape.
29. A – After the goal was stated in Paragraph 1, the details about beginning the journey are best placed there.
30. F – The passage highlights the various challenges in the hike such as the temperature and difficult footing, along with the risk of falling rocks.

Passage III: The Pottery of Mata Ortiz

31. B – No need to isolate the actual name with commas. If the word "named" had not been used, commas would have been required for the appositive.
32. H – This alternative does not work due to no comma after the end of the parentheses.
33. B – No punctuation is required to set off the dependent clause.
34. H – This option provides a nice transition from his desire and the action he took in producing pottery that mirrored his ancestors.
35. A – You need to keep the verb in the past tense and keep it simple.
36. F – If an anthropologist mistook his work for the real thing, it would indicate that his technique had closely matched the ancient ways.
37. A – This is the proper form for the past tense of the verb.
38. F – The adjective "eventual" indicates that the partnership took some time to develop.
39. C – This is the correct way to simply connect the two parts of the sentence.
40. J – This is the correct way to indicate what Quezada wanted to do.
41. C – You need the specificity of what the four hundred are (potters) and where they are located (Mata Ortiz). Since this sentence moved in time to "today", this clarification is required to avoid confusion.
42. G – You need to use the objective form "whom" to go with the preposition "of".
43. D – The pronouns need to match "Each artist" and "his or her" is the proper way to indicate that both genders may be involved.
44. J – This sentence goes best after 2 because it directly references the "people" who were taught the skill by Quezada and it stays in the time frame of his early teaching in his home village.
45. C – This essay does not summarize the history of pottery making in Mexico, but rather has a single artist focus on relearning a lost art.

Passage IV: Beaux Arts Architecture in the Spotlight

46. J – Use the possessive which does not have an apostrophe; also, you must use the singular form because it refers to a specific building.
47. D – No punctuation required and the verb needs to in a non-ing form.
48. H – Need a contrast between those who attend a performance and those that admire the architecture.
49. B – Simple transition to the verb "admire".
50. F – The semi-colon is necessary to separate the two clauses that make up the sentence.
51. D- The suggested addition is a detail that detracts from the main focus on the architecture.
52. J – The word "gray" is redundant because earlier it was stated that the building was made from "gray limestone".

53. A – No connecting words are necessary for the description of the "balustrade".
54. F – Plural subject and verb agree.
55. B – To mimic the style being described, the word "embellished" best suits this sentence.
56. G – This further description continues the emphasis on the elaborate interior of the theater.
57. C – At this point, the author moves from the exterior to the interior of the building.
58. F – You do not need contrast or any special connection to the previous paragraph.
59. D – Short is sweet and no additional words are required.
60. G – The article definitely gives numerous examples of the Beaux Art architectural style.

Passage V: Mother Jones: True to the Spirit of Her Cause

61. C – You need a noun and an adjective to be grammatically correct.
62. G – Use a colon to separate the two clauses and ensure that the second clause has both a subject and a verb.
63. D – The subject of the sentence is plural (untruths) and it must match the verb "matter".
64. F – Simple comma is all that is needed for the transition to the dependent clause.
65. C – The article begins a description of her activity in labor issues.
66. H – Need a possessive with "movement" and no possessive with "advocates".
67. D – No punctuation is required for the appositive.
68. G – This is a useful elaboration on her actions to remain consistent with her public persona.
69. D – The punctuation is incorrect in answers A, B, and C. A simple semi-colon will create the required pause between the two clauses.
70. J – This would reinforce the claim that she redefined the boundaries of home.
71. A – This addition works with the idea of "matriarch" introduced earlier in the sentence.
72. F – The colon presents a list that follows.
73. B – It is because of her efforts that she gained worker trust.
74. H – You need the possessive "their".
75. D – This is an article about a specific figure in the labor movement.

MATHEMATICS TEST

D 1) ADD 67 (A) & 6 (AB) = 73

PROBABILITY = $\frac{73}{150}$

H 2) MEAN = $\frac{\text{SUM}}{5} = \frac{\$1710}{5} = \$342$

E 3) THERE ARE FIVE $\frac{1}{2}$" IN $2\frac{1}{2}$"

THUS, THE DISTANCE = $5 \times 18 = 90$ MILES

YOU CAN ALSO USE A PROPORTION:

$\frac{\frac{1}{2}}{2\frac{1}{2}} = \frac{18}{x} \Rightarrow \frac{1}{2}x = 45$

$x = 2 \cdot 45 = 90$ MILES

F 4) $f = cd^3 \Rightarrow c = \frac{f}{d^3} = \frac{450}{(10)^3} = \frac{450}{1000}$

$= 0.45$

E 5) $f(1) = (3(1)+7)^2 = (10)^2 = 100$

H 6) NEW WAGE = $\$12 \times (1.06) = \$12.72$

E 7) YOU FIND THE NEXT NUMBER IN THE GEOMETRIC SEQUENCE BY MULTIPLYING BY (-3)

$1, -3, 9, -27, 81, -243, (729)$ 7TH TERM

H 8) FIFTEEN POUNDS FALLS IN THE 10-25 CATEGORY.

$$\text{COST} = \$10.00 + 15(\$0.65) = \$10 + \$9.75$$
$$= \$19.75$$

A 9) THICKNESS $= 0.32\,cm = 2(0.03) + N(0.02)$

SOLVE FOR N:

$$0.26 = N(0.02)$$
$$13 = N$$

K 10) SINCE THERE ARE 12 MONTHS (EVEN), THE MEDIAN IS THE AVERAGE OF THE 6TH & 7TH ENTRY IN THE ORDERED SET FROM SMALLEST TO LARGEST:

$$13, 15, 16, 19, 19, \underset{6^{TH}}{22}, \underset{7^{TH}}{25}, \ldots$$

$$\frac{22+25}{2} = \frac{47}{2} = 23.5$$

C 11) AT $t=0$, $d=14$ $\Rightarrow \Delta d = +6$

$t=1$, $d=20$

$$\boxed{d = 6t + 14}$$

K 12) AREA $= 54\,cm^2 = L \cdot W$ FOR $L=9$

$$\frac{54}{9} = W = 6\,cm$$

PERIMETER $= 2 \cdot L + 2 \cdot W = 2(9) + 2(6) = 18 + 12$

$$= 30\,cm$$

B 13) $\overline{AD}$ & $\overline{BE}$ INTERSECT AT C.
THUS $\angle BCA = \angle ECD = 45°$
TRIANGLE BAC HAS 3 VERTEX ANGLES THAT MUST ADD TO 180°
THUS $\angle BAC = 180 - 35 - 45 = 180 - 80$
$= 100°$

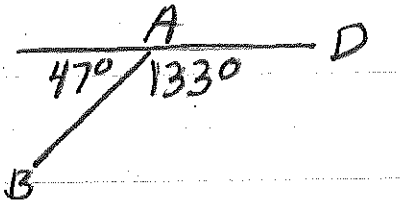
H 14) CORE SUBJECTS = 4 HOURS
TOTAL HOURS = 9 HOURS
FIND ANGLE BY: $\frac{4}{9} \times 360 = 160°$

B 15) LET L = # OF LARGE FIGURINES SOLD
S = # OF SMALL FIGURINES SOLD
REVENUE OF SMALL = REVENUE OF LARGE
$8S = 12L$

THUS $8S = 12L$
OR $S = \frac{12}{8}L = \frac{3}{2}L$

NOW, $S + L = 70$
$\frac{3}{2}L + L = 70$
$\frac{5}{2}L = 70$
$L = \frac{2}{5} \times 70 = 28$

H 16) $a = \frac{\Delta V}{\Delta t} = \frac{V_2 - V_1}{\Delta t} = \frac{220 - 88}{3} = \frac{132}{3} = 44 \frac{M}{S^2}$

D 17) 

THE TWO ANGLES MUST EQUAL 180° [SUPPLEMENTARY]

F 18) IN DECIMALS: $\frac{1}{2} = 0.5$; $\frac{5}{8} = 0.625$; $\frac{5}{6} = .8333\overline{3}$

THUS: $\frac{1}{2} < \frac{5}{8} < \frac{5}{6}$

D 19) $6.7 \times 10^8 + 7.0 \times 10^8 = 13.7 \times 10^8$
$= 1.37 \times 10^9$

F 20) ANGLES A & D MUST BE SUPPLEMENTARY
$\angle A = (180 - x)^\circ$

B 21) $1000 \times 0.8 = 800$ PASS WRITTEN TEST
$800 \times 0.6 = 480$ PASS DRIVING TEST

H 22) $x \cdot y = a^b \cdot c^b = (ac)^b$

A 23) $\frac{1}{2} y^2 (18x) = 9xy^2$

H 24) $(500p - p^2) > \$60{,}000$ MAKE A QUADRATIC EQUATION

$0 > p^2 - 500p + 60{,}000$
$0 > (p - 200)(p - 300)$

THE RIGHT SIDE IS A PARABOLA OPENING UPWARDS WITH ROOTS OF $p = 200$ & $p = 300$ BETWEEN 200 & 300, THE PROFIT IS GREATER THAN \$60,000. THUS $p = 200$ IS THE FEWEST P PAINTINGS TO GENERATE A PROFIT OF AT LEAST \$60,000.

B 25) HER GREATEST EXPENSE WAS #254 FOR CLOTHING. AS A PERCENTAGE:

$$\frac{\#254}{\#900} = 0.2822\overline{2} \approx 28\%$$

G 26) $\angle BAC$ & $\angle CAD$ ARE COMPLEMENTARY THUS

$$\angle BAC + \angle CAD = 90°$$
$$\angle CAD = 90° - (x + 20°)$$
$$= (70 - x)°$$

E 27) IN AN ISOSOLES TRIANGLE, THE SIDES ARE IN THE RATIO:

$$1 : 1 : \sqrt{2}$$

THUS FOR THIS TRIANGLE

$$8 : 8 : 8\sqrt{2}$$

PERIMETER $= 16 + 8\sqrt{2}$

H 28) FROM THE GRAPH, THE PARABOLA CROSSES THE X-AXIS AT TWO POINTS, ONE NEGATIVE & ONE POSITIVE. BOTH ARE REAL.

C 29) $(-3i + 4)(3i + 4) = 7$ FOIL

$$-9i^2 + 12i - 12i + 16 = +9 + 16 = 25$$

G 30) $\tan(\theta) = \frac{\text{OPPOSITE}}{\text{ADJACENT}} = \frac{7}{5}$

D 31) PROBABILITY $= \frac{5}{755}$

K 32) $\frac{2}{3} = \frac{8}{12}$ & $\frac{3}{4} = \frac{9}{12}$

THUS HALFWAY BETWEEN $\frac{16}{24}$ & $\frac{18}{24}$

IS $\boxed{\frac{17}{24}}$

B 33) $0.25'' = 2\,st$ SO $0.125'' = \frac{1}{8}'' = 1$ FOOT

$15' \times \frac{\frac{1}{8}''}{1'} = \frac{15}{8} = 1\frac{7}{8} = 1.875''$

H 34) TOTAL AREA IS $12' \times 15' = 180\ st^2$
WALL CABINETS TAKE $2' \times 12' = 24\ st^2$
CENTER CABINETS TAKE $4 \times 2' \times 2' = 16\ st^2$
FLOOR WITH TILE $= 180 - 40 = 140\ st^2$

D 35) ORIGINAL ESTIMATE HAS $6 + 4 = 10$ CABINETS
$\$2150 = \$650 + 10 \cdot X$
$\$1500 = 10 \cdot X$
$\$150 = X =$ COST PER CABINET

NEW ESTIMATE $= \$650 + 20(\$150) = \$3,650.00$

J 36) SEPARATE INEQUALITIES
$1 < X + Y$ OR $Y > 1 - X$
$2 > X + Y$ OR $Y < 2 - X$
THUS GRAPH (J) CAPTURES BOTH

A 37) MEDIAN IS $\frac{8+10}{2} = \frac{18}{2} = 9$

MEAN = $\frac{36}{4} = 9$

DIFFERENCE = 0

F 38) THE TWO FUNCTIONS INTERSECT AT EXACTLY THE TWO POINTS SHOWN AND NO OTHERS.

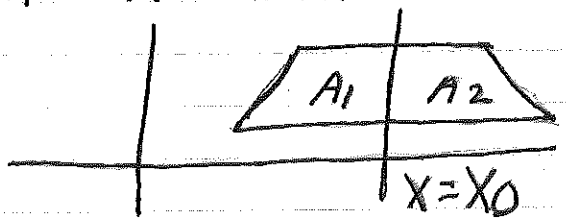
B 39) SLOPE = $\frac{\Delta Y}{\Delta X} = \frac{(1-4)}{12-9} = \frac{-3}{+3} = -1$

F 40) THE REFLECTION OVER THE Y-AXIS WILL RESULT IN D' BEING $(-12, 1)$

E 41) THE AREA OF A TRAPEZOID IS GIVEN BY:

$\left(\frac{b_1+b_2}{2}\right) h$

DRAW AN UNKNOWN VERTICAL LINE $X = X_0$



$A_1 = A_2$

$h = 4-1 = 3$

$A_1 = \frac{(X_0-3)+(X_0-2)}{2}(3)$

$A_2 = \frac{(9-X_0)+(12-X_0)}{2}(3)$

$A_1 = A_2 \Rightarrow 2X_0 - 5 = 21 - 2X_0$

$4X_0 = 26 \Rightarrow X_0 = 6.5$

K 42) $g\left(\frac{1}{2}\right) = \frac{1}{\frac{1}{2}} = 2 \qquad f(2) = 2 - \frac{1}{2} = \frac{3}{2}$

D 43) $P = \frac{\frac{1}{2}arY + a}{12Y} = \frac{a\left(\frac{1}{2}rY + 1\right)}{12Y}$

IF a IS DOUBLED, P IS DOUBLED.

G 44) $\Delta Y = 12 - 4 = 8$; $\Delta X = 14 - 6 = 8$
$8 \div 4 = 2$ UNITS
THUS D HAS AN X COORDINATE OF $6+2=8$
AND A Y COORDINATE OF $4+2=6$
$D(8,6)$

D 45) $a \cdot 6 = 27$ OR $a = 4.5$
THUS $X = 4.5(2) = 9$
$Z = 4.5(4) = 18$
THUS $X+Z = 27$

J 46) $\frac{3}{4} = \frac{6}{8}$ THUS 10 CUPS $= \frac{6}{8} - \frac{1}{8} = \frac{5}{8}V$
WHERE V = VOLUME OF THE CONTAINER.

$$10 = \frac{5}{8}V \Rightarrow V = \frac{8}{5}(10) = 16 \text{ CUPS}$$

B 47) RATIO OF TENTH : 86 : 255
RATIO OF ELEVENTH : 18 : 5) OR 90 : 255
THEREFORE TWELFTH : $255 - (86+90) = 79 : 255$

HIGHEST PROBABILITY IS 11TH GRADE

G 48) $\frac{4}{\sqrt{2}} + \frac{2}{\sqrt{3}} = \frac{4\sqrt{3} + 2\sqrt{2}}{\sqrt{6}}$

A 49) THE SHADED PORTION IS BELOW THE LINE AND WITHIN THE BOUNDARY OF THE CIRCLE. THUS

$\begin{cases} Y < -X + 2 & \text{LINE} \\ (X-1)^2 + (Y-2)^2 < 9 & \text{WITHIN CIRCLE} \end{cases}$

F 50) $\Delta V = 40\,cm \times 30\,cm \times 0.25\,cm$
$= 300\,cm^3$

E 51) $\frac{X}{Y} = \frac{5}{2}$ & $\frac{Y}{Z} = \frac{3}{2}$

$\frac{X}{Y} \cdot \frac{Y}{Z} = \frac{X}{Z} \Rightarrow \frac{5}{2} \cdot \frac{3}{2} = \boxed{\frac{15}{4}}$

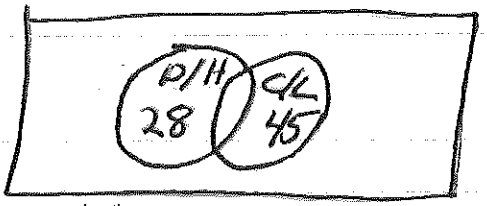
H 52) SEPARATE INEQUALITIES:

$-5 < 1 - 3X$ & $1 - 3X < 10$
$-6 < -3X$ & $-3X < 9$
$2 > X$ & $X > -3$

B 53) $S.A = 2LW + 2LH + 2WH$
DOUBLE L, W, & H
NEW S.A. $= 2(2L)(2W) + 2(2L)(2H) + 2(2W)(2H)$
FACTOR OUT 4
NEW S.A. $= 4[2LW + 2LH + 2WH]$
NEW S.A. $= 4 \times$ OLD S.A.

K 54) POG EATS $\frac{7}{3}$ CANS PER DAY
IN $(3+d)$ DAYS
CANS $= \frac{7}{3}(3+d) = 7 + \frac{7d}{3}$

55) BY QUESTION 1, 55 STUDENTS HAVE NEVER SKIED.
THUS $120 - 55 = 65$ HAVE SKIED.
NOW USE A VENN DIAGRAM WITH THE 65.



$28 + 45 = 73$

$73 - 65 = 8$

8 MUST HAVE SKIED BOTH D/H & C/C.

K 56) EACH ROW HAS $\frac{1}{3}$ TOTAL AREA
TOP ROW: A HAS $\frac{1}{2} \times \frac{1}{3} = 1/6$ TOTAL AREA
MIDDLE ROW: A HAS $\frac{1}{3} \times \frac{1}{3} = 1/9$ TOTAL AREA
BOTTOM ROW: A HAS $\frac{1}{4} \times \frac{1}{3} = 1/12$ TOTAL AREA.

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

A 57) $Y = SIN(X)$ STARTS AT THE ORIGIN,
$Y = SIN(X+a) + b$ IS SHIFTED TO THE RIGHT.
THUS a MUST BE NEGATIVE,
b MUST BE ZERO AS NO VERTICAL SHIFT.

NOTE: ANOTHER POSSIBLE ANSWER IS
$a > 0$ AND $b = 0$, BUT IT IS NOT
GIVEN AS A CHOICE.

K 58) THIS IS A BIT OF A TRICK QUESTION. AN ABSOLUTE VALUE CANNOT BE NEGATIVE THUS NO VALUE OF X WILL SATISFY THE INEQUALITY

E 59) EACH ANSWER HAS $\frac{1}{3}$ CHANCE OF BEING CORRECT.
$P(\text{ALL FOUR CORRECT}) = \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{81}$

J 60) SMALLEST ANGLE MUST BE OPPOSITE THE SMALLEST SIDE AND LAW OF COSINES APPLIES

$$(14)^2 = (18)^2 + (20)^2 - 2(18)(20)\cos(\theta)$$

Reading Test

Passage I: Prose Fiction

1. A – The narrator is remembering his upbringing in Bombay and shares his memories of the interaction each of them had with the city and the parents' role in helping to construct it.
2. J – He did not like the old photographs that showed panoramas of the city and its buildings. The narrator wanted to study the life of the city, its people, at the street level.
3. C – Injecting some humor, the narrator talked about the city rushing to be finished so his arrival to the world could see it as an accomplished project.
4. H – His mother was out there with "her", meaning Bombay. This is an illustration of personifying an inanimate object; in this case, a city.
5. B – Both parents played roles in child-raising and city building and managed this process carefully.
6. J – The Art Deco provided a broad area of influence along Marine Drive.
7. A – The comparison was obviously Rome, which was definitely a different place and time.
8. H – In line 33, the narrator mentions his jealousy of the city because it took the attention of both his parents during his childhood.
9. B – Similar to parents in today's busy world, his parents had to prepare a list so that all responsibilities could be managed.
10. J – His father is more in tune with the buildings than the people and believes that architecture and construction practices reveal the people who inhabit the city. The narrator does not agree and looked to build a career in photography that focused on people's lives.

Passage II: Social Science

11. A – Everything is so vast and the ocean is deep when it should be shallow and vice versa. He marvels at the discoveries of the world beneath the seas.
12. J – Surprisingly, these early named sites were all part of this huge mountain range in the Atlantic. Line 43
13. C – Power lies below this calm façade. Line 7
14. J – Lines 69 and 70 describe the 11,000 mile long canyon.
15. B- This portion of the article describes the volcanic hills as an otherworldly setting.
16. H – This ongoing flow of molten material from these gashes in the sea floor brings new material that is cooled and used to form the evolving sea floor itself.
17. B – If you wade into the ocean from a beach, it is a natural assumption to believe that the deepest portions of the ocean would be near the middle, not right off the shoreline.
18. F – As the line was allowed to follow the weights down into the depth of the ocean, it was "dispensed" from some type of reel.
19. D- Lines 51 and 52 state that the ocean basin compares with the surface area of the dry land of the continents.
20. F – Lines 56 through 58 discuss the skeletal remains that cover the peaks of the mountains.

Passage III: Humanities

21. A – His style of writing was to let words trigger ideas that became stories.
22. G – Lines 3 and 4 talk about young writers trying to force ideas into stories.
23. D – By struggling with the word, approaching it from different points of view, he could find the meaning of it in his life.
24. J - His memories of his grandparents' surroundings provided rich input to help him put his past experiences into focus.
25. C – Lines 40 through 42 discuss the moving of John Huff east for his stories.
26. G – His exaggerations indicate that he thought very highly of his friend.
27. C – The news changed the writer's life and the cloud never left.
28. J – The writer reacts to words and the associations they bring to create stories that are very imaginative.
29. C – The key object was the train ticket and that would have driven his imagination.
30. G - Life experiences were key to his writing and the triggers from his reality would deviate as the story developed.

Passage IV: Natural Science

31. A – This passage discusses the rare phenomenon of high-energy jaws of a species of ants.
32. G – These light-hearted insertions contrast nicely with the more technical material of the article.
33. A – The prey usually have protective outer surfaces that the high-energy jaws can penetrate. The other characteristics describe the ants themselves
34. J – The analogy of the archer's bow demonstrated the slow storage and then rapid release of the jaws.
35. D – This is an effective escape mechanism when intruders enter the nest.
36. H – The last three lines mention that the development of the bouncer-defense jump was a chance occurrence that resulted in an evolutionary advantage.
37. B – In this case, domain is the area of expertise of the scientists mentioned in the article.
38. J – Lines 49 - 51 discuss the deceleration of the jaws to prevent collision injury.
39. A – Lines 61 – 64 discuss the opportunity to launch a counter-attack on an intruder.
40. H – Due to conservation of momentum, both the intruder and the ant could be thrown out of the nest.

Science Test

Passage I: Fruit Flies

1. C – In Study 2, the 5%, SY medium sample had some fruit flies live beyond 75 days.
2. G – All the fruit flies were virgins, so the birthrate was zero.
3. D – The difference between Study 1 and Study 2 was the concentration of the sugar yeast media.
4. G – You need to interpolate between the 10% and 15% concentrations and that would put the anticipated result between the two entries in Table 1: 55.6 and 58.6 days.
5. C – Table 1 clearly shows an increased average life span for Strain X fruit flies that could not detect odors.
6. F – To determine this, Stain X should be used in the 15% medium.
7. A – Tubes 1 and 4 have only the sugar yeast media.

Passage II: Monarch Butterflies

8. F – Hypothesis 1 is the only one that states that the butterflies store lipids prior to migration and again when they are beginning the overwintering period.
9. D – All three hypotheses state that lipid storage is required during some period.
10. J – According to Hypothesis 3, lipids are only required for the overwintering period. Thus there would be an increasing level of lipids during migration, starting at zero.
11. C – Migration takes energy and the lipids store this energy prior to migration according to Hypotheses 1 & 2.
12. F – Hypothesis 1 requires the butterflies to store lipids prior to overwintering; thus a source of nectar must be present at these sites.
13. B – All three state that the lipid mass will change during migration.
14. F – From a knowledge of biology, ATP is the molecule that is created to provide energy for activity. Lipids store energy which is then converted to ATP to fuel the cells.

Passage III: Greenhouse Gases

15. C – Looking at Figure 2 and the dashed graph, at 8000 years ago, the left vertical scale reads about 500 watts/square meter.
16. F – This is the only answer that makes sense. It could have been significantly less than 550 ppb.
17. B – Graph B most closely follows the methane concentration levels of Figure 2.
18. H – 480 watts per square meter most closely fits in the middle of the cyclical graph.
19. B – Comparing peak to peak time values, the period would fall between 15,000 and 35,000 years.
20. J – This is the whole point of global warming hypotheses: gases absorb heat that would have radiated out into space and thus warms the climate.

Passage IV: Friction and Force

21. D – Newton's Third Law of motion requires that for every action, there must be an equal and opposite reaction.
22. F – For a constant force, the lighter blocks will accelerate more quickly: thus going from shortest time to longest time, the order would be 2.00 Kg, 2.50 kg, and 3.00 kg. This is based on Newton's second Law: Force = Mass x Acceleration.
23. B – Acceleration is defined as the change in velocity divided by the time interval. Thus the acceleration is 15 divided by 3 seconds = 5.0 meters per second squared. Remember that friction will reduce the net force from the applied force of 30 N.
24. J – Pulling force is the vertical axis and mass is the horizontal axis. The relationship is linear, so the slope of the line is found by dividing 20 by 4, giving 5.0 as the slope.
25. B – The speeds decreased as the mass increased.
26. H – The slope of the line was 5, so a mass of 6 kg would match with a force of 30 N. Remember that the friction reduces the net force from the applied force and the net force is what determines the acceleration. Since Experiment 1 has the blocks going at a constant speed, the pulling force just balances against the frictional force and the frictional force is dependent on the normal force, or the mass affected by gravity.

Passage V: Acid – Base Indicators

27. A - The pH values were known in Experiment 2 but were unknown in Experiment 3.
28. J – White would have been a good background as contrast to the indicator colors.
29. C – It changed colors between 7 and 9; thus the 7.4 to 8.6 would be a legitimate range for the transition point.
30. F – Indigo carmine does not change color until a pH around 12. It has the same color at pH of 1 and pH of 6.
31. B – Resorcin blue changes around 5 and should match propyl red.
32. G – No. Resorcin blue is red and this indicates a pH below 5 from Table 1.
33. D – Solution IV has a pH of 2 when it turns orange; thus it must be the lowest or most acidic of the four unknown solutions in Table 3.

Passage VI: Drilling Mud

34. J – The sunlight should be directly overhead and would be most intense.
35. A – The effects of the drilling mud on plant life and soil temperature were the reason for the data collection and they needed to control for other variables that might skew the results.
36. H – July 26 shows the indicated albedo measurements.
37. B – Sixty divided by five is twelve.
38. F – The albedo level was not calculated on July 20; you can see that no symbol is shown on the graphs on July 20th.
39. D – From the graphs, one can see that the albedo is lower than the control plot (#1). Temperatures, however, dropped in the soil due to the DM cover.
40. J – Since the proportion was 20% on August 3rd, there must have been 80% not reflected.

41.Essay: Public Health and Individual Freedom

42. Notes:
43. -Public versus private rights and freedoms go well beyond Health
44. -Socrates: the duty of the individual within a community
45. -Personal freedom and governmental intervention
46. -Concept of utility (the good of all)
47. -Example of The Cleveland Clinic
48. - Super-sized sodas and the effects of poor health choices

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49. **Essay One**:
50. When Dr. Tony Cosgrove, CEO of The Cleveland Clinic, outlawed smoking on the hospital campus, he was accused of overstepping his authority. As a lung surgeon, who had seen his own father die prematurely due to smoking, he had a personal interest in this issue and could not allow one of the premiere healthcare institutions in the world to remain silent. He also organized the vote on banning smoking from all public spaces, which passed and became law. Dr. Cosgrove has extended his "big brother" attitude to obesity, lack of exercise, and types of food served at The Clinic. He also refuses to hire anyone who has chosen to smoke. As a result, health insurance premiums have come under control and employees are performing at a higher and more effective level.
51. The focus on the "common good" is not a new concept and falls into the category of utility theory. When faced with a conflict between the utility to an individual and that of the community, the rational approach is to analyze the cumulative good that can come against the ill that might be done to the individual. Perspective One captures that approach and is a time-tested way to make trade-offs. Even though the calculations can be challenging, the very attempt to balance these attributes helps focus the attention on the various stakeholders in a public policy decision. "Click it or ticket!" is the commercial about laws requiring seat belt use in automobiles. "Don't text and drive, stay alive", reminds us to keep our eyes on the road.
52. Our country was founded on freedom and rights. "Life, liberty, and the pursuit of happiness" was penned by Thomas Jefferson in 1776 to announce this idea to the world. The "Bill of Rights" followed and then other amendments to The Constitution. The right to bear arms versus gun violence, freedom of speech versus flag burning, and the woman's right to choose versus the life of the soon to be born. Perspective Two goes a bit too far in putting its finger on the scale favoring individual freedom.
53. Do we all have to right to do destructive things to our own health and that of others? Your heath does affect me in the cost of my insurance premium, because those of us who choose healthy lifestyles pay more because you choose to smoke, eat pizza, and play videogames. I can remember well flying on planes where there was a smoking section, but we all breathed the air, smoking sections at Bob Evans, but with the same adverse effects. Slowly, the common good has begun to win some battles on the health fronts, but each small victory only comes after lots of discussion and hand-wringing.
54. In the 3rd century BCE, Socrates sat in this jail cell, condemned by his community to drink the hemlock. The charges were trumped up and he could have manipulated his way out of the sentence or simply agreed to leave the city of Athens under banishment. He chose to carry out the sentence because he believed that when one seeks to enjoy the benefits of a community, one must agree to live under its customs and regulations. An enlightened person should

understand his or her desires, evaluate whether others will benefit or lose, and then employ common courtesy or restraint to find the line in the sand where personal freedom and community responsibility merge.

55.

56. **Essay Two:**

57. It is everywhere! People and institutions telling me what I should or should not do. Parents, teachers, coaches, government and television all conspire to bring me under their collective control. I learned in Social Studies that our country was founded on personal freedom and didn't the early immigrants to North America come here to escape all the persecution that the institutions of the old world sent their way? I know exactly how they feel when I watch anti-smoking commercials or watch that power-wielding state trooper smirk, "Click it or ticket!"

58. Now they are telling me what to eat and how to spend my free time. If I smoke a cigarette, people look at me like I am a leper and should be shunned. Hey, I wasn't born a smoker, I chose to partake. I know the risks, but there are risks everywhere; life is a journey and you might as well enjoy it a little. What is wrong with some pizza on a Friday night and some sweet-tasting Coca Cola? The TV commercials tell me that I will be more social and smile way more than I would eating a cob salad and diet Sprite.

59. This onslaught on personal freedom has reached new levels in our country and was even highlighted in our recent Presidential Campaign. People are tired of Washington telling us what is good for us. They are likely being bought off by the special interests anyway. Drain the swamp they say. Keep your hands off our guns. Let us dig coal and frack oil and get this economy going again and bring back all those well-paying jobs they shipped overseas. Climate change is phony science and is just a way for the tree-huggers to feel powerful. Well, the election reset the stage and I doubt if the "Big Gulp" is going to be outlawed at Seven-Eleven stores in the near future. Throw BMIs on the trash dump of medical history and let stout become an attractive attribute again. And stay away from our national past time, NFL football. A little contact never hurt a real football player. Know the difference between pain and injury. Leave us alone.

60. Hey, I understand that if I expect to have rights, I can't take them away from others. I don't like thinking about drunk drivers coming down the road at 70 mph with blurry vision. Or being rear-ended by some nerd responding to an innocuous text message. Yes, we should all use basic common sense and if we did, we wouldn't need all the edicts and orders from the higher-ups. The pendulum seems to swing from time to time, and I just think the powerful elites have gone too far in telling the common person what he should wear, put on his plate, and text on his phone. Just as the "invisible hand" has worked so well in economics since the 18th century, so will the collective decisions of the millions of freedom loving citizens find the right balance between free choice and collective responsibility. Hey, Joe, make that a double cheeseburger, that new tangy sauce on the fries, and don't forget the dairy: triple chocolate milkshake! Man, I love saving money on those combo meals.