Practice ACT #7

Instructions:

Please print off this practice ACT if you can to simulate test-day conditions and be sure to follow the self-timing guidelines strictly. Do NOT give yourself a few extra minutes to finish any sections of the test. If you run out of time, guess just like you would on test day.

You can find the self-timing sheets in the "Welcome To The Ultimate ACT Course" Course in the lecture titled "Download Practice ACTs + How To Best Use Them." If you are approved for extended time, use the extended timing sheets. Otherwise, use normal time.

Ideally, it is best to take your practice tests in the morning at 8:30am to simulate test day (you will arrive at 8:00am on test day, but you will most likely not actually start the test until closer to 8:30). Take the practice test in a quiet environment without interruptions.

Scoring:

Once you have completed this practice ACT, you can use the answer key at the back of this test to score your answers. You can then use the scoring table at the back to find your scores. You will get a score 1-36 for each section (English, Math, Reading, Science). Your composite score is an average of your 4 section scores rounded to the nearest whole number.

ENGLISH TEST

45 Minutes—75 Questions

DIRECTIONS: In the five passages that follow, certain words and phrases are underlined and numbered. In the right-hand column, you will find alternatives for the underlined part. In most cases, you are to choose the one that best expresses the idea, makes the statement appropriate for standard written English, or is worded most consistently with the style and tone of the passage as a whole. If you think the original version is best, choose "NO CHANGE." In some cases, you will find in the right-hand column a question about the underlined part. You are to choose the best answer to the question.

You will also find questions about a section of the passage, or about the passage as a whole. These questions do not refer to an underlined portion of the passage, but rather are identified by a number or numbers in a box.

For each question, choose the alternative you consider best and fill in the corresponding oval on your answer document. Read each passage through once before you begin to answer the questions that accompany it. For many of the questions, you must read several sentences beyond the question to determine the answer. Be sure that you have read far enough ahead each time you choose an alternative.

PASSAGE I

King Tut's Space Bug

Among the treasures found in Pharaoh Tutankhamen's tomb, in the 1920s[1] one diminutive ornament poses a mystery that spans the ages. The "pectoral," a kind of jewelry worn on one's chest[2] depicts Egyptian symbols with gold and gems. Most strikingly, at the piece's center is a beetle carved from an ethereal yellow-green material.

[1] Originally, archaeologists identified the beetle as chalcedony, a quartz gemstone. [2] In 1996, likewise,[3] mineralogist Vincenzo de Michele noticed the beetle at the Egyptian Museum in Cairo and suspected it wasn't chalcedony. [3] After studying the beetle, he determined it to be 28.5-million-year-old glass. [4] De Michele then traced the glass to the Great Sand Sea of western Egypt, where pieces of it lay strewn across 6,500 square kilometers. [5] Glass is made by heating substances, such as,[4] sand.

1. **A.** NO CHANGE
B. tomb: in the 1920s
C. tomb in the 1920s,
D. tomb in the 1920s

2. **F.** NO CHANGE
G. "pectoral"—a kind of jewelry worn on one's chest—
H. "pectoral," a kind of jewelry worn on one's chest—
J. "pectoral"—a kind of jewelry worn on one's chest,

3. **A.** NO CHANGE
B. though,
C. truly,
D. also,

4. **F.** NO CHANGE
G. heating, substances such as
H. heating substances such as,
J. heating substances such as

[6] Though lava and lightning strikes can create glass the desert glass's traces of the elements iridium and osmium pointed to an unearthly culprit: a meteoroid. [7] It's true that the tremendous heat and pressure around the globe of meteorite impacts in many places have created glass. [8] But meteorites leave craters, and their was no crater that could account for the desert glass. [9]

In recent years, scientists John Wasson and Mark Boslough have put their research-whiz brains to work on a new explanation for the desert glass. Intrigued by the 1994 collision of Comet Shoemaker-Levy 9 with Jupiter and a 1908 meteoroid airburst over a remote region of Russia that flattened 80 million trees but left no crater, they ran sophisticated computer simulations.

5. **A.** NO CHANGE
B. glass, the desert glass's,
C. glass, the desert glass's
D. glass the desert glass's,

6. **F.** NO CHANGE
G. about
H. with
J. DELETE the underlined portion.

7. **A.** NO CHANGE
B. in many places around the globe of meteorite impacts have created glass.
C. of meteorite impacts have created glass in many places around the globe.
D. have created glass of meteorite impacts in many places around the globe.

8. **F.** NO CHANGE
G. there were
H. their were
J. there was

9. The writer wants to divide this paragraph into two in order to separate information about the discovery of the source of the beetle's material from the discussion regarding how that material was created. The best place to begin the new paragraph would be at the beginning of:

A. Sentence 4.
B. Sentence 5.
C. Sentence 6.
D. Sentence 7.

10. **F.** NO CHANGE
G. postulated radiative melting as effectuating
H. formed a compelling explanation for
J. whipped up a fresh theory about

11. If the writer were to delete the underlined portion (adjusting the punctuation as needed), the essay would primarily lose:

A. an indication that the Russian meteoroid's destructive power was greater than the event that created the desert glass.
B. a detail that suggests a key similarity between the Russian meteoroid and the event that created the desert glass.
C. a definition of "meteoroid airburst" that clarifies why such events are rarely studied by scientists.
D. an explanation of a scientific theory for why meteoroid airbursts occur.

Their conclusion: a meteoroid burned up in the atmosphere, but its fireball reached Earth and scorched an expanse of sandstone to temperatures above 1,800°C. [13]

12. **F.** NO CHANGE
G. whether
H. which
J. that

13. Which of the following true statements, if added here, would provide the best transition to the next paragraph and maintain logical chronology?

A. In 2010 and 2011, scientific studies using microspectroscopy and chemical analysis bolstered Wasson and Boslough's theory.
B. In 1932, English surveyor P. A. Clayton happened upon the desert glass and helped write the first detailed account of it.
C. The resulting glass was broken, scattered, and eroded over millions of years.
D. Scientists marvel at the desert glass's purity—about 98 percent silica.

Imagination can take the story through there. Some three thousand years ago, an artisan admired a piece of desert glass; so gorgeous that, with a little carving, it would befit a great pharaoh.

14. **F.** NO CHANGE
G. from
H. in
J. at

15. **A.** NO CHANGE
B. glass so gorgeous. That
C. glass so gorgeous; that
D. glass so gorgeous that,

PASSAGE II

Not All It's Krakened Up to Be

On a peaceful June night in my hometown of Muscatine, Iowa, I pulled into a parking spot near the Mississippi River, eager to see my friends. Then I saw it. Protruding from the windows of the old brick building in front of me were four enormous, bright-pink tentacles (they must have been twenty-five feet long!) that waved in the slight breeze. I didn't wait around to get a full view of the creature. Instead, I put the car in reverse, driving home, figured my friends could have dinner without me.

16. **F.** NO CHANGE
G. Iowa I pulled into a parking spot near the Mississippi River,
H. Iowa, I pulled into a parking spot near the Mississippi River
J. Iowa I pulled into a parking spot near the Mississippi River

17. **A.** NO CHANGE
B. reverse and driving home, figuring
C. reverse and drove home, figuring
D. reverse, drove home, figuring

While I was somewhat familiar with the Norse
18

legend of the squid-like kraken, a mythological sea
19
creature that resembled an oversize squid. Supposedly, the kraken could wrap an entire ship in its tentacled embrace eventually swallowing the ship whole—sailors
20
and all. But the kraken of Norse legend certainly never frequented the homes or places of business. And
21

who had ever heard of a neon-pink sea monster?
22

A month after my ordeal, my friend Rhonda called
23
me and asked if I was feeling okay. I was just starting to
23
relax and enjoy our nighttime stroll when we turned onto Mulberry Avenue. I must have made a noise—a yelp, or perhaps a blood-curdling scream because Rhonda looked
24
over at me with eyebrows raised. I pointed vaguely, expecting her to share in my horror.

This time, the tentacles unfolded from the windows of a large yellow house. I covered my eyes, and Rhonda said, "Louise. It's just an *art installation*." I peered through my fingers as she told me that Andrew Anderson, a local artist [25], had created the pink kraken. I had to admit that the kraken looked kind of friendly up close.

18. **F.** NO CHANGE
G. Although
H. Being
J. I was

19. **A.** NO CHANGE
B. ocean-dwelling creature,
C. creature,
D. kraken,

20. **F.** NO CHANGE
G. embrace, eventually swallowing the ship whole—
H. embrace, eventually swallowing the ship whole
J. embrace eventually swallowing the ship whole

21. **A.** NO CHANGE
B. people's
C. those
D. its

22. **F.** NO CHANGE
G. whom had ever heard
H. who will ever hear
J. whomever hears

23. Which choice provides the best transition to what follows in the paragraph?

A. NO CHANGE
B. my friend Rhonda convinced me that it was safe to leave my house.
C. I sat in my house while the summer slipped slowly by.
D. I was still unsure about leaving my house.

24. **F.** NO CHANGE
G. scream—because
H. scream, because
J. scream because,

25. At this point, the writer is considering adding the following accurate information:

who spent five years in Istanbul, Turkey

Should the writer make this addition here?

A. Yes, because it explains how Anderson's experiences helped him come up with the concept of the pink kraken.
B. Yes, because it provides information about Anderson's background as an artist.
C. No, because it provides information that is not directly related to the description of Anderson's pink kraken.
D. No, because it detracts from the paragraph's focus on Rhonda's knowledge of art.

The undersides of the soft, air-filled tentacles, were
26

white-and-pink plaid. I could hear the unceasing buzz
27
of the air blowers that, according to Rhonda, were responsible for making the inflatable sculpture seem alive.

As we walked away, I felt a little silly. I made
28
Rhonda promise not to tell our friends. And then I snuck one last peek at my summertime stalker and smiled. 29

26. **F.** NO CHANGE
G. undersides, of the soft air-filled tentacles,
H. undersides of the soft, air-filled tentacles
J. undersides of the soft air-filled tentacles,

27. Which choice most clearly indicates that the narrator's initial opinion of the pink kraken has shifted?

A. NO CHANGE
B. menacing sounds
C. soothing hum
D. noise

28. **F.** NO CHANGE
G. vacuous.
H. humble.
J. trivial.

29. Which of the following statements, if added here, would best conclude the essay by maintaining the characterization of the pink kraken as harmless rather than threatening?

A. It was a sight I wouldn't soon forget.
B. But it still looked too real to me.
C. It waved back.
D. But was it art?

Question 30 asks about the preceding passage as a whole.

30. Suppose the writer's primary purpose had been to write an essay describing the art scene in Muscatine, Iowa. Would this essay accomplish that purpose?

F. Yes, because it describes the pink kraken art installation and its origins.
G. Yes, because it describes how the narrator became interested in local art.
H. No, because it instead describes how one particular piece of art became a tourist attraction.
J. No, because it instead describes the narrator's experience with one particular piece of art.

PASSAGE III

Programmed for Success

Today's palm-sized computers descended from
31
the Electronic Numerical Integrator and Computer (ENIAC), the world's first successful electronic computer. It was a massive machine that took up 1,800 square feet of floor space and weighed 30 tons.

31. **A.** NO CHANGE
B. are devices that were eventually derived from the development of
C. come from a historical lineage of technology that initially began with
D. are descendants whose ancestor was

ENIAC was designed during World War II with the intention of helping the US military calculate precise trajectory tables that would of allowed artillery to be adjusted quickly.

32. **F.** NO CHANGE
G. would allow
H. has allowed
J. allows

A group of men designed and built ENIAC, a group of six women mathematicians, lead by Jean Jennings Bartik, programmed it. Bartik and her team figured out how to set ENIAC's 3,000 switches and hundreds of connection cables so that it could run each calculation correctly. Programming ENIAC required enormous patience. To change a program, the women had to rewire the machine manually by manipulating punch cards and switches in a series of wiring boards. It could take as long as two days to make even a small change.

33. **A.** NO CHANGE
B. It was a group of men who
C. Although a group of men
D. Several men

34. **F.** NO CHANGE
G. led among
H. lead with
J. led by

Once Bartik's team finished a program, though, a complex calculation such that it would have taken a human several days to complete could be done by ENIAC in a fraction of a second. Therefore, the machine could instantly determine the cube root of 2,589 to the 16th power. In one second, ENIAC could discharge 5,000 additions, 357 multiplications, or 38 divisions.

35. **A.** NO CHANGE
B. coincidentally,
C. moreover,
D. likewise,

36. **F.** NO CHANGE
G. of which
H. that
J. DELETE the underlined portion.

37. **A.** NO CHANGE
B. For example,
C. In addition,
D. Meanwhile,

38. **F.** NO CHANGE
G. administer
H. execute
J. invoke

Such computational capacity was used not only by the military but also in many scientific fields, including weather prediction, atomic energy research, and wind-tunnel design.

[1] But all the media attention went to the machine itself and the men who designed it. [2] The introduction of ENIAC to the world in 1946 was headline news. [3] The women programmers were largely forgotten until the late 1980s, when Harvard student, Kathryn Kleiman, came across the women's names' in a computer-history book.

[4] Kleiman filmed twenty hours of interviews with Bartik included with other surviving programmers. [5] This material finally brought attention to the ENIAC women, they were the twentieth century's first computer programmers. [45]

39. If the writer were to delete the underlined portion (adjusting the punctuation as needed), the essay would primarily lose:

- **A.** a suggestion of the writer's skepticism regarding ENIAC's usefulness for nonmilitary purposes.
- **B.** a claim that indicates the vital role of palm-sized computers in modern life.
- **C.** an indication of the broad scope of ENIAC's impact.
- **D.** a list of practical ways ENIAC is commonly used today.

40.
- **F.** NO CHANGE
- **G.** student Kathryn Kleiman,
- **H.** student, Kathryn Kleiman
- **J.** student Kathryn Kleiman

41.
- **A.** NO CHANGE
- **B.** womens' names'
- **C.** women's names
- **D.** womens names

42. The writer is considering deleting the underlined portion. Should the underlined portion be kept or deleted?

- **F.** Kept, because it suggests that Kleiman interviewed the programmers with some depth and thoroughness before sharing their stories.
- **G.** Kept, because it makes clear Kleiman's extensive experience and talent as an interviewer.
- **H.** Deleted, because it suggests that Kleiman was more interested in personal glory than in uncovering the programmers' untold stories.
- **J.** Deleted, because it shifts the focus from the women Kleiman interviewed to her own professional achievements.

43.
- **A.** NO CHANGE
- **B.** along with interviewing
- **C.** having included the
- **D.** and the

44.
- **F.** NO CHANGE
- **G.** we now honor them as
- **H.** it highlighted
- **J.** DELETE the underlined portion.

45. For the sake of logic and cohesion, Sentence 1 should be placed:

- **A.** where it is now.
- **B.** after Sentence 2.
- **C.** after Sentence 3.
- **D.** after Sentence 4.

PASSAGE IV

Painting Outside the Lines

[1]

Today, Yankton Sioux modernist painter, Oscar Howe, (46) is recognized as one of the most influential American Indian artists of the twentieth century. Howe received many prizes and accolades during his career. (47) But a pivotal moment in 1958 led to his emergence as a key position (48) responsible for broadening the boundaries of American Indian art.

[2]

In 1958, Howe submitted a painting, *Umine Wacipe: War and Peace Dance*, to the Philbrook Art Center for consideration in the museum's annual competition showcasing art by American Indians. Representative of Howe's style at the time, the painting featured sharp, angular shapes in rich pink, blue, and purple hues that geometrically depicted five dancers. [A] The jurors for the competition rejected Howe's submission, claiming it was "a fine painting . . . but not Indian." The then widely held (49) jurors shared the position that American Indian art should be based on the conventions of the Studio style.

46. **F.** NO CHANGE
G. modernist painter Oscar Howe
H. modernist, painter Oscar Howe,
J. modernist painter, Oscar Howe

47. At this point, the writer is considering adding the following true sentence:

> While serving in the armed forces during World War II, Howe met the woman who would later become his wife, Heidi Hampel.

Should the writer make this addition here?

A. Yes, because it establishes Hampel as an important figure in Howe's life and work.
B. Yes, because it offers details about Howe's life that are later expanded upon in the essay.
C. No, because it provides a detail about Howe's life that is only loosely related to the main subject of the essay.
D. No, because it disrupts the description of the range of prizes Howe received during his career.

48. **F.** NO CHANGE
G. figure
H. taker
J. role

49. The best placement for the underlined portion would be:

A. where it is now.
B. after the words *shared the*.
C. after the word *that*.
D. after the word *art*.

Works in this style depict traditional ceremonies, dance, and mythology and feature (50) strong outlines and flat fields of color. [B] Howe's deviation from the style, in particular his use of certain techniques, (51) was perceived to be the result of European influences, which the jurors considered (52) incompatible with authentic American Indian art.

[3]

Howe displayed his work in more than sixty solo art shows. (53) In an open letter, Howe argued that adhering and sticking (54) to notions of tradition would suffocate innovation in American Indian art. Furthermore, he argued, his work did employ American Indian art conventions. The angular shapes in his painting, Howe noted, is (55) actually derivative of the Dakota notion of *tohokmu*, the spider web.

[4]

The Philbrook's jurors conceded; they expanded the scope of the competition to internalize (56) experimental art. [C] Although questions related to art and identity are still on people's minds, (57) Howe's efforts continue to inspire confidence in many artists who (58) might otherwise feel confined by tradition. [D]

50. **F.** NO CHANGE
G. and while it featured
H. and featuring
J. featured

51. Which choice offers the most specific description of a characteristic of Howe's painting?

A. NO CHANGE
B. shaded, geometric shapes,
C. carefully created images,
D. some types of shapes,

52. **F.** NO CHANGE
G. these were considered by the jurors
H. the jurors considered these
J. they were considered

53. Given that all the choices are true, which one most effectively leads the reader from the previous paragraph into this paragraph?

A. NO CHANGE
B. Many artists who would later become well known attended the Studio School for art instruction in Santa Fe.
C. Established by Dorothy Dunn, the Studio School was in operation for sixty years.
D. Howe responded vehemently and publicly to the rejection.

54. **F.** NO CHANGE
G. and sticking too tightly
H. strictly and tightly
J. too strictly

55. **A.** NO CHANGE
B. has been
C. were
D. was

56. **F.** NO CHANGE
G. envelop
H. include
J. entail

57. The writer wants to emphasize the intensity of the questions related to art and identity. Which choice best accomplishes that goal?

A. NO CHANGE
B. talked about to some extent,
C. a matter of concern,
D. hotly debated,

58. **F.** NO CHANGE
G. for whom
H. for who
J. whom

Questions 59 and 60 ask about the preceding passage as a whole.

59. The writer is considering adding the following sentence to the essay:

> Eight years later, the museum awarded Howe the Waite Phillips Trophy for Outstanding Contributions to American Indian Art.

If the writer were to add this sentence, it would most logically be placed at:

A. Point A in Paragraph 2.
B. Point B in Paragraph 2.
C. Point C in Paragraph 4.
D. Point D in Paragraph 4.

60. Suppose the writer's primary purpose had been to discuss a significant point in an artist's career. Would this essay accomplish that purpose?

F. Yes, because it describes Howe's interaction with the jurors of the Philbrook competition and the effect of that interaction.
G. Yes, because it chronicles Howe's career up to Howe's involvement with the Philbrook competition.
H. No, because it does not explain why Howe's participation in the 1958 competition at the Philbrook was important.
J. No, because although it mentions Howe, it focuses mainly on the jurors for the Philbrook's annual competition.

PASSAGE V

In Tune

Every April, North Carolina's Louisburg College, normally only humming with students, welcomes a whistling crew for the weeklong International Whistlers Convention. A competition spawned from a folk festival, the IWC has existed for over forty years, attracting [61] whistlers from across the globe.

[1] Since most [62] whistlers aren't professional (though a few do make a living from whistling [63] tours and commercial spots). [63] [2] Technique, which includes tone and pitch, represent [64] only fifty percent of their scoring criteria.

61. Which of the following alternatives to the underlined portion would NOT be acceptable?

A. years, continuing to attract
B. years and attracts
C. years; attracting
D. years. It attracts

62. **F.** NO CHANGE
G. Considering most
H. While most
J. Most

63. If the writer were to delete the underlined portion (ending the sentence with a period), the essay would primarily lose information that:

A. indicates that many professional whistlers love to compete but have other jobs on the side.
B. hints at career options for whistlers and the talent of some of the competitors.
C. implies that it is unusual for professional whistlers to compete at the convention.
D. explains that competition winners go on to lucrative careers.

64. **F.** NO CHANGE
G. pitch, represents
H. pitch represents
J. pitch represent

[3] Still, qualifying for the IWC requires rigorous training. [4] Judges look for far more than a performer's ability to carry a tune. [5] Presentation and performance make up the rest, requiring judges to scrutinize participants' facial expressions, how participants present themselves overall onstage, and use of lips. [68]

Participants can compete in both classical and popular musical categories. They might, nevertheless, whistle an entire movement from Beethoven's Fifth Symphony or a more modern selection from pop artist Beyoncé. Many returning participants ambitiously aim on top of their previous performances with even more complex pieces.

Competitors, however, are far from cutthroat. The global whistling community is a tight-knit family, and Louisburg its home. A 2012 documentary about the IWC captures these sentiments. Filmmaker, Ien Chi, a first-time whistling competitor himself, tells the story of a niche group of individuals from Japan, Korea, France, Israel, and elsewhere, whose mutual passion for whistling eclipses language barriers.

65. Which choice makes it most clear that participants have to earn a spot to compete at the IWC?

A. NO CHANGE
B. becoming part of
C. preparing for
D. enrolling in

66. **F.** NO CHANGE
G. rest and this requires
H. rest, this requires
J. rest; requiring

67. **A.** NO CHANGE
B. participants' overall stage presence,
C. presenting themselves overall,
D. overall stage presence,

68. For the sake of logic and cohesion, Sentence 2 should be placed:

F. where it is now.
G. after Sentence 3.
H. after Sentence 4.
J. after Sentence 5.

69. **A.** NO CHANGE
B. might, moreover,
C. might, however,
D. might

70. **F.** NO CHANGE
G. over top of
H. on topping
J. to top

71. **A.** NO CHANGE
B. Filmmaker Ien Chi,
C. Filmmaker, Ien Chi
D. Filmmaker Ien Chi

One US participant shared with Chi that he
72
had waited thirty-four years to attend the world's

premier whistling competition, and meet fellow whistlers.
73
Others, acknowledging the outside perception of whistling

as simply a quirky hobby, described their craft as an art
74
form that fosters joy. Chi concludes that the IWC attracts

people who are not just vying for medals; the convention
75
also allows participants to communally celebrate this art

form, year after year.

72. **F.** NO CHANGE
G. One participant in particular (from the United States) interviewed by Chi
H. Specifically, one individual participant who was from the United States
J. According to Chi, one US participant

73. **A.** NO CHANGE
B. premier, whistling competition,
C. premier, whistling competition
D. premier whistling competition

74. Which choice makes it most clear that many outsiders perceive whistling as a lighthearted and informal activity?

F. NO CHANGE
G. an irregular avocation,
H. an obtuse specialty,
J. a zealous interest,

75. **A.** NO CHANGE
B. people, whom
C. people whom
D. people, who

END OF TEST 1

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose, but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

DO YOUR FIGURING HERE.

1. Carnell is paid a regular hourly wage of $13.50 per hour for working up to and including 40 hours in 1 week. For each additional hour he works in a week, Carnell is paid twice his regular hourly wage. Carnell worked 48 hours this week. What is his pay for this week?

(Note: Amounts are before taxes and benefits are deducted.)

A. $ 594.00
B. $ 648.00
C. $ 756.00
D. $ 864.00
E. $1,296.00

2. In the standard (x,y) coordinate plane, what is the slope of the line with the equation $y - 2 = \frac{1}{2}(x + 3)$?

F. $\frac{1}{2}$

G. $\frac{3}{2}$

H. -2

J. 1

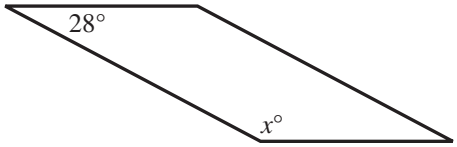
K. 3

3. Sofia earned scores of 85, 86, 87, and 82 points on 4 math tests. What score must Sofia earn on the 5th math test for the average of the 5 tests to be exactly 3 points higher than the average of the first 4 tests?

A. 70
B. 82
C. 85
D. 88
E. 100

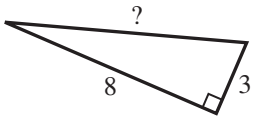
DO YOUR FIGURING HERE.

4. The parallelogram below has consecutive angles with measures $x°$ and 28°. What is the value of x ?



F. 112
G. 118
H. 124
J. 146
K. 152

5. Two side lengths of the right triangle shown below are given in inches. How many inches long is the hypotenuse?



A. $\sqrt{22}$
B. $\sqrt{55}$
C. $\sqrt{73}$
D. 11
E. 73

6. Using *only* Step 1 followed by Step 2 below, Amir correctly solved a linear equation.

Step 1: Subtract 16 from both sides of the equation.

Step 2: Multiply both sides of the resulting equation by 5.

One of the following equations is the equation that Amir solved. Which one?

F. $\frac{1}{5}n - 16 = 14$

G. $\frac{1}{5}n - 14 = 16$

H. $\frac{1}{5}n + 16 = 14$

J. $5n - 16 = 14$

K. $5n + 14 = 16$

DO YOUR FIGURING HERE.

7. All the kindergarten students at Cannon Elementary School are in exactly 1 of 3 classes. The 1st class has 10 boys and 15 girls, the 2nd class has 9 boys and 17 girls, and the 3rd class has 11 boys and 12 girls. All the kindergarten students at Cannon Elementary School are gathered in the gym for an assembly where 1 kindergarten student is randomly selected to win a prize. What is the probability that the selected student will be a boy?

A. $\frac{1}{2}$

B. $\frac{15}{22}$

C. $\frac{15}{37}$

D. $\frac{22}{37}$

E. $\frac{19}{51}$

8. Jamal purchased a car that had a purchase price of \$6,400, which included all other costs and tax. He paid \$1,500 as a down payment and got a loan for the rest of the purchase price. Jamal paid off the loan by making 36 payments of \$200 each. The total of all his payments, including the down payment, was how much more than the car's purchase price?

F. \$ 800
G. \$2,300
H. \$4,900
J. \$7,200
K. \$8,700

9. What is the solution of the equation $8(x + 2) = 4x - 2(x - 3)$?

A. $-\frac{5}{3}$

B. $-\frac{5}{6}$

C. $-\frac{11}{3}$

D. $\frac{1}{6}$

E. $\frac{2}{3}$

10. The expression $(2x)^3(3x)^2$ is equivalent to:

F. $36x^5$
G. $36x^7$
H. $72x^5$
J. $72x^6$
K. $72x^7$

DO YOUR FIGURING HERE.

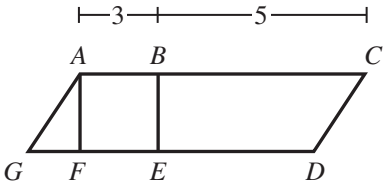
11. $3a - 4(2b - 5a) + 7(3a + 2b)$ is equivalent to:

A. $4a + 3b$
B. $4a + 6b$
C. $4a + 7b$
D. $44a - b$
E. $44a + 6b$

12. A square and a rectangle have the same area. The length of the rectangle is 45 centimeters, and the width of the rectangle is 5 centimeters. What is the length, in centimeters, of a side of the square?

F. 10
G. 15
H. 25
J. 100
K. 225

13. Square *ABEF* and parallelogram *ACDG* are shown in the figure below. Points *E* and *F* are on $\overline{DG}$, *B* is on $\overline{AC}$, and the lengths given are in inches. What is the ratio of the area of *ABEF* to the area of *ACDG* ?



A. 1:8
B. 1:16
C. 3:8
D. 8:1
E. 8:3

14. A 2-liter bottle of Fizzo contains approximately 67.6 ounces of soda. An 8-ounce serving of Fizzo has 110 calories. Which of the following is closest to the number of calories in a 2-liter bottle of Fizzo?

F. 220
G. 880
H. 930
J. 1,760
K. 7,440

15. What is the smallest integer greater than $\sqrt{77}$?

A. 5
B. 8
C. 9
D. 11
E. 39

DO YOUR FIGURING HERE.

16. A wheelchair ramp will be constructed for a public library. The ramp will extend 20 inches horizontally for every 1 inch of rise vertically. The rise of the ramp will be 30 inches. Which of the following values is closest to the length, in *feet*, the ramp will extend horizontally?

F. 3
G. 10
H. 18
J. 36
K. 50

17. Padma's teacher asked her to subtract 3 from a certain number and then divide the result by 9. Instead, Padma subtracted 9 and divided the result by 3, getting an answer of 43. What would her answer have been had she worked the problem as her teacher asked?

A. 15

B. 34

C. 138

D. $\frac{40}{9}$

E. $\frac{43}{3}$

18. On the local car dealer's lot, there are only 26 cars with a sunroof and only 18 cars with cruise control. The number of cars on the lot with both a sunroof and cruise control *must* be:

F. exactly 44.
G. exactly 8.
H. at least 8.
J. no more than 8.
K. no more than 18.

DO YOUR FIGURING HERE.

19. On her algebra exam, Hannah had to solve the equation $x^2 + 3x - 8 = 0$ for x. Confident that the quadratic formula was the correct method to solve this equation, she started her solution with the equation below. What error, if any, did Hannah make in setting up the equation?

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(8)}}{2(1)}$$

A. Hannah should have used -8 instead of 8 in the term $-4(1)(8)$ under the radical.
B. Hannah should have used -3 instead of 3^2 under the radical.
C. Hannah should have used -2 instead of 2 in the denominator.
D. Hannah should have used 3 instead of -3 in the numerator.
E. Hannah did not make an error.

20. Every 10 minutes, Channel 7 begins a 60-second-long commercial. Every 12 minutes, Channel 5 begins a 60-second-long commercial. Each channel began a 60-second-long commercial at the same instant. How many minutes will elapse before both channels next begin a 60-second-long commercial at the same instant?

F. 22
G. 24
H. 30
J. 44
K. 60

21. When Professor Soto began his trip to a mathematics conference, he noticed that the 2 digits of the recorded temperature, in degrees Fahrenheit, had a sum of 8. Later, he noticed that the 2 digits were reversed and that the temperature had warmed 18°F. What was the temperature, in degrees Fahrenheit, at the *beginning* of his trip?

A. 17°F
B. 26°F
C. 35°F
D. 53°F
E. 62°F

22. Given functions $f(x) = 4x + 1$ and $g(x) = x^2 - 2$, what is the value of $f(g(-3))$?

F. -123
G. -43
H. -31
J. 29
K. 119

DO YOUR FIGURING HERE.

23. In the standard (x,y) coordinate plane, A is located at (4,9). What is the location of the image of A that results from reflecting A over the y-axis?

A. (–9, 4)
B. (–4,–9)
C. (–4, 9)
D. (4,–9)
E. (9,–4)

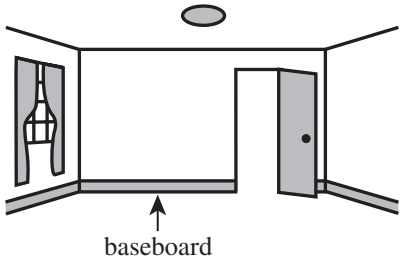
24. For every odd integer x, the expression $x^2 + x$ results in:

F. an even integer.
G. an odd integer.
H. a positive integer.
J. a negative integer.
K. a prime number.

25. What is the least positive number that has a remainder of 5 when divided by 7 and a remainder of 3 when divided by 5 ?

A. 20
B. 27
C. 33
D. 35
E. 50

26. Naomi is going to install baseboard around the perimeter of her room's rectangular floor, shown below. The floor has dimensions 15 feet by 20 feet. The 2 doorways in her room are each 3 feet wide and do not require baseboard. Assuming an average cost of \$0.30 per linear foot requiring baseboard, how much will it cost Naomi to purchase baseboard for her room?



F. \$10.50
G. \$19.20
H. \$21.00
J. \$88.20
K. \$90.00

27. Chou flies directly from New York City to San Francisco. New York City's time is 3 hours later than San Francisco's time. Chou left New York City at 7:30 a.m. local time and landed in San Francisco at 11:12 a.m. local time. How long was the trip?

A. 3 hours 42 minutes
B. 4 hours 18 minutes
C. 6 hours 18 minutes
D. 6 hours 42 minutes
E. 7 hours 18 minutes

DO YOUR FIGURING HERE.

Use the following information to answer questions 28–30.

Petsnacks produces and markets food treats and toys for pets. It currently produces 3 different flavored treats for cats and 4 different flavored treats for dogs. One of its cat toys is a spherical catnip ball with an outside diameter of 4 inches. Catnip is an herb that causes a reaction in 80% of all domestic cats. Petsnacks makes a profit of $7.50 on each catnip ball it sells.

28. Petsnacks is going to test its catnip ball on 200 domestic cats. Which of the following values is equal to the expected number of cats that will NOT have a reaction to the catnip in the toy?

F. 20
G. 40
H. 80
J. 120
K. 160

29. Petsnacks sold 1,500 catnip balls in its 7th month of operation and 1,550 catnip balls in its 8th month. Given that its sales of these toys have followed an arithmetic sequence since the operation began, how much profit, in dollars, did Petsnacks make on the catnip balls in its 3rd month of operation?

A. $ 9,375
B. $ 9,750
C. $10,125
D. $11,250
E. $11,625

30. Next month at a pet-food trade show, Petsnacks will exhibit 1 box of each flavor of its entire line of pet treats in a row on a shelf. By that time, the company will have added 3 different flavors of gerbil treats to its line of pet treats. Which of the following computations gives the number of *additional* orders in which Petsnacks will be able to arrange its treats on the shelf with the new line of gerbil treats than without the gerbil treats?

F. $\frac{10!}{3!}$

G. $\frac{10!}{3!7!}$

H. $(10 - 3)!$

J. $10! - 7!$

K. $\frac{10!}{4!3!3!} - \frac{7!}{3!4!}$

DO YOUR FIGURING HERE.

31. A tree farmer has exactly 3 kinds of trees on his farm: apple, cherry, and evergreen. Of these trees, $\frac{1}{2}$ are apple, $\frac{1}{3}$ are cherry, and 120 trees are evergreen. The farmer has how many trees on his farm?

A. 203
B. 210
C. 220
D. 400
E. 720

32. What is the median of the list of 10 numbers below?

87, 85, 78, 94, 67, 97, 55, 81, 87, 99

F. 82
G. 83
H. 85
J. 86
K. 87

33. A board $1\frac{5}{8}$ inches by $3\frac{5}{8}$ inches is $6\frac{1}{2}$ feet long. You want to cut as many pieces as possible from the board so that each piece is $1\frac{5}{8}$ inches by $3\frac{5}{8}$ inches and 6 inches long. Each saw cut wastes $\frac{1}{8}$ inch of the board. How many 6-inch-long pieces will you be able to cut?

A. 13
B. 12
C. 11
D. 10
E. 9

34. The probability that Event A will occur is $\frac{1}{8}$. The probability that Event B will occur is $\frac{1}{4}$. Given that Events A and B are mutually exclusive, what is the probability that Event A *or* Event B will occur?

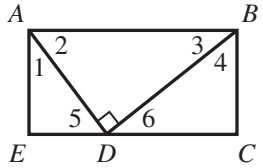
F. $\frac{1}{32}$
G. $\frac{1}{12}$
H. $\frac{1}{8}$
J. $\frac{3}{8}$
K. $\frac{1}{2}$

DO YOUR FIGURING HERE.

35. What is the measure, in degrees, of an angle with a measure of $\frac{7\pi}{9}$ radians?

A. 63°
B. 70°
C. 90°
D. 140°
E. 280°

36. As shown below, D is on side $\overline{CE}$ of rectangle $ABCE$ such that the measure of $\angle ADB$ is 90°. Which of the following angles *must* be congruent to $\angle 1$?



F. $\angle 2$ only
G. $\angle 4$ only
H. $\angle 5$ only
J. $\angle 2$ and $\angle 4$
K. $\angle 3$ and $\angle 6$

37. The area of a circle is 64π square inches. What is the circumference, in inches, of the circle?

A. 8π
B. 16π
C. 24π
D. 32π
E. 64π

38. In the standard (x,y) coordinate plane, points $A(2,3)$, $B(4,0)$, and $C(7,b)$ lie on the same line. What is b ?

F. $-\frac{21}{2}$

G. $-\frac{9}{2}$

H. $-\frac{1}{3}$

J. 6

K. $\frac{19}{3}$

DO YOUR FIGURING HERE.

39. When $a \neq 0$, which of the following is equivalent to $\frac{1}{a} + \frac{2}{3}$?

A. $\frac{2}{3a}$

B. $\frac{3}{3a}$

C. $\frac{3}{a+3}$

D. $\frac{3+2a}{3a}$

E. $\frac{3+2a}{3+a}$

40. A jar contains 2 green mints and 3 white mints. If Renée randomly takes 2 mints out of the jar to eat, what is the probability that *both* of these mints are green?

F. $\frac{1}{10}$

G. $\frac{3}{10}$

H. $\frac{1}{20}$

J. $\frac{9}{20}$

K. $\frac{3}{5}$

41. The number of decibels, d, produced by an audio source can be modeled by the equation $d = 10 \log\left(\frac{I}{10^{-12}}\right)$, where I is the sound intensity, in watts per square meter, of the audio source. What is the sound intensity, in watts per square meter, for an audio source that produces 100 decibels?

A. 10^{-2}

B. 10^{22}

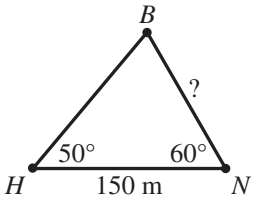
C. 10^{78}

D. 14

E. 140

DO YOUR FIGURING HERE.

42. The diagram below shows the location of Manuel's boat, which is on a lake and anchored to a stationary buoy at point B. On the shore, Manuel's house is at point H and his nearest neighbor's house is at point N, which is 150 meters from H. The measures of 2 angles are given. Which of the following expressions represents the straight-line distance, in meters, from B to N ?



(Note: For a triangle with sides of length a, b, and c that are opposite angles $\angle A$, $\angle B$, and $\angle C$, respectively, $\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c}$.)

F. $\frac{150 \sin 50°}{\sin 60°}$

G. $\frac{150 \sin 50°}{\sin 70°}$

H. $\frac{150 \sin 60°}{\sin 50°}$

J. $\frac{150 \sin 60°}{\sin 70°}$

K. $\frac{150 \sin 70°}{\sin 50°}$

43. Packmore Box Company manufactures a standard rectangular box a feet by b feet by c feet. A customer ordered a new box with double the volume of the standard box. Which of the following expressions represents the volume, in cubic feet, of the new box?

A. $8abc$

B. $a^2b^2c^2$

C. $2a + b + c$

D. $2a + 2b + 2c$

E. $2abc$

44. For her mathematics class, Ms. Wilkerson is preparing a probability experiment using only dried kidney beans, dried pinto beans, and an empty jar. First, she puts 4 kidney beans into the empty jar. How many pinto beans must be added to the jar in order to make the probability of drawing a kidney bean exactly $\frac{1}{5}$ when randomly drawing 1 bean from the jar?

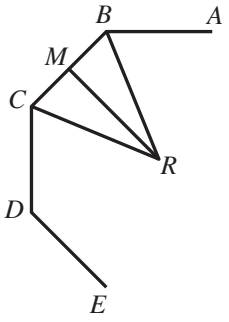
F. 20
G. 16
H. 5
J. 4
K. 1

DO YOUR FIGURING HERE.

45. A car rental agency has 20 cars. Of those cars, 4 are luxury sedans and all the other cars are midsize sedans. Each luxury sedan rents at a daily rate 50% greater than the daily rate for the midsize sedans. If the luxury sedans rent for \$45 per day, what is the average daily rental fee, to the nearest dollar, of all 20 cars at this agency?

A. \$27
B. \$33
C. \$38
D. \$42
E. \$56

46. A portion of a regular polygon (all sides of equal length and all interior angles of equal measure) with n sides is shown below. The midpoint of $\overline{BC}$ is M. The distance, in centimeters, from the polygon's center, R, to the midpoint of a side is the same for all sides. Which of the following is an expression for the area, in square centimeters, of the polygon?



F. $\frac{n}{2}(BC)(MR)$
G. $\frac{n}{2}(CM)(MR)$
H. $n(BC)$
J. $n(BC + BR + CR)$
K. $\sqrt{(CM)^2 + (MR)^2}$

47. Let a, b, and c be the respective side lengths, in feet, of a triangle. Given that a is 5 and b is 7, which of the following inequalities gives all and only the possible values of c ?

A. $c > 2$
B. $c < 12$
C. $0 < c < 12$
D. $2 < c < 12$
E. $5 < c < 7$

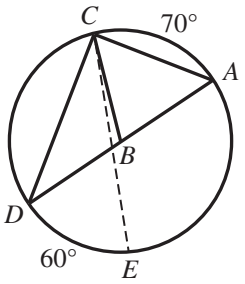
48. For the complex number i, which of the following expressions is equivalent to $(x + i)(x - i)$?

F. $x^2 + 1$
G. $x^2 - 1$
H. $x^2 + 2ix + 1$
J. $x^2 - 2ix + 1$
K. $x^2 - 2ix - 1$

DO YOUR FIGURING HERE.

Use the following information to answer questions 49–51.

The center of the circle shown below is at B, and the length of diameter $\overline{AD}$ is 12 cm. The measure of $\overset{\frown}{DE}$ is 60°, and the measure of $\overset{\frown}{AC}$ is 70°.



49. What is the measure of major arc $\overset{\frown}{ACE}$?

A. 130°
B. 230°
C. 240°
D. 250°
E. 260°

50. Triangle $\triangle ACD$ is a right triangle. Which of the following expressions represents the length, in centimeters, of $\overline{AC}$?

F. 6 sin 35°
G. 6 sin 55°
H. 6 sin 70°
J. 12 sin 35°
K. 12 sin 70°

51. If all points on the circle remain fixed in their current positions except E, which moves along the circle counterclockwise (↺) until it reaches A, the length of $\overline{CE}$ during this movement will:

A. remain unchanged.
B. decrease, then increase.
C. decrease only.
D. increase only.
E. increase, then decrease.

DO YOUR FIGURING HERE.

52. The function $f(x) = x^3$ is defined for all real numbers x. Which of the following expressions represents $f^{-1}(x)$?

F. $\sqrt[3]{x}$

G. $\frac{1}{\sqrt[3]{x}}$

H. $\frac{1}{x^3}$

J. $\frac{1}{3}x$

K. $-\frac{1}{3}x$

53. Given positive integers a and b such that $b < a < 14$, what is the largest value of $a + b$ that has a factor of 3 ?

A. 15
B. 18
C. 21
D. 24
E. 27

54. At an end-of-school-year party for juniors and seniors only, there are 20 more juniors than seniors. Of the 52 students at the party, 25% have summer jobs. Which of the following is closest to the maximum possible percent of the seniors at the party who have summer jobs?

F. 25%
G. 36%
H. 44%
J. 81%
K. 97%

55. What is the minimum value of $2x - 3y$ given that x and y satisfy the system of inequalities below?

$$\begin{aligned} x &\geq -2 \\ y &\leq 3 \\ x - y &\leq 5 \end{aligned}$$

A. −25
B. −13
C. 7
D. 17
E. 25

56. The ratio of a to b is 5 to 1, and the ratio of b to c is 9 to 1. What is the value of $\frac{2a+3b}{4b+3c}$?

F. 3

G. $\frac{1}{3}$

H. $\frac{13}{31}$

J. $\frac{37}{39}$

K. $\frac{37}{7}$

DO YOUR FIGURING HERE.

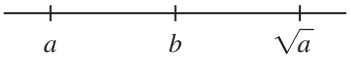
57. If t is any real number, which of the following statements must be true?

A. $-t < 0$
B. $-t < t$
C. $-t = t$
D. $-t \leq |-t|$
E. $(-t)^2 = -t^2$

58. Let a and b be positive real numbers such that $\log(a) = 3$ and $\log(b) = 2$. What is the value of $\log(a^2b)$?

F. 7
G. 8
H. 11
J. 12
K. 18

59. For real numbers a and b on the number line below, where $a < b$, which of the following values is a possible value for b ?



A. −2
B. 0
C. $\frac{3}{7}$
D. 1
E. $\frac{9}{4}$

60. For all positive values of x, which of the following expressions is equivalent to $2\sqrt[3]{2x} \cdot \sqrt[3]{x}$?

F. $\sqrt[3]{12x}$
G. $\sqrt[3]{24x}$
H. $\sqrt[3]{4x^2}$
J. $\sqrt[3]{8x^2}$
K. $\sqrt[3]{16x^2}$

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.

READING TEST

35 Minutes—40 Questions

DIRECTIONS: There are several passages in this test. Each passage is accompanied by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

Passage I

LITERARY NARRATIVE: This passage is adapted from the memoir *City Kid* by Nelson George (©2009 by Nelson George).

I am in the living room of apartment 6C in the Samuel J. Tilden housing projects in Brownsville, Brooklyn. It is 1960. I am four. I stand on my tiptoes in my stocking feet. My small brown fingers clutch the edge of a Motorola high-fidelity stereo, which is made of shiny lacquered wood and has a lemony smell, from the polish my mother applies every Saturday afternoon.

I feel the bass speakers in my stomach. I smell the polish. I feel the music. Looking over the edge, down into the bowels of the hi-fi, I watch the turntable needle roll across the grooves of a seven-inch record with a blue-and-white label at 45 revolutions per minute. The song is "Please Mr. Postman" by the Marvelettes.

As much as I enjoy "Please Mr. Postman," I'm anxious to hear the next record. Not just because it's Roy Orbison's "Oh, Pretty Woman" (which is the first record I ever asked my mother to buy for me), but because above "Mr. Postman" on the turntable are a slew of seven-inch singles suspended around a fat brown cylinder. Once "Please Mr. Postman" finishes, the needle arm moves away, a single vinyl 45 plops down on the turntable, and the needle returns, catching the groove and sending the rhythm of "Oh, Pretty Woman" vibrating through my body.

This Motorola stereo was the centerpiece of my family's living room, and our social life. Ma didn't allow my little sister, Andrea, or me in our living room too often, because she didn't want us sitting on her plastic-covered sofa or fingering the dice-shaped lighter on her glass-and-wood living-room table. But if we were playing records in the early evenings or on weekends, it was okay.

All through my childhood, from my first consciousness of music into the early seventies, that Motorola was my passport, not simply to records, but to the vast nation outside New York that the music came from. While the black-and-red labels of Atlantic 45s carried a Broadway address, most of the records in her collection came from Memphis (the Stax Records label was pale blue, with a finger-snapping logo) or Detroit (Motown's black-and-white label had a red star for the Motor City, while Tamla's colors were yellow and brown). As I read the labels of the records Ma brought home, I slowly became familiar with the cities of soul—Philadelphia, Los Angeles, Chicago, and Cincinnati. By the time I was an adolescent, I could identify certain names that recurred in the credits. Way before I understood what these credits meant, or who these people were, I was already collecting info for the books and articles I had no idea I would eventually write.

My interest in these records stemmed from a desire to better understand my mother's life. My mother was a soul girl: petite and cute, with a bright, girlish smile. Arizona Bacchus George, aka Doll, aka Ma, was full of life, and loved to laugh. Though burdened with raising two kids alone in a Brooklyn housing project, she didn't allow herself to become a stranger to fun. Not only was her ever-growing stack of 45s a testament to her love of music and dance, but she regularly held parties in that sacrosanct living room for her girlfriends and their male admirers.

I remember the time we took a pilgrimage to the Apollo Theater for a matinee show. It was a chilly, overcast day, and my mother and I joined a long line of black folk, as far as I could see, huddled on 125th Street, awaiting entry. Once inside, we sat in the orchestra near the back. I remember the elements of the James Brown Revue quite distinctly: Pigmeat Markham did his famous "Here Comes the Judge" routine; the Fabulous Flames danced like demons and harmonized like choir boys; the J.B.s, behind the antic introduction of MC Danny Ray, banged out a medley of the great man's hits.

Then Brown himself appeared, a short, dark man with shiny, processed hair who whirled and shuddered and shouted. On the way back to Brooklyn on the A train, I babbled to my mother about the sweaty man who kept tossing the cape off his back and running back to the mike to wail, "Please! Please! Please!"

It was special for me, not only because I'd seen James Brown, but because I was too young for so many of the shows my mother attended. Unlike today, when the separation between adult and kid entertainment has been blurred to the detriment of both, soul music was fundamentally music by, about, and for adults. When

my ma put on her auburn wig to see Otis Redding, or her blue eyeliner to watch the Supremes, it was to experience things so raw and so smooth, they weren't right for a child to see.

1. The tone of the passage could best be described as:

A. remorseful; the narrator imagines the life his mother could have had without the burden of raising a family in a Brooklyn housing project.
B. jubilant; the narrator expresses his delight that the musicians he revered in childhood eventually became such big stars.
C. inspirational; the narrator explains how he managed to overcome the obstacles he faced during childhood and pursue an education in music.
D. nostalgic; the narrator fondly describes his childhood experiences with music and his relationship with his mother.

2. In the fourth paragraph (lines 25–32), the perspective of the narrator shifts from being that of a child describing an enjoyable experience to being that of:

F. an adult reflecting on the role music played during his childhood.
G. an adult reminiscing about his relationship with his sister.
H. a child daydreaming about what his life will be like when he grows up.
J. a child describing what his mother likes to do for fun.

3. The passage states that as a child the narrator associated the colors and designs on the labels of his mother's records with:

A. favorite musicians.
B. various genres of music.
C. different American cities.
D. important events that occurred in his childhood.

4. It can reasonably be inferred that the phrase "the great man's hits" (lines 72–73) refers to the music of:

F. James Brown.
G. Otis Redding.
H. MC Danny Ray.
J. Pigmeat Markham.

5. In the narrator's description of his mother's stereo, which detail most clearly points to the care she gave it?

A. "Motorola high-fidelity" (line 5)
B. "Lacquered wood" (line 6)
C. "Lemony smell" (line 6)
D. "Fat brown cylinder" (lines 19–20)

6. The passage indicates that the first record the narrator asked his mother to buy for him was by:

F. the Marvelettes.
G. Roy Orbison.
H. Otis Redding.
J. James Brown.

7. The passage suggests that the narrator was initially drawn to his mother's records because he wanted to:

A. learn about places outside of New York City.
B. sing and dance in the style of the great soul musicians.
C. impress his friends with his knowledge of soul music.
D. gain insight into his mother's life.

8. The narrator describes the performances of which of the following Apollo Theater performers in terms of the contrast between singing style and dancing style?

F. Pigmeat Markham
G. MC Danny Ray
H. The J.B.s
J. The Fabulous Flames

9. The narrator suggests that going to the concert at the Apollo Theater was special because:

A. Otis Redding and the Supremes joined James Brown onstage.
B. soul music wasn't considered appropriate for children.
C. James Brown was his favorite musician.
D. it was the first time he had ridden a train.

10. Another writer made the following statement about soul music:

> Musically, I believe, soul remains the story of how a universal sound emerged from the black church.

How does this statement relate to the ideas expressed in the passage?

F. It echoes the narrator's view of soul as he recalls the living room, where he listened to music.
G. It's consistent with the narrator's opinion that soul was originally meant to be music for listeners of all races.
H. It contradicts the narrator's claim that soul was secular music, not religious music.
J. It addresses a topic, the origin of soul, which the narrator doesn't address in the passage.

Passage II

SOCIAL SCIENCE: Passage A is adapted from the article "Talk to the Hands" by Jen Doll (©2013 by The Atlantic Monthly Group). Passage B is adapted from the article "Gestures Offer Insight" by Ipke Wachsmuth (©2006 by Scientific American).

Passage A by Jen Doll

Leaving a group of friends the other night, I turned to wave. "Text me!" one of them said, waggling her thumbs in the air. I didn't need the words to understand.

Today, we may be more likely to move our fingers across a tablet than turn the pages of a book; to swipe a card, press a button, or enter numbers onto a keypad than turn a key. We type on keyboards more often than we put pens to paper, and we roll down the windows of our cars by pressing a button instead of cranking a handle. Yet when it comes to gesturing, certain outdated motions endure.

Gestures can generally be sorted into two categories, according to Spencer Kelly, an associate professor of psychology at Colgate University. "Co-speech gestures" are the idiosyncratic, often unconscious ways we move our hands as we talk. Researchers believe these gestures help us think and speak and even learn. "Emblematic gestures" are the culturally codified motions that we use to supplement or substitute speech—the peace sign, the thumbs-up. Some of these gestures are symbolic, and some, as in the case of thumb-texting, are imitative.

As with words, we tend to pick up our hand movements from the groups with whom we communicate most frequently—especially our peers. If your friends are thumb-texting at you, you will thumb-text back at them. Soon enough, Kelly says, "the movement of your thumbs can be done without speech, and people know what it is. That's the definition of an emblem."

Some emblems are recycled, their meanings changing as cultures evolve. Anthony Corbeill at the University of Kansas suspects that the current American connotation of the thumbs-up gesture developed during the 20th century, when GIs used the thumbs-up to signify that a plane was cleared for takeoff. Other emblems are coined afresh, the result of ubiquitous new technology or the quirks of a public figure. The fist bump, which went viral after Barack and Michelle Obama were photographed in action in 2008, can be traced to the germophobic mid-20th-century baseball player Stan Musial, who is said to have preferred it to the high five.

Passage B by Ipke Wachsmuth

The interpretations of sounds and movements are closely related. For years, the link could be demonstrated only indirectly by asking test subjects what information they gleaned from others who were speaking and gesticulating. Recent brain research has provided much better insight. For example, neuroscientist Spencer D. Kelly of Colgate University has studied gestures with the help of event-related potentials—characteristic brain waves consisting of a sequence of peaks and valleys—that occur in certain patterns when one person observes another communicating. The patterns reveal neuronal-processing steps in particular brain regions. One of the negative peaks (a valley), referred to as N400, is especially significant. It occurs when we stumble over an inappropriate and unexpected word, for example, when we hear a sentence like "He spread his toast with socks."

Kelly hooked test subjects to an electroencephalograph and charted their event-related potentials while they watched a video. In it, an actor spoke while using gestures to indicate characteristics of an object. A hand movement might fit a word semantically, such as when the word "tall" was illustrated by gesturing at a long-stem glass on a table. A gesture might also be used to convey additional information, such as when "tall" was accompanied by finger movements that indicated the thinness of the elongated stem of the glass. Viewers saw contradictory scenes, too, in which an actor combined the word "tall" with a gesture that referred to a short object on the table. And sometimes an actor made no gesture at all; in this control situation, the test subjects heard only the spoken word.

Subjects exhibited substantially different brainwave patterns depending on the situation. The researchers found strong negative peaks—a so-called N400 effect—whenever speech and gesture contradicted one another. They interpreted this phenomenon to mean that gestures and words are in fact processed together: observers factor the meaning of a gesture into their interpretation of a word.

This conclusion was supported by the finding that the event-related potentials exhibited no comparable negativity in the control situation. Even during early processing, the curves differ depending on whether the hand movement fits the word, complements it or contradicts it. "The semantic content" of hand gestures, Kelly says, "contributes to the processing of word meaning in the brain."

Questions 11 and 12 ask about Passage A.

11. Passage A primarily focuses on which of the following types of gestures?

- **A.** Co-speech gestures
- **B.** Repurposed gestures
- **C.** Emblematic gestures
- **D.** Illogical gestures

12. The main point of the second paragraph of Passage A (lines 4–11) is that:

- **F.** although technology is changing how we interact with the world, many gestures remain the same.
- **G.** we have more ways to communicate than ever, so gestures are increasingly important.
- **H.** as a result of new technologies, new gestures are being created at a fast rate.
- **J.** because technology has become so complicated, gestures are symbolic of simpler times.

Questions 13–17 ask about Passage B.

13. Which of the following quotations from Passage B best represents the passage's central claim?

- **A.** "Kelly hooked test subjects to an electroencephalograph and charted their event-related potentials" (lines 60–61).
- **B.** "Subjects exhibited substantially different brainwave patterns depending on the situation" (lines 75–76).
- **C.** "Observers factor the meaning of a gesture into their interpretation of a word" (lines 81–82).
- **D.** "The curves differ depending on whether the hand movement fits the word, complements it or contradicts it" (lines 86–88).

14. Details in Passage B most strongly suggest that recent research into the relationship between speech and gestures is more fruitful than previous research because scientists can now:

- **F.** simultaneously test reactions to both logical and illogical speech and gestures.
- **G.** objectively measure the brain's responses to speech and gestures.
- **H.** question test subjects about their reactions to gestures.
- **J.** use video recording to document how gestures change over time.

15. The main purpose of the second paragraph of Passage B (lines 60–74) is to:

- **A.** describe the experiment that Kelly conducted.
- **B.** explain that speech and gestures are processed separately.
- **C.** illustrate how test subjects reconciled differences between speech and gestures.
- **D.** clarify why speech and gestures relate to each other.

16. Based on Passage B, which of the following sentences would be most likely to evoke an N400 negative peak in brain activity?

- **F.** As the batteries die, the radio's volume fades.
- **G.** The baker decorates the cake with frosting.
- **H.** A car squeezes through the alleyway.
- **J.** At the top of the tree sits a library.

17. According to Passage B, while their brain activity was being monitored, test subjects in Kelly's experiment watched:

- **A.** two actors gesturing to each other.
- **B.** past test subjects gesturing to each other.
- **C.** a video of an actor speaking and gesturing.
- **D.** Kelly speaking and gesturing.

Questions 18–20 ask about both passages.

18. How do the writing styles of the two passages compare?

- **F.** Passage A is more argumentative and persistent than Passage B.
- **G.** Passage A is more personal and conversational than Passage B.
- **H.** Passage B is more humorous and anecdotal than Passage A.
- **J.** Passage B is more opinion-based and loosely organized than Passage A.

19. Which of the following statements best captures the main difference in the purposes of the two passages?

- **A.** Passage A explains how hand gestures enhance speech, while Passage B explains how hand gestures overrule speech.
- **B.** Passage A argues that technology is decreasing our use of hand gestures, while Passage B examines how speech and hand gestures evolved together.
- **C.** Passage A considers the types and origins of hand gestures, while Passage B considers how hand gestures are processed by the brain.
- **D.** Passage A speculates that gestures existed before speech, while Passage B contrasts logical hand gestures with illogical hand gestures.

20. The gesture referred to in lines 2–3 of Passage A is similar to the gestures referred to in Kelly's experiment in Passage B in that these gestures all are:

- **F.** used by the authors' friends.
- **G.** associated with cell phones.
- **H.** describing recent trends.
- **J.** referring to physical objects.

Passage III

HUMANITIES: This passage is adapted from the book *The Lost Painting* by Jonathan Harr (©2005 by Jonathan Harr).

The *St. John* is a painting by seventeenth-century Italian painter Michelangelo Merisi da Caravaggio. At the time of the examinations, the Doria *St. John* version belonged to the Doria Pamphili Gallery in Rome, and the Capitoline *St. John* version belonged to the Capitoline Museum in Rome.

Close up, Francesca Cappelletti could see the damage caused to the Doria *St. John* by time. Over its entire surface the picture had lost many tiny particles of paint, mere pinpricks—puntinature, Paola Sannucci, the restorer, called them—not discernible from a normal viewing distance. These particles had fallen at nearly regular intervals, at the intersections where the threads of the canvas, the warp and the weft, crossed each other and formed small nodules. The canvas had been cheap, made of poor-quality hemp and carelessly woven. Still, Caravaggio might have used just such a canvas. He had once painted a picture on a bedsheet. Another time, after he'd left the Mattei palazzo and was living alone in a small house off the Via della Scrofa, he had spread a half-finished canvas on a kitchen table and dined off the back of it.

The earlier examination of the Capitoline *St. John* had revealed it to be in much better shape than the Doria, in large part because the Capitoline canvas was of higher quality, more tightly woven with linen threads of uniform diameter.

The technical examination lasted the entire day, and for long periods Francesca had nothing to do but observe. The portable X-ray machine could capture only a small portion of the painting, and the technicians had to keep repositioning the machine, sixteen times in all, to get a composite of the entire picture. Francesca wandered in and out of the room and tried to dream up an excuse for leaving early.

Giampaolo Correale had a particular interest—an obsession, one could call it—with finding incised lines in Caravaggio's paintings. Few other Baroque painters had made these types of lines, scored with the butt end of a brush into the wet undercoat, and no one had made them in quite the same way as Caravaggio. He painted from life, from models sitting before him, and most art historians believed that he didn't make preliminary drawings. In this, he had departed from a long-established tradition by which painters made detailed studies before applying brush to canvas. The scored lines, it was surmised, had served as a guide for positioning his models. In the finished paintings, the lines were sometimes visible to the naked eye, usually at a certain angle, in a raking light. Not every one of his paintings revealed signs of these marks. But to Caravaggio experts, their presence was almost as good as the artist's signature.

Two weeks earlier, during the examination of the Capitoline *St. John*, Correale had hoped to find incised lines, and thus add to the proof that it was Caravaggio's original. He and Paola Sannucci and the technicians had scrutinized every inch of the painting, but in the end they had not found a scoring mark. True, there were a few faint ridges on the borders of the boy's figure, and for a while Correale maintained that these *could* be scoring marks, but everyone else interpreted them merely as brushstrokes in wet paint, places where Caravaggio had defined the boy's flesh against the dark background.

But evidence of a different kind had emerged from beneath the surface of the Capitoline version, and it seemed to confirm the painting's authenticity. The X rays and the infrared images had revealed a ghostly image—a pentimento—at the precise point where the boy's arm and the curved horn of the ram intersected. The artist had painted the arm first, and then had painted the ram's horn over the finished arm. This constituted a clear sign that the painting was the authentic one. A copyist, following the outlines of an original painting, would not have bothered to paint the arm and then paint the horn over it. The infrared images also revealed other pentimenti, in the folds and drapery of the red and white cloths, and in the foliage in the dark background. These were false starts and adjustments that no copyist would have needed to make.

So Correale had come to accept the Capitoline as the original even before the technical examination of the Doria version. All the same, the paintings were so strikingly similar—the outline of one placed atop the other matched in almost every contour—that it seemed necessary to examine the Doria picture as fully as the Capitoline. But how, Correale wondered, could anyone make such a near perfect copy?

This question interested Francesca, too. She thought of all the copies art historian Roberto Longhi had found of Caravaggio's lost *Taking of Christ*. None of them had been good enough for Longhi to mistake for the original. Yet the Doria *St. John* had fooled him completely.

21. Which of the following statements comparing the Doria *St. John* and the Capitoline *St. John* is best supported by the passage?

- **A.** The Doria *St. John* was painted on cheaper canvas than was the Capitoline *St. John*.
- **B.** The Doria *St. John* canvas had smaller nodules than that of the Capitoline *St. John*.
- **C.** The Capitoline *St. John* showed evidence of more puntinature than did the Doria *St. John*.
- **D.** The Capitoline *St. John* contained more incised lines than did the Doria *St. John*.

22. It can most reasonably be inferred from the passage that Francesca wanted to leave the examination early mainly because she:

- **F.** had already witnessed an examination of the Doria *St. John*.
- **G.** disliked working alongside Correale.
- **H.** was uninterested in Caravaggio's paintings.
- **J.** disliked being a mere observer.

23. According to the passage, who at first maintained that the Capitoline *St. John* might show evidence of incised lines?

- **A.** Sannucci
- **B.** Correale
- **C.** Francesca
- **D.** The technicians

24. The main purpose of the sixth paragraph (lines 60–75) is to:

- **F.** describe the discovery that helped prove the authenticity of the Capitoline *St. John*.
- **G.** provide a more specific description of the scene depicted in the *St. John* painting.
- **H.** describe the steps a copyist must take when re-creating a painting.
- **J.** provide a definition of the term "pentimento."

25. In the last paragraph, the comparison between Longhi's appraisal of the *Taking of Christ* copies and Longhi's appraisal of the Doria *St. John* mainly serves to:

- **A.** demonstrate that *Taking of Christ* was one of Caravaggio's more popular paintings.
- **B.** suggest that Longhi studied the *Taking of Christ* copies more thoroughly than he did the Doria *St. John*.
- **C.** emphasize that the Doria *St. John* was painted with unusual skill.
- **D.** prove that the copyist who painted the Doria *St. John* was another well-known Baroque artist.

26. Which of the following details from the passage best exemplifies the idea that Caravaggio sometimes used unconventional canvases for his paintings?

- **F.** He once dined off the back of a half-finished painting.
- **G.** He used colorful cloths as the backdrop for some of his paintings.
- **H.** He painted the *St. John* on woven linen.
- **J.** He once painted a picture on a bedsheet.

27. As it is used in line 24, the word *capture* most nearly means:

- **A.** seize.
- **B.** divert.
- **C.** document.
- **D.** control.

28. According to the passage, Caravaggio used incised lines in his paintings most likely to:

- **F.** guide the positioning of his models.
- **G.** reflect light off the surface of his paintings.
- **H.** indicate the authenticity of the painting.
- **J.** separate his style from that of other Baroque painters.

29. The passage states that most experts who study Caravaggio agree that:

- **A.** the practice of using incised lines in painting was pioneered by Caravaggio.
- **B.** the presence of Caravaggio's style of incised lines is strong evidence that a painting is an authentic Caravaggio.
- **C.** even an experienced copyist could not have painted the Doria *St. John*.
- **D.** an authentic Caravaggio probably would not contain as many false starts and adjustments as the Capitoline *St. John* had.

30. In the context of the passage, which of the following is evidence of a pentimento in the Capitoline *St. John* ?

- **F.** The brushstrokes that define the boy's flesh against the dark background
- **G.** The contrast of the red and white cloths against the dark background
- **H.** The faint ridges on the border of the boy's figure
- **J.** The ram's horn painted over the boy's finished arm

Passage IV

NATURAL SCIENCE: This passage is adapted from the essay "Archives of Life: Science and Collections" by Richard Fortey (©2010 by Richard Fortey).

Safely stored behind the scenes at the Natural History Museum in London is a slightly twisted vertebrate skeleton preserved on a slab of creamy white limestone. This particular specimen was discovered in quarries near Solnhofen in southern Germany in 1861. The fine limestones of Solnhofen are ideally suited to making lithographic stones, and in the nineteenth century lithographs provided one of the most important means of book illustration—indeed lithographic stones of this quality are still in demand by artists today. Vast quantities of this lithographic limestone of Jurassic age—about 150 million years old—have been taken out of opencast workings, where the rocks can be split into convenient slabs a centimetre or two thick. On many of these flat-surfaced pieces of rock, fossils are laid out like gifts on a salver.

Some Solnhofen fossils are rather common, such as those of delicate little sea lilies. Others are both rare and more spectacular. There are a great variety of fish species known nowhere else, for example. The fossil horseshoe crab *Mesolimulus* provides evidence that its living relatives breeding each year along the Atlantic coast of America have changed little over tens of millions of years. Delicate flying reptiles—half a dozen species or so of pterodactyl—testify by contrast to creatures that have vanished from the Earth forever. A few species of dinosaur are known, of the most delicate sort (*Compsognathus*), and quite unlike the monsters of popular imagination. Insects include dragonflies (*Aeschnogomphus*) whose every wing-vein is visible as delicate tracery. All these creatures are preserved in rocks which originated as tacky muds flooring a lagoon that lay offshore from a richly biodiverse habitat. Such special circumstances sampled and preserved a much wider variety of organisms than the usual fossil locality, and the wide range of fossils provides a rare window into an entire habitat from a very different world. Yet if the remains were not kept carefully in museums all this evidence of past life would perish, and new generations of children and scholars could not interrogate the past. Local museums at Eichstätt and Solnhofen fulfil that function for those who would come to Bavaria and marvel at its geological treasures. But some of the specimens from the Solnhofen limestone have a relevance that extends far beyond the reconstruction of the late Jurassic scene, and these specimens are treasures in the collections of museums around the world. None more so than that specimen—a mere 35 cm at its longest—safely curated in the Natural History Museum in London.

For this is the first example ever discovered of the early bird *Archaeopteryx*. It remains one of the most important specimens in the British national collections. The next complete fossil bird of the same species—the so-called Berlin specimen—was found sixteen years later. It would be difficult to overstate the importance of this London specimen of *Archaeopteryx* in the history of biology.

First, the date of its discovery is only two years after the publication of *The Origin of Species*. Charles Darwin famously described what he called 'difficulties on theory' in that work, where he anticipated a number of criticisms that he expected his great idea to encounter. Prime among these was 'the rarity or absence of intermediate forms' in the fossil record. Second, the detailed scientific description of *Archaeopteryx* was an accomplishment of Richard Owen in 1863; he was later to become first director of the Natural History Museum. Owen was no Darwinian, but he was an able anatomist. It must have proved anathema to him when *Archaeopteryx* was recruited as probably the best example of an 'intermediate form' and one that had turned up with the impeccable timing usually associated with a good piece of theatre. Its amalgam of reptilian and bird features (feathers and wishbone among them) was a striking vindication of the notion of descent with modification, and a rebuttal to those who might wonder how it was possible for animals to make the transition from earth to the skies.

In this sense *Archaeopteryx* became a kind of talisman for evolution. Owen was enough of a 'Museum man' to ensure that this fossil was safely curated, and part of any museum's function is just that—to protect material regardless of the current explanations of its importance. The old bird has now been joined by half a dozen or so subsequent examples worldwide, but its importance has not diminished over the years.

31. In terms of its overall structure, the passage can best be described as:

- **A.** a description of the types of specimens found at the Natural History Museum in London, followed by a discussion of the importance of the museum.
- **B.** an overview of the geological discoveries made in Solnhofen, followed by a discussion of one particular discovery.
- **C.** a list of the types of fossils Darwin used to research his theory, followed by a description of a particular fossil he discovered.
- **D.** a general explanation of the process of making lithographic stones, followed by an example of how the stones are used.

32. The passage most strongly suggests that in the history of biology, the discovery of the *Archaeopteryx* fossil was significant mainly because it:

- **F.** made the Natural History Museum of London the most visited museum in the world.
- **G.** was the first bird fossil ever discovered.
- **H.** helped scientists accurately reconstruct the late Jurassic scene.
- **J.** helped fill a critical gap in Darwin's evolutionary theory.

33. The passage author's characterization of Owen as a "Museum man" (lines 81–82) can best be described as:

- **A.** a compliment; the author respects Owen as both a Darwinian and an anatomist.
- **B.** a compliment; the author appreciates Owen's understanding of the importance of safely curating a fossil.
- **C.** an insult; the author resents Owen's lack of interest in the *Archaeopteryx* fossil.
- **D.** an insult; the author believes the *Archaeopteryx* fossil should have been curated by a more capable anatomist than Owen.

34. In the passage, the main point the author makes about museums is that they primarily:

- **F.** exist to educate tourists about the areas they are visiting.
- **G.** function to protect and preserve specimens for future study.
- **H.** preserve only the specimens excavated from nearby sites.
- **J.** display only the specimens that are currently considered to be important.

35. The detail about the *Archaeopteryx* fossil being "a mere 35 cm at its longest" (line 48) helps establish a contrast between the fossil's small size and the:

- **A.** considerable time it took to curate the fossil.
- **B.** substantial impact the fossil had on the scientific community.
- **C.** overall complexity of *Archaeopteryx*'s bone structure.
- **D.** ferocity associated with the *Archaeopteryx* species.

36. Which of the following events mentioned in the passage occurred first chronologically?

- **F.** An *Archaeopteryx* fossil was discovered in Solnhofen.
- **G.** The *Archaeopteryx* fossil known as the Berlin specimen was discovered.
- **H.** Darwin's book *The Origin of Species* was published.
- **J.** Owen became the first director of the Natural History Museum.

37. The passage author characterizes the timing of the *Archaeopteryx* fossil discovery as ideal. Which of the following people mentioned in the passage would be most likely to support this characterization?

- **A.** Darwin
- **B.** Owen
- **C.** Critics of Darwin's theory
- **D.** Visitors of the Eichstätt and Solnhofen museums

38. It can reasonably be inferred that one reason the *Archaeopteryx* fossil qualifies as an example of an "intermediate form" is that:

- **F.** its mixture of reptilian and bird features demonstrates the notion of descent with modification.
- **G.** its significance was not fully realized until long after it had been curated.
- **H.** it was discovered in the time between the excavations of the *Mesolimulus* and *Compsognathus* fossils.
- **J.** it convinced critics that animals were not yet capable of transitioning from earth to the skies.

39. Based on the passage, compared to the "delicate little" sea lily fossils found at Solnhofen, the fossils of certain species of fish found at Solnhofen are more:

- **A.** well-preserved.
- **B.** indistinct.
- **C.** rare.
- **D.** fragile.

40. As it is used in line 40, the word *interrogate* most nearly means:

- **F.** request.
- **G.** demand.
- **H.** signal.
- **J.** examine.

END OF TEST 3

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO A PREVIOUS TEST.

SCIENCE TEST

35 Minutes—40 Questions

DIRECTIONS: There are several passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Passage I

Two experiments examined how pH and temperature affect the activity of *Amoeba limax* (a single-celled eukaryote).

Experiment 1

Twenty identical glass slides were equally divided into 5 groups (Groups 1–5). Each slide was then prepared as follows: First, a drop of water containing a single 1-day-old *A. limax* was placed on the slide. Next, the water (but not the *A. limax*) was removed and replaced with a drop of an aqueous solution having a pH of 8.2. Then, a glass cover slip was placed over the drop, and *paraffin* (a type of wax) was used to seal the edges of the cover slip.

Each of the Group 1 slides was incubated at a temperature of 0°C. During incubation, the movement of the *A. limax* on each slide was observed for 30 min, and the total distance traveled (TDT) by the *A. limax* over the 30 min was recorded. The average TDT for Group 1 was then determined.

The procedure for Group 1 was repeated for each of Groups 2–5, except that each group was kept at a different incubation temperature.

The results are shown in Table 1.

Table 1

Group	Incubation temperature (°C)	Average TDT (mm)
1	0	0.4
2	5	2.0
3	10	3.9
4	15	5.6
5	20	6.1

Table 1 adapted from C. F. A. Pantin, "On the Physiology of Amoeboid Movement II.—The Effect of Temperature." ©1924 by The Company of Biologists Ltd.

Experiment 2

Twenty more of the slides were equally divided into 5 groups (Groups 6–10). Each slide was prepared as in Experiment 1, except that for each group, the aqueous solution had a different pH (see Table 2).

Each of the Group 6 slides was incubated at a temperature of 10°C. During incubation, the movement of the *A. limax* on each slide was observed for 30 min, and the TDT by the *A. limax* over the 30 min was recorded. The average TDT for Group 6 was then determined.

The procedure for Group 6 was repeated for each of Groups 7–10.

The results are shown in Table 2.

Table 2

Group	pH	Average TDT (mm)
6	6.6	3.9
7	7.0	6.2
8	7.5	7.0
9	8.7	5.0
10	9.3	3.1

Table 2 adapted from C. F. A. Pantin, "On the Physiology of Amoeboid Movement III.—The Action of Calcium." ©1926 by The Company of Biologists Ltd.

1. According to the results of Experiment 1, as the incubation temperature increased, the average TDT:

A. increased only.
B. decreased only.
C. increased, then decreased.
D. decreased, then increased.

2. Consider the claim "On average, the activity of *A. limax* always increases with increasing pH." Are the results of Experiment 2 from pH 6.6 through pH 9.3 consistent with this claim?

F. Yes; as the pH increased from 6.6 through 9.3, the average TDT increased only.
G. Yes; as the pH increased from 6.6 through 9.3, the average TDT decreased only.
H. No; as the pH increased from 6.6 through 9.3, the average TDT initially increased and then decreased.
J. No; as the pH increased from 6.6 through 9.3, the average TDT initially decreased and then increased.

3. In Experiments 1 and 2 combined, the incubation temperature was either at or below the freezing point of water for how many of the groups tested, if any?

A. 0
B. 1
C. 2
D. 4

4. Which, if either, of the paraffin and the cover slip likely functioned to slow the rate of evaporation from each slide?

F. The paraffin only
G. The cover slip only
H. Both the paraffin and the cover slip
J. Neither the paraffin nor the cover slip

5. Assume that for *A. limax*, the greater the activity level, the greater the frequency of cell division. Under the conditions of Experiment 1, an *A. limax* would most likely undergo the *fewest* cell divisions at which of the incubation temperatures tested?

A. 0°C
B. 5°C
C. 15°C
D. 20°C

6. In Experiments 1 and 2 combined, for how many of Groups 1–10 was the average TDT *less* than 1 *centimeter* ?

F. 0
G. 2
H. 5
J. 10

7. Was the solution placed on the Group 10 slides acidic or basic?

A. Acidic, because its pH was less than 7.
B. Acidic, because its pH was greater than 7.
C. Basic, because its pH was less than 7.
D. Basic, because its pH was greater than 7.

Passage II

The amino acid molecules necessary for life are thought to have been produced on Earth before organisms were present. Amino acids can be produced through chemical reactions among ammonia (NH_3), methane (CH_4), hydrogen (H_2), and water (H_2O). Four hypotheses have been proposed to describe the conditions that were responsible for the production of amino acids on Earth.

Hypothesis 1

Amino acids were introduced to Earth by meteors containing NH_3, CH_4, H_2, and H_2O. If the reactions among these 4 substances are provided enough energy, amino acids can be produced. As meteors containing these substances entered Earth's atmosphere, the substances were rapidly heated by friction, and this heat resulted in immediate amino acid production on the surface of the meteors.

Hypothesis 2

Hypothesis 1 is correct that meteors brought NH_3, CH_4, H_2, and H_2O to Earth; however, amino acid production did not occur on the meteors. Once a meteor containing these substances entered Earth's atmosphere, the substances were released into the atmosphere. Meteors continued to enter the atmosphere over hundreds of millions of years. The concentration of these substances in the atmosphere eventually became high enough for the reactions that produce amino acids to occur. The energy provided to these reactions was UV light energy from the sun.

Hypothesis 3

Meteors had nothing to do with the production of amino acids. *Thermal vents* (cracks in the floors of Earth's oceans) allowed magma from Earth's crust to seep into the ocean. The magma caused some of the ocean water to boil. Since ocean water contains dissolved NH_3, CH_4, and H_2, these substances were released into the atmosphere (along with H_2O) upon boiling. Then, UV light from the sun provided the energy for these substances to react to produce amino acids.

Hypothesis 4

Magma from thermal vents did not provide enough energy to cause ocean water to boil; however, the magma did provide enough energy to cause the NH_3, CH_4, and H_2 dissolved in ocean water to react with the ocean water, producing amino acids. These reactions occurred near the thermal vents.

8. Suppose that a scientist determined that UV light does not provide enough energy to cause any chemical reactions to occur. This finding would *weaken* which hypotheses?

F. Hypotheses 1 and 2 only
G. Hypotheses 1 and 4 only
H. Hypotheses 2 and 3 only
J. Hypotheses 1, 2, and 3 only

9. Hypothesis 3 and Hypothesis 4 agree on which of the aspects of amino acid production listed below?

I. The source of the substances needed for amino acid production
II. The location of amino acid production
III. The source of the energy needed for amino acid production

A. I only
B. II only
C. II and III only
D. I, II, and III

10. Which of Hypotheses 1 and 2, if either, state(s) or suggest(s) that amino acid production occurred on the surface of a meteor?

F. Hypothesis 1 only
G. Hypothesis 2 only
H. Both Hypothesis 1 and Hypothesis 2
J. Neither Hypothesis 1 nor Hypothesis 2

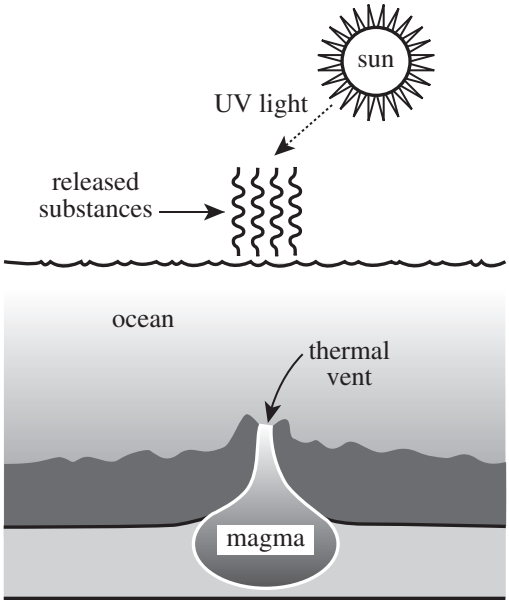
11. Which hypothesis suggests that the reactions among the 4 substances that form amino acids occurred in an aqueous solution?

A. Hypothesis 1
B. Hypothesis 2
C. Hypothesis 3
D. Hypothesis 4

12. The chemical formula for the amino acid *glycine* is $C_2H_5O_2N$. Based on the information in the passage, how many molecules of methane would be needed to provide the correct number of carbon atoms in 1 molecule of glycine?

F. 1
G. 2
H. 3
J. 4

13. The diagram below best illustrates which hypothesis?



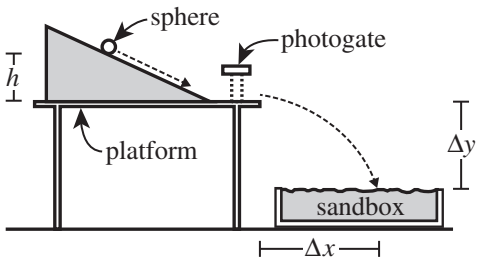
A. Hypothesis 1
B. Hypothesis 2
C. Hypothesis 3
D. Hypothesis 4

14. Which hypotheses, if any, claim that amino acid production occurred within thermal vents?

F. Hypotheses 1 and 2 only
G. Hypotheses 2 and 3 only
H. Hypotheses 3 and 4 only
J. None of the hypotheses

Passage III

A class of physics students performed 3 experiments on the topic of motion using the apparatus shown in Figure 1.



Note: The figure is not drawn to scale.

Figure 1

In each trial, the following occurred: First, the students placed a platform with a ramp at a height Δy above a sandbox. Then, they released either a 10 g solid sphere or a 10 g hollow sphere from a height h above the platform. The sphere rolled down the ramp and through a *photogate* (a device that emitted 2 beams of light, spaced 1.5 cm apart, and calculated the speed, v, of a sphere passing through both beams). Next, the students started a timer when the sphere rolled off the platform, and they stopped the timer when the sphere landed in the sandbox. They recorded this time interval as the sphere's *time of flight*, Δt. Last, they measured the horizontal distance traveled by the sphere while it was in flight, Δx.

Experiment 1

In Trials 1–5, the students set Δy to 95 cm and released the solid sphere from various h (measured in cm). They recorded v in centimeters per second (cm/sec), Δt in sec, and Δx in cm (see Table 1).

Table 1

Trial	h (cm)	v (cm/sec)	Δt (sec)	Δx (cm)
1	5	84	0.44	37
2	15	145	0.44	64
3	25	187	0.44	82
4	35	221	0.44	98
5	45	251	0.44	111

Experiment 2

In Trials 6–10, the students set Δy to 95 cm and released the hollow sphere from various h (see Table 2).

Table 2

Trial	h (cm)	v (cm/sec)	Δt (sec)	Δx (cm)
6	5	77	0.44	34
7	15	133	0.44	59
8	25	171	0.44	76
9	35	203	0.44	89
10	45	230	0.44	101

Experiment 3

In Trials 11–15, the students set Δy to various values and released the solid sphere from $h = 25$ cm (see Table 3).

Table 3

Trial	Δy (cm)	v (cm/sec)	Δt (sec)	Δx (cm)
11	95	187	0.44	82
12	145	187	0.54	102
13	195	187	0.63	118
14	245	187	0.71	132
15	295	187	0.78	145

15. Based on the results of Experiment 1, as h increased, did v decrease or increase?

A. Decrease, because the farther a sphere rolls down a ramp, the slower the sphere will be moving at the bottom of the ramp.
B. Decrease, because the farther a sphere rolls down a ramp, the faster the sphere will be moving at the bottom of the ramp.
C. Increase, because the farther a sphere rolls down a ramp, the slower the sphere will be moving at the bottom of the ramp.
D. Increase, because the farther a sphere rolls down a ramp, the faster the sphere will be moving at the bottom of the ramp.

16. Based on Figure 1, in any trial, Δy was:

F. half the total vertical distance traveled by the sphere.
G. the total vertical distance traveled by the sphere.
H. half the vertical distance between the top of the ramp and the top of the sandbox.
J. the vertical distance between the top of the platform and the top of the sandbox.

17. A *controlled variable* is a variable that is held at a constant value throughout an experiment. In which of the experiments, if any, was Δy a controlled variable?

A. Experiment 1 only
B. Experiment 3 only
C. Experiments 1 and 2 only
D. None of the experiments

18. Based on the results of Experiment 2, which of the following values of v and Δx, respectively, would most likely have been measured for the hollow sphere if it had been released from $h = 10$ cm ?

	v (cm/sec)	Δx (cm)
F.	105	47
G.	105	68
H.	152	47
J.	152	68

19. Consider a *landing point* to be a point in the sandbox where a sphere landed. Based on the values of Δx in Trials 1–15, at the conclusion of the experiments, what was the greatest distance between 2 landing points in the sandbox?

(Note: The sandbox was not moved throughout the experiments.)

A. 34 cm
B. 111 cm
C. 179 cm
D. 290 cm

20. Consider the value of v for the hollow sphere in Trial 9. An object moving in a straight horizontal line with this speed would travel approximately what distance during a 2 sec period?

F. 0.4 cm
G. 4 cm
H. 40 cm
J. 400 cm

21. Suppose that in Trial 13 the speed v had been 171 cm/sec. Based on the results of Experiments 2 and 3, which of the following errors could have accounted for this result?

A. The hollow sphere was accidentally tested instead of the solid sphere.
B. The solid sphere was accidentally tested instead of the hollow sphere.
C. The height h was accidentally set to 195 cm instead of 25 cm.
D. The height Δy was accidentally set to 25 cm instead of 195 cm.

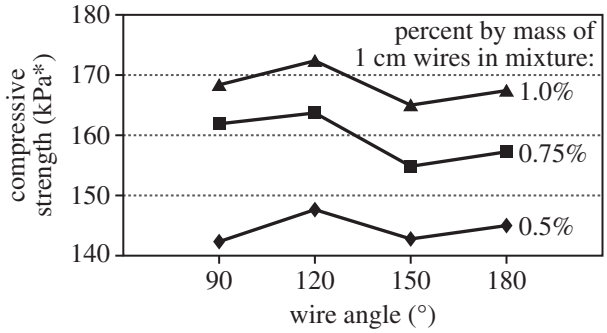
Passage IV

The soil beneath a heavy structure can *fail* (crack or flow). Adding wires to a soil produces a mixture with a greater *compressive strength* than that of the soil alone. (Compressive strength is the minimum downward pressure that will cause a material to fail.)

Mixtures of Soil X and 1 mm diameter steel wires were tested for compressive strength. All the wires in a mixture had the same length (1 cm, 2 cm, or 3 cm) and the same angle (90°, 120°, 150°, or 180°, as shown below).

diagram of wire angles

Figures 1, 2, and 3 show how the compressive strength of the mixtures with 1 cm, 2 cm, and 3 cm wires, respectively, varied with wire angle and with the percent by mass of the wires.



*kPa = kilopascals

Figure 1

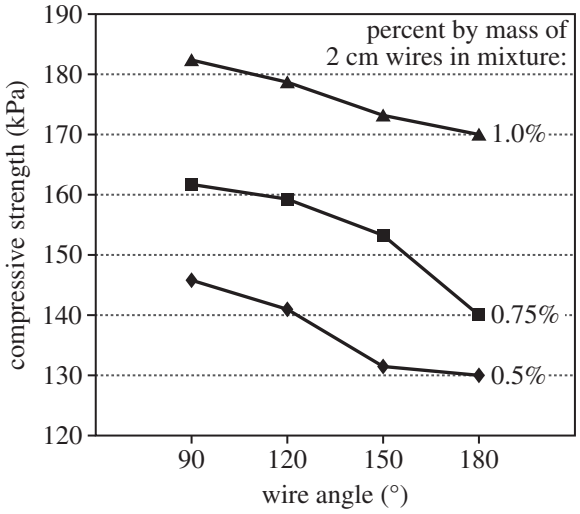


Figure 2

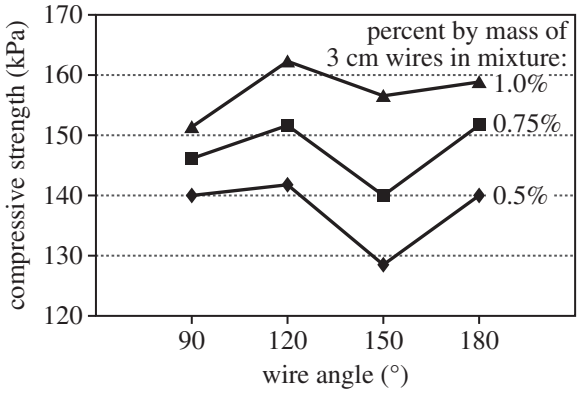


Figure 3

Diagram and figures adapted from Amir Kalhor, "Effect of Metal Fibers on Clayey Soils." ©2008 by Electronic Journal of Geotechnical Engineering.

22. In Figures 1–3, consider the compressive strengths of the mixtures containing 0.75 percent by mass of wires. For which of the wire lengths was the compressive strength greater for a wire angle of 120° than it was for a wire angle of 90° ?

F. 3 cm only
G. 1 cm and 2 cm only
H. 1 cm and 3 cm only
J. 1 cm, 2 cm, and 3 cm

23. According to Figures 1–3, for mixtures containing 1.0 percent by mass of wires bent at an angle of 90°, as wire length increased, the compressive strength:

A. increased only.
B. decreased only.
C. increased, then decreased.
D. decreased, then increased.

24. According to Figures 1–3, the greatest compressive strength was recorded for the mixture with which wire length, wire angle, and percent by mass of wires?

	length	angle	percent by mass
F.	1 cm	90°	0.5%
G.	2 cm	90°	1.0%
H.	2 cm	120°	0.75%
J.	3 cm	120°	1.0%

25. In Figure 1, consider the compressive strength of the mixture containing 0.75 percent by mass of 1 cm wires with an angle of 180°. Would a downward pressure of 160 kPa cause this mixture to fail?

A. No; that pressure would be less than the compressive strength of the mixture.
B. No; that pressure would be greater than the compressive strength of the mixture.
C. Yes; that pressure would be less than the compressive strength of the mixture.
D. Yes; that pressure would be greater than the compressive strength of the mixture.

26. According to Figure 3, increasing the percent by mass of 3 cm wires resulted in the *least* variation in compressive strength for which wire angle?

F. 90°
G. 120°
H. 150°
J. 180°

27. Based on the information provided, the compressive strength of Soil X alone was most likely:

A. less than 129 kPa.
B. between 129 kPa and 139 kPa.
C. between 139 kPa and 149 kPa.
D. greater than 149 kPa.

Passage V

Ultraviolet (UV) light is harmful to skin. A sunscreen applied to the skin lessens the skin's exposure to the harmful light, such as through absorption of the light. A sunscreen's *sun protection factor* (SPF) is a measure of its ability to lessen exposure.

Students did 2 experiments to measure the absorbance of UV light by various solutions at 25°C, each solution containing a single sunscreen. To make their measurements, the students used a *spectrophotometer* (see diagram).

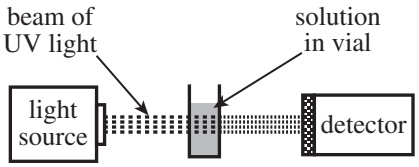


diagram of spectrophotometer

In each trial of the experiments, Steps 1–4 were performed:

1. A solution having a particular sunscreen concentration was prepared.
2. Four mL of the solution was poured into a clear plastic vial, and the vial was placed in the spectrophotometer.
3. A beam of UV light was directed through the solution.
4. The absorbance was measured as the wavelength of the UV light was varied from 290 nanometers (nm; 1 nm = 10^{-9} m) through 400 nm. (Note: UVB light has wavelengths from 290 nm to 320 nm; UVA light has wavelengths from 320 nm to 400 nm.)

Experiment 1

Five sunscreens were tested. Each sunscreen had a different SPF, but the concentration of each sunscreen in solution was the same (0.10 g/L). The results are shown in Figure 1.

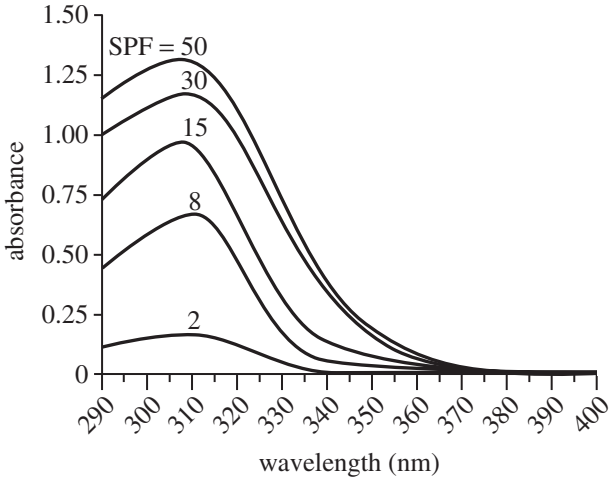


Figure 1

Experiment 2

Three sunscreens—the SPF 8 sunscreen, the SPF 15 sunscreen, and the SPF 50 sunscreen—were tested, each at 3 different concentrations in solution (0.025 g/L, 0.050 g/L, and 0.20 g/L). Table 1 shows the maximum absorbance by each solution.

Table 1

SPF	Maximum absorbance at a sunscreen concentration of:		
	0.025 g/L	0.050 g/L	0.20 g/L
8	0.20	0.28	1.17
15	0.22	0.46	1.74
50	0.31	0.55	2.25

Figure 1 and Table 1 adapted from J. R. Abney and B. A. Scalettar, "Saving Your Students' Skin. Undergraduate Experiments That Probe UV Protection by Sunscreens and Sunglasses." ©1998 by the Division of Chemical Education, Inc., American Chemical Society.

28. According to the results of Experiment 1, the maximum absorbance by each of the sunscreen solutions was obtained at a wavelength closest to which of the following?

F. 300 nm
G. 310 nm
H. 320 nm
J. 330 nm

29. In Experiment 2, at a given sunscreen concentration, as SPF increased, the maximum absorbance:

A. decreased only.
B. increased only.
C. decreased, then increased.
D. increased, then decreased.

30. In Experiment 1, which type of UV light was more effectively absorbed by each sunscreen solution?

F. UVA; the absorbance of light between 290 nm and 320 nm was greater than the absorbance of light between 320 nm and 400 nm.
G. UVA; the absorbance of light between 320 nm and 400 nm was greater than the absorbance of light between 290 nm and 320 nm.
H. UVB; the absorbance of light between 290 nm and 320 nm was greater than the absorbance of light between 320 nm and 400 nm.
J. UVB; the absorbance of light between 320 nm and 400 nm was greater than the absorbance of light between 290 nm and 320 nm.

31. Which of the following conditions differed between Experiments 1 and 2 ?

A. Temperature of solution
B. Concentration of sunscreen in solution
C. Volume of solution in vial
D. Wavelengths of light passed through solution

32. Suppose that a sunscreen with an SPF of 20 had been tested in Experiment 1. The maximum absorbance by the solution of this sunscreen would most likely have been closest to which of the following?

F. 0.50
G. 0.75
H. 1.00
J. 1.25

33. *PABA* is a common sunscreen ingredient that has its maximum absorbance in the UVB light range. Which of the following wavelengths is a possible wavelength at which PABA has its maximum absorbance?

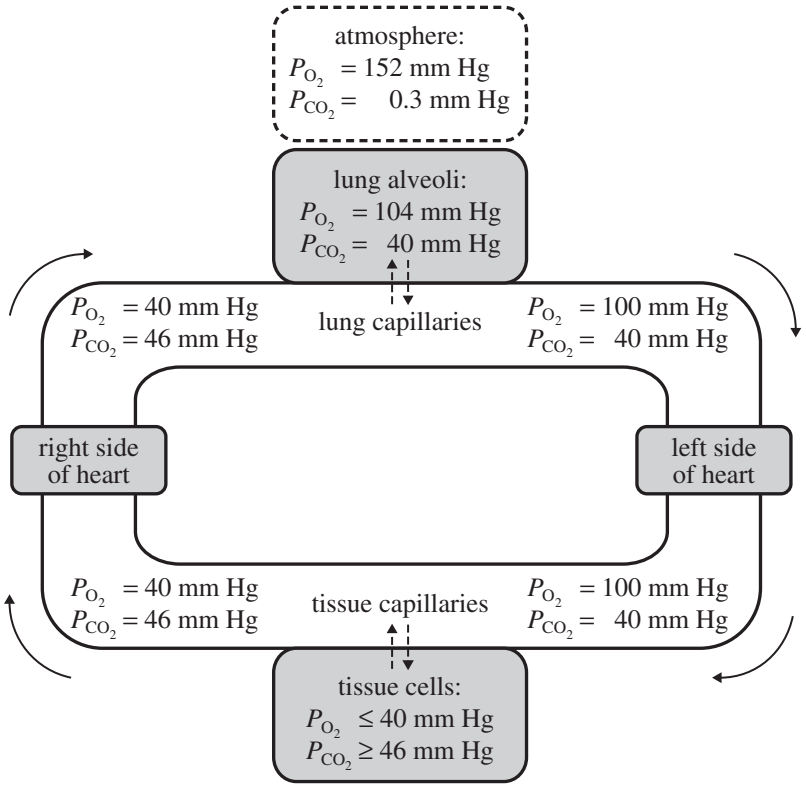
A. 306 nm
B. 321 nm
C. 343 nm
D. 368 nm

34. Assume that in Step 4, absorbance measurements were made in 5 nm increments. Based on this information, each sunscreen solution was exposed to how many different wavelengths of UV light?

F. 5
G. 8
H. 14
J. 23

Passage VI

In the human body, O_2 and CO_2 are exchanged between the lungs and the blood and between the blood and the tissues as indicated in Figure 1. These exchanges occur by the diffusion of each gas from a region where its *partial pressure* (the pressure contributed by a single gas) is higher to a region where its partial pressure is lower. The figure gives the partial pressures P_{O_2} and P_{CO_2} in the lung *alveoli* (sacs), in the tissue cells, and in the blood of a healthy resting person at sea level.



Note: Dashed arrows indicate exchange of O_2 and CO_2. Solid arrows indicate direction of blood flow. Partial pressures are given in millimeters of mercury (mm Hg).

Figure 1

Figure 2 shows how alveolar P_{O_2} and P_{CO_2} vary with *alveolar ventilation* (volume of air per unit time available to the alveoli for gas exchange).

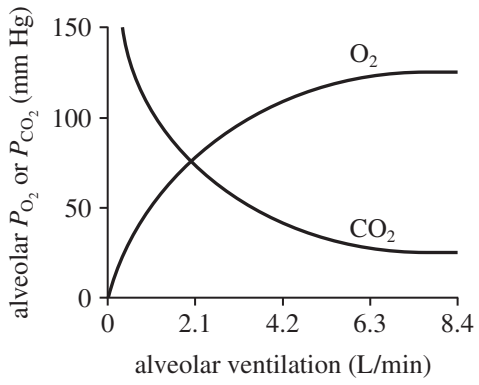


Figure 2

Figures adapted from Arthur J. Vander, James H. Sherman, and Dorothy S. Luciano, *Human Physiology: The Mechanisms of Body Function*. ©1985 by McGraw-Hill, Inc.

35. According to Figure 1, for a healthy resting person at sea level, as blood passes through the left side of the heart, which is greater, the P_{O_2} or the P_{CO_2} ?

- **A.** The P_{O_2}; its value is 100 mm Hg through the left side of the heart.
- **B.** The P_{O_2}; its value is 40 mm Hg through the left side of the heart.
- **C.** The P_{CO_2}; its value is 100 mm Hg through the left side of the heart.
- **D.** The P_{CO_2}; its value is 46 mm Hg through the left side of the heart.

36. The P_{CO_2} in the lung capillaries that enter the lung alveoli differs from the P_{CO_2} in the lung capillaries that leave the lung alveoli. Based on Figure 1, for a healthy resting person at sea level, what is the range of the P_{CO_2} in the lung capillaries?

- **F.** From 0.3 mm Hg to 40 mm Hg
- **G.** From 40 mm Hg to 46 mm Hg
- **H.** From 46 mm Hg to 100 mm Hg
- **J.** From 100 mm Hg to 152 mm Hg

37. Based on Figure 2, if a person's alveolar ventilation decreases from a value of 6.3 L/min, how do the person's alveolar P_{O_2} and alveolar P_{CO_2}, respectively, change?

	alveolar P_{O_2}	alveolar P_{CO_2}
A.	increase	decrease
B.	increase	increase
C.	decrease	increase
D.	decrease	decrease

38. Based on Figure 1, for a healthy resting person at sea level, does O_2 in the air that enters the lung alveoli diffuse into the lung capillaries?

- **F.** Yes, because the P_{O_2} in the lung alveoli is greater than the P_{O_2} in the lung capillaries.
- **G.** Yes, because the P_{O_2} in the lung capillaries is greater than the P_{O_2} in the lung alveoli.
- **H.** No, because the P_{O_2} in the lung alveoli is greater than the P_{O_2} in the lung capillaries.
- **J.** No, because the P_{O_2} in the lung capillaries is greater than the P_{O_2} in the lung alveoli.

39. Consider the values of P_{O_2} and P_{CO_2} that are given in Figure 1 for the lung alveoli. According to Figure 2, to maintain those values, alveolar ventilation must be closest to which of the following?

- **A.** 2.1 L/min
- **B.** 4.2 L/min
- **C.** 6.3 L/min
- **D.** 8.4 L/min

40. Consider the combinations of P_{CO_2} values for tissue cells and tissue capillaries listed in the table below.

P_{CO_2} in tissue cells	P_{CO_2} in tissue capillaries
52 mm Hg	50 mm Hg
52 mm Hg	60 mm Hg
46 mm Hg	50 mm Hg
46 mm Hg	60 mm Hg

For how many of the combinations would CO_2 diffuse from the tissue cells into the tissue capillaries?

- **F.** 1
- **G.** 2
- **H.** 3
- **J.** 4

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.

Scoring Keys for Form F07

Use the scoring key for each test to score your answer document for the multiple-choice tests. Mark a "1" in the blank for each question you answered correctly. Add up the numbers in each reporting category and enter the total number correct for each reporting category in the blanks provided. Also enter the total number correct for each test in the blanks provided. The total number correct for each test is the sum of the number correct in each reporting category.

Test 1: English—Scoring Key

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

		Reporting Category*		
	Key	POW	KLA	CSE
39.	C	___		
40.	J			___
41.	C			___
42.	F	___		
43.	D			___
44.	J			___
45.	B	___		
46.	G			___
47.	C	___		
48.	G		___	
49.	B			___
50.	F			___
51.	B		___	
52.	F			___
53.	D	___		
54.	J		___	
55.	C			___
56.	H		___	
57.	D	___		
58.	F			___
59.	C	___		
60.	F	___		
61.	C			___
62.	J			___
63.	B	___		
64.	G			___
65.	A	___		
66.	F			___
67.	D		___	
68.	H	___		
69.	D	___		
70.	J			___
71.	B			___
72.	F		___	
73.	D			___
74.	F		___	
75.	A			___

***Reporting Categories**
POW = Production of Writing
KLA = Knowledge of Language
CSE = Conventions of Standard English

Number Correct (Raw Score) for:

Production of Writing (POW) _____ (23)

Knowledge of Language (KLA) _____ (12)

Conventions of Standard English (CSE) _____ (40)

Total Number Correct for English Test (POW + KLA + CSE) _____ (75)

Test 2: Mathematics—Scoring Key

	Key	Reporting Category*						
		PHM						
		N	A	F	G	S	IES	MDL
1.	C						___	___
2.	F			___				
3.	E					___		___
4.	K				___			___
5.	C				___			___
6.	H		___					___
7.	C						___	
8.	G						___	___
9.	A		___					
10.	H		___					
11.	E						___	
12.	G						___	___
13.	C						___	___
14.	H	___						___
15.	C	___						
16.	K						___	___
17.	A						___	
18.	K					___		___
19.	A		___					___
20.	K						___	___
21.	C						___	
22.	J			___				
23.	C				___			
24.	F						___	
25.	C						___	
26.	G						___	___
27.	D						___	
28.	G						___	___
29.	B			___				___
30.	J					___		___

	Key	Reporting Category*						
		PHM						
		N	A	F	G	S	IES	MDL
31.	E		___					___
32.	J						___	
33.	B						___	___
34.	J					___		
35.	D			___				
36.	K				___			
37.	B						___	
38.	G			___				
39.	D		___					
40.	F					___		___
41.	A			___				
42.	G				___			
43.	E						___	___
44.	G						___	___
45.	B					___		___
46.	F						___	___
47.	D						___	___
48.	F	___						
49.	C				___			
50.	J				___			
51.	E				___			___
52.	F			___				
53.	D						___	
54.	J						___	___
55.	B		___					___
56.	F		___					
57.	D						___	
58.	G			___				
59.	C	___						
60.	K	___						

Combine the totals of these columns and put in the blank for PHM in the box below.

***Reporting Categories**
PHM = Preparing for Higher Math
N = Number & Quantity
A = Algebra
F = Functions
G = Geometry
S = Statistics & Probability
IES = Integrating Essential Skills
MDL = Modeling

Number Correct (Raw Score) for:

Preparing for Higher Math (PHM) (N + A + F + G + S)	_____ (35)
Integrating Essential Skills (IES)	_____ (25)
Total Number Correct for Mathematics Test (PHM + IES)	_____ (60)
Modeling (MDL) (Not included in total number correct for mathematics test raw score)	_____ (28)

Test 3: Reading—Scoring Key

	Key	Reporting Category* KID	CS	IKI
1.	D	___		
2.	F		___	
3.	C	___		
4.	F	___		
5.	C		___	
6.	G	___		
7.	D	___		
8.	J	___		
9.	B	___		
10.	J			___
11.	C	___		
12.	F	___		
13.	C			___
14.	G	___		
15.	A		___	
16.	J	___		
17.	C	___		
18.	G			___
19.	C			___
20.	J			___

	Key	Reporting Category* KID	CS	IKI
21.	A	___		
22.	J	___		
23.	B	___		
24.	F		___	
25.	C			___
26.	J		___	
27.	C		___	
28.	F	___		
29.	B	___		
30.	J	___		
31.	B		___	
32.	J	___		
33.	B		___	
34.	G	___		
35.	B		___	
36.	H	___		
37.	A		___	
38.	F	___		
39.	C	___		
40.	J		___	

***Reporting Categories**
KID = Key Ideas & Details
CS = Craft & Structure
IKI = Integration of Knowledge & Ideas

Number Correct (Raw Score) for:

Key Ideas & Details (KID) _____ (23)

Craft & Structure (CS) _____ (11)

Integration of Knowledge & Ideas (IKI) _____ (6)

Total Number Correct for Reading Test (KID + CS + IKI) _____ (40)

Test 4: Science—Scoring Key

	Key	Reporting Category* IOD	SIN	EMI
1.	A	___		
2.	H			___
3.	B		___	
4.	H		___	
5.	A			___
6.	J	___		
7.	D	___		
8.	H			___
9.	A			___
10.	F			___
11.	D			___
12.	G			___
13.	C	___		
14.	J			___
15.	D	___		
16.	J		___	
17.	C		___	
18.	F	___		
19.	B			___
20.	J			___

	Key	Reporting Category* IOD	SIN	EMI
21.	A		___	
22.	H	___		
23.	C	___		
24.	G	___		
25.	D			___
26.	F	___		
27.	A			___
28.	G	___		
29.	B	___		
30.	H			___
31.	B		___	
32.	H	___		
33.	A			___
34.	J		___	
35.	A	___		
36.	G	___		
37.	C	___		
38.	F			___
39.	B	___		
40.	F			___

***Reporting Categories**
IOD = Interpretation of Data
SIN = Scientific Investigation
EMI = Evaluation of Models, Inferences & Experimental Results

Number Correct (Raw Score) for:

Interpretation of Data (IOD) _____ (17)

Scientific Investigation (SIN) _____ (7)

Evaluation of Models, Inferences & Experimental Results (EMI) _____ (16)

Total Number Correct for Science Test (IOD + SIN + EMI) _____ (40)

Explanation of Procedures Used to Obtain Scale Scores from Raw Scores

On each of the four tests on which you marked any responses, the total number of correct responses yields a raw score. Use the table below to convert your raw scores to scale scores. For each test, locate and circle your raw score or the range of raw scores that includes it in the table below. Then, read across to either outside column of the table and circle the scale score that corresponds to that raw score. As you determine your scale scores, enter them in the blanks provided on the right. The highest possible scale score for each test is 36. The lowest possible scale score for any test on which you marked any responses is 1.

Next, compute the Composite score by averaging the four scale scores. To do this, add your four scale scores and divide the sum by 4. If the resulting number ends in a fraction, round it off to the nearest whole number. (Round down any fraction less than one-half; round up any fraction that is one-half or more.) Enter this number in the blank. This is your Composite score. The highest possible Composite score is 36. The lowest possible Composite score is 1.

ACT Test F07	Your Scale Score
English	_____
Mathematics	_____
Reading	_____
Science	_____
Sum of scores	_____
Composite score (sum ÷ 4)	_____

NOTE: If you left a test completely blank and marked no items, do not list a scale score for that test. If any test was completely blank, do not calculate a Composite score.

Scale Score	Raw Scores				Scale Score
	Test 1 English	Test 2 Mathematics	Test 3 Reading	Test 4 Science	
36	73-75	58-60	40	40	**36**
35	71-72	55-57	39	—	**35**
34	70	53-54	38	39	**34**
33	69	52	37	—	**33**
32	68	50-51	36	38	**32**
31	67	49	35	37	**31**
30	65-66	47-48	34	—	**30**
29	64	45-46	33	36	**29**
28	63	43-44	32	35	**28**
27	61-62	40-42	31	34	**27**
26	59-60	38-39	30	32-33	**26**
25	57-58	35-37	29	31	**25**
24	54-56	33-34	28	28-30	**24**
23	51-53	32	27	26-27	**23**
22	48-50	30-31	25-26	24-25	**22**
21	45-47	29	23-24	22-23	**21**
20	42-44	28	22	21	**20**
19	40-41	26-27	21	19-20	**19**
18	38-39	24-25	19-20	18	**18**
17	36-37	20-23	18	16-17	**17**
16	33-35	16-19	16-17	14-15	**16**
15	30-32	13-15	15	13	**15**
14	27-29	10-12	13-14	12	**14**
13	25-26	8-9	12	10-11	**13**
12	23-24	6-7	10-11	9	**12**
11	21-22	5	8-9	8	**11**
10	18-20	4	7	7	**10**
9	15-17	—	6	6	**9**
8	13-14	3	5	5	**8**
7	11-12	2	—	4	**7**
6	8-10	—	4	3	**6**
5	7	—	3	—	**5**
4	5-6	1	2	2	**4**
3	3-4	—	—	1	**3**
2	2	—	1	—	**2**
1	0-1	0	0	0	**1**