FULL-LENGTH PRACTICE TEST 21

1 1

ENGLISH TEST

35 Minutes—50 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 correctly 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 correct, 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 correct 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 correct 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

The Special Ingredient

As the firstborn grandchild, I made the most to$_1$ the years when I had the undivided attention of my adult relatives. I especially loved spending the day with my grandmother. I was ready to "help" around the house with everything;$_2$ weeding,

1. **A.** NO CHANGE
   B. along
   C. of
   D. into

2. **F.** NO CHANGE
   G. house with, everything:
   H. house with everything:
   J. house. With everything

changing sheets, even washing windows. Solitary$_3$ jobs thrilled me because I was spending time alone with her. She made

3. Which choice best suggests the potentially unusual nature of the narrator's enthusiasm for the kinds of housework she helped her grandmother with?

   A. NO CHANGE
   B. Mundane
   C. Exciting
   D. Necessary

everyday chores meaningful, when she set to work,$_4$ hard and easy tasks alike were undertaken as acts of love.

4. **F.** NO CHANGE
   G. meaningful. When she set to work
   H. meaningful and when she set to work
   J. meaningful. When she set to work,

I loved dinner preparations. No tasks seemed more magical then it.[5]

5. **A.** NO CHANGE
B. then those of the kitchen.
C. than it.
D. than those of the kitchen.

Cooking without[6] written recipes, conjuring complex dishes with the same ease with which a magician pulls a rabbit from

6. **F.** NO CHANGE
G. Cooking as she did without
H. Grandma cooked without
J. Without

a hat. My favorite dish, however[7], was a simple one: chicken

7. **A.** NO CHANGE
B. moreover,
C. naturally,
D. then,

and dumplings. She always began by teasingly[8] asking me to catch and pluck a chicken, the way she'd had to do growing up. While a store-bought chicken cooked in the soup pot, Grandma transformed a few ingredients into dough, which she let rest and then cut into the thin strips that would plump up in the broth. After my brother was born, I became even more determined to keep some activities just for myself. To reduce the resulting quarrels, we both met with Grandma, whom promised us[9] that we'd each have special activities. I rejoiced that I got to keep chicken and dumplings.

When I left for college and then began a career abroad, "our dish" came to signal[10] everything I missed about

8. If the writer were to delete the underlined portion, the paragraph would primarily lose:

F. a sense of the relationship between the narrator and her grandmother as they engaged in their cooking rituals.
G. an insight into how the grandmother both loved and kept a distance from her granddaughter.
H. a suggestion that sometimes the narrator felt her grandmother picked on her.
J. a detail that keeps the narrator's reminiscences from seeming too perfect.

9. **A.** NO CHANGE
B. who promised us
C. who promised ourselves
D. whom promised ourselves

10. **F.** NO CHANGE
G. represent
H. stand up for
J. give anew

home when I was far away from it.[11] In desperation, whenever I came across chicken and dumplings on a menu, I'd order it with high hopes, but the restaurant's version never tasted as good as Grandma's. Eventually I became resigned to the fact

11. **A.** NO CHANGE
B. home when I wasn't there.
C. home.
D. the place I loved a lot, which was home.

that my favorite food was only available over$_{12}$ visits home or, after Grandma's death, in my dreams.

12. **F.** NO CHANGE
G. when
H. before
J. on

After hearing this lament$_{13}$ a few times over the years, my mother finally challenged me to cook the dish myself. I objected

13. Which choice indicates most specifically how the narrator felt about her access to the dish she craved, prior to her mother's suggestion?

A. NO CHANGE
B. explanation
C. story
D. long tale

that none of Grandma's recipes$_{14}$ were written down, but Mom dismissed my concerns, insisting my memories would guide me —especially since I already knew that the most important ingredient was love.

It turned out Mom was right. It took some trial and error, but with help from the Internet, I found a recipe for chicken and dumplings that I love.$_{15}$

14. **F.** NO CHANGE
G. Grandmas' recipes
H. Grandmas recipes
J. Grandmas recipe's

15. Which choice best concludes the essay by emphasizing the central point made in the first and second paragraphs?

A. NO CHANGE
B. Grandma wouldn't have wanted me to be a quitter.
C. perfecting a recipe for a dish you love always takes some practice.
D. memories of how safe, happy, and loved I felt in the kitchen with Grandma helped me remember what to do—and, more importantly, how to do it.

PASSAGE II

Ada Lovelace, Programming the Future

[1] In 1833, when Ada Lovelace was seventeen, she met the inventor Charles Babbage at a party. [2] Lovelace's intelligence seems to have fazed$_{16}$ him, because he soon offered to show her a device he'd been working on. [3] Babbage introduced Lovelace to his complicated Difference Engine—a towering mechanical

16. **F.** NO CHANGE
G. overawed
H. impressed
J. motivated

calculator. [4] Such$_{17}$ was a pivotal moment, as it was only after

17. **A.** NO CHANGE
B. These
C. There
D. This

seeing this machine that Lovelace fully focused$_{18}$ her keen understanding on the subject that absorbed her thereafter. [5] With the benefit of an unusually extensive education, Lovelace had excelled in many subjects; after meeting Babbage though,$_{19}$

18. **F.** NO CHANGE
G. Lovelace fully to engage with
H. Lovelace—she was fully engaged with
J. Lovelace, she focused fully on

19. **A.** NO CHANGE
B. Babbage, though,
C. Babbage though
D. Babbage, though

she concentrated on mathematical theories and methods. [20]

Almost a decade later, Babbage delivered a lecture on a new, more sophisticated machine—the Analytical Engine. The transcript of this lecture was published only in French. After reading that version, Lovelace decided to translate it into English. As she did so, she wrote footnotes to contribute her own additional insights, including many$_{21}$ that greatly clarified the mechanism of Babbage's work and expanded on its vast

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

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

21. **A.** NO CHANGE
B. a number of hers

C. many of those insights
D. a lot of her insights

potential. [22] In 1801, Joseph-Marie Jacquard had invented a weaving machine that "read" a series of punched cards to determine which patterns to weave. Babbage proposed that, in his machine, such a card could specify mathematical

22. At this point, the writer is considering dividing the paragraph into two. Making this change would help organize the essay by separating:

F. a suggestion that Lovelace took unwarranted liberties in the act of translation from an explanation of why she did so.
G. an overview of the limitations of Babbage's lecture from an explanation of how the Analytical Engine could improve industries such as weaving.
H. details of how Lovelace translated the French text from an explanation of Babbage's response to that translation.
J. an introduction to Lovelace's translation from details that establish why it was so extraordinary.

operations Lovelace quickly grasped. This$_{23}$ idea's immense potential and strove to demonstrate it. Today, her outline of the input data needed to calculate certain numbers have been widely regarded$_{24}$ as the first computer program.

23. **A.** NO CHANGE
B. operations. Lovelace quickly grasped this
C. operations, Lovelace quickly grasped this
D. operations Lovelace quickly grasped; this

24. **F.** NO CHANGE
G. are widely regarded
H. have wide regard

J. is widely regarded

Further, she predicted that such a machine could be$_{25}$ used to do more than just manipulate numbers. Lovelace's suggestion that

25. **A.** NO CHANGE
B. could be employed and
C. akin to that could be
D. like that could be

such a machine could produce diverse things: scientific analysis,$_{26}$

26. **F.** NO CHANGE
G. things (scientific analysis,
H. things, scientific analysis,
J. things (scientific analysis

visual images, and music) to foreshadow$_{27}$ the digital revolution.

Lovelace died in 1852, decades before the first "real" computer was built, but recognition of her trailblazing role as

27. **A.** NO CHANGE
B. foreshadowed
C. foreshadowing
D. DELETE the underlined portion.

a woman in computing has grown. Naturally, in$_{28}$ the 1970s, the Department of Defense named a software language "Ada" in her honor, and, on the second Tuesday of every October, Ada Lovelace

28. **F.** NO CHANGE
G. However, in
H. In
J. By contrast, in

Day prompts us to notice$_{29}$ women in STEM fields.

29. Which choice most strongly and specifically emphasizes that Ada Lovelace Day is intended to shine a light on often-overlooked work done by women in math and science fields?

A. NO CHANGE
B. think about the work of
C. celebrate under-recognized contributions of
D. honor efforts by

Question 30 asks about the preceding passage as a whole.

30. Suppose the writer's primary purpose had been to discuss a mathematician whose work was remarkable but did not receive great recognition during the mathematician's lifetime. Would this essay accomplish that purpose?

F. Yes, because it proves that Lovelace improved on Babbage's work to change the course of computer science.
G. Yes, because it recounts the story of Ada Lovelace's pioneering work in her field and of the recognition she has received decades after her death.
H. No, because although it describes the program Lovelace wrote, it does not provide evidence that the program was remarkable.

J. No, because the passage speculates that Babbage recognized Lovelace's intelligence.

PASSAGE III

On Volcano's Edge

[1]

The U.S. is home to approximately 170 active volcanoes. While some in Alaska and Hawaii are so active that they erupt daily, many more lie dormant for years—[31] or even decades, between eruptions. Since some of these active volcanoes sit near populated towns and cities, predicting future eruptions is essential to public safety.

[2]

The National Volcano Early Warning System reports that approximately 54 U.S. volcanoes pose a high or very high risk to public safety.[32] The field of volcanology is devoted to understanding the formation and dynamics of volcanoes. [A]

31. **A.** NO CHANGE
B. years,
C. years
D. years;

32. Given that all the choices are true, which one would provide the most effective introduction to the paragraph?

F. NO CHANGE
G. This task is the responsibility of volcanologists.

H. On average, approximately one volcano erupts per week somewhere around the world.

J. The deadliest volcanic event in the United States occurred when Mount St. Helens erupted in 1980.

This work can focus on dead and dormant volcanoes,$_{33}$ it can also require volcanologists to monitor volcanoes that are active or potentially "reawakening."

[3]

[B] Field research on dead or dormant volcanoes frequently involves$_{34}$ analyzing the chemical makeup of the rocks around the

33. **A.** NO CHANGE
B. volcanoes; since
C. volcanoes
D. volcanoes, but

34. **F.** NO CHANGE
G. have involved
H. involve
J. are involving

volcano site to determine the amounts of sulfur and iron in the rocks.$_{35}$ At active sites,

35. The writer wants to end this sentence by emphasizing that analysis of dormant and dead volcanoes provides insights into the geological history of those sites. Which choice best accomplishes that goal?

A. NO CHANGE
B. establish when and how previous eruptions occurred.

C. confirm that the volcanoes are unlikely to erupt again in the near future.
D. test for evidence of ancient civilizations that might have lived there.

however,$_{36}$ volcanologists collect samples and measure lava temperatures, gas emissions, and ongoing earthquake activities. "Long-period" earthquakes can indicate magma rising

36. **F.** NO CHANGE
G. in fact,
H. therefore,
J. furthermore,

through$_{37}$ Earth's crust. As

37. **A.** NO CHANGE
B. behind
C. of
D. with

magma liquefied rock that eventually becomes lava,$_{38}$ builds up under the surface, a volcano's shape often changes. Thus,

38. **F.** NO CHANGE
G. magma, liquefied rock that eventually becomes lava—
H. magma—liquefied rock that eventually becomes lava—
J. magma, liquefied rock that eventually becomes lava

it's$_{39}$ vital to monitor a volcano using GPS and precisely calibrated instruments to detect and react to such changes.

39. **A.** NO CHANGE
B. it was
C. its'

D. its

[4]

Volcanologists also help to prepare areas for the chance that a volcano could erupt.[40] Fast-moving lava, avalanches, and sudden rocky explosions pose dire risks to nearby humans, animals, and their homes. Even far from the eruption site, plumes of ash can harm crops and air travel is disrupted in places nowhere near the volcano.[41] Advising the public about when to evacuate and when to stay away from a site can save thousands of lives. [C]

[5]

Because[42] a career that involves camping by a soon-to-erupt volcano might seem spectacularly dangerous, only two U.S. geologists have ever died as a result of volcanic eruption. [D] Recent advances in technology and methods of prediction help[43] volcanologists advise residents living near an active site while greatly minimizing risks to the scientists themselves.

[6]

Like many applied science positions, a volcanologist's job combines direct observation, theoretical modeling, and analyzing of data.[44]

40. **F.** NO CHANGE
G. the possibility that a volcano could erupt in a certain area.
H. a possible eruption.
J. a likelihood that a volcano will erupt nearby, since they know it could happen.

41. **A.** NO CHANGE
B. ash plumes can cause problems for farmers, crops, air traffic controllers, and airplanes.
C. ash that forms massive clouds in the sky can rain down on fields and affect airplane travel in faraway locales.
D. plumes of ash can disrupt air travel and affect agriculture.

42. **F.** NO CHANGE
G. Considering that
H. Since
J. While

43. **A.** NO CHANGE
B. has helped
C. is helping
D. helps

44. **F.** NO CHANGE
G. they analyze data.
H. data to be analyzed.
J. data analysis.

Question 45 asks about the preceding passage as a whole.

45. The writer wants to add the following sentence to the essay:

Whatever a volcano's status, volcanologists must conduct much of this monitoring on site.

The sentence would most logically be placed at:

A. Point A in Paragraph 2.
B. Point B in Paragraph 3.
C. Point C in Paragraph 4.
D. Point D in Paragraph 5.

PASSAGE IV

Vermeer's Artistry

The following paragraphs may or may not be in the most logical order. Each paragraph is numbered in brackets, and question 59 will ask you to choose where Paragraph 4 should most logically be placed.

[1]

Johannes Vermeer's *The Art of Painting* combines realistic representation with metaphorical details to prompt the viewer to think about how art works.$_{46}$ Vermeer is best known for

46. Which choice best indicates where Vermeer was born and worked?

F. NO CHANGE
G. in one of the Dutch painter's most self-referential works.
H. to produce a complex statement about the politics and practice of painting.
J. in a painting owned by the Kunsthistorisches Museum in Vienna.

portraying women in everyday domestic moments, since he showed$_{47}$ them making lace, reading, or doing chores. This

47. A. NO CHANGE
B. showing
C. in which he showed
D. DELETE the underlined portion.

painting, however, centers on a male artist; critics$_{48}$ believe represents Vermeer himself, as he paints a female model. Thus, the painting seems to offer the artist's commentary on his art.

[2]

[1] Yet some details are inconsistent with the work's prevailing realism. [2] In one place, the painter's hair fades gradually into the background colors of the map behind him. [3] In another, blurring of background details,$_{49}$ the folds of drapery on the table are out of focus, creating an impressionistic

48. **F.** NO CHANGE
G. artist, critics
H. artist. Critics
J. artist critics

49. **A.** NO CHANGE
B. another blurring of background details,
C. another, blurring of background details
D. another blurring, of background details

effect. [4] Basic tools which$_{50}$ the painter would need access in order to paint, like a palette, are absent from the image. [5] It also appears that, were the painter to stand up, he'd bang

50. **F.** NO CHANGE
G. to which

H. for

J. DELETE the underlined portion.

MATHEMATICS TEST

50 Minutes—45 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then darken the corresponding oval on your answer sheet.

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.

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1. What is the value of $4x - 9$ when $x = 7$?

A. 19
B. 37
C. 28
D. 25

2. If $6y + 15 = 45$, then $y = ?$

F. 3
G. 4
H. 5
J. 6

3. What is 28% of 250?

A. 60
B. 65
C. 70
D. 75

4. Which of the following is equivalent to $5(3x - 8)$?

F. $15x - 8$
G. $3x - 40$
H. $15x - 40$
J. $8x - 13$

5. A laptop costs $720 after a 20% discount. What was the original price?

A. $864
B. $900
C. $840
D. $960

6. What is the slope of a line passing through points (2, 5) and (8, 17)?

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

7. If $h(x) = 2x^2 - 3x + 4$, what is $h(3)$?

A. 13
B. 15
C. 17
D. 19

8. What is the value of $|-24 + 9|$?

F. -33
G. -15
H. 15
J. 33

9. A triangle has a base of 18 cm and a height of 14 cm. What is its area?

A. 32 cm^2
B. 126 cm^2
C. 252 cm^2
D. 64 cm^2

10. If $7x - 12 = 3x + 20$, then $x = ?$

F. 4
G. 6
H. 8
J. 10

11. What is the circumference of a circle with diameter 18 inches? (Use $\pi \approx 3.14$)

A. 28.26 in
B. 36 in
C. 56.52 in
D. 254.34 in

12. Which of the following is a solution to $x^2 - 9x + 20 = 0$?

F. 2
G. 3
H. 4
J. 6

13. In a school of 400 students, 160 participate in sports. What percent participate in sports?

A. 35%
B. 40%
C. 45%
D. 50%

14. What is the distance between points (3, 8) and (3, -6) in the coordinate plane?

F. 2
G. 11
H. 14
J. 0

15. If 3/8 of a number is 24, what is the number?

A. 9
B. 32
C. 48
D. 64

16. What is the value of 4^5?

F. 20
G. 256
H. 512
J. 1,024

17. If the sum of three consecutive integers is 72, what is the largest of these integers?

A. 22
B. 23
C. 24
D. 25

18. Which of the following is equivalent to $(x + 9)(x - 6)$?

F. $x^2 + 3x - 54$
G. $x^2 - 3x - 54$
H. $x^2 + 15x - 54$
J. $x^2 - 15x + 54$

19. What is the perimeter of a rectangle with length 19 inches and width 12 inches?

A. 31 in
B. 50 in
C. 62 in
D. 228 in

20. If y varies directly with x, and $y = 18$ when $x = 6$, what is y when $x = 11$?

F. 27
G. 30
H. 33
J. 36

21. What is the value of $\sqrt{144} - \sqrt{81}$?

A. 3
B. 5
C. 7
D. $\sqrt{63}$

22. A bag contains 18 red marbles, 12 blue marbles, and 15 green marbles. What is the probability of randomly selecting a red marble?

F. 1/3
G. 2/5
H. 18/45
J. 1/2

23. If $\sin(\theta) = 8/17$ where θ is an acute angle, what is $\cos(\theta)$?

A. 15/17
B. 8/15
C. 17/15
D. 15/8

24. What is the solution set for the inequality $5x - 8 \geq 27$?

F. $x \geq 19$
G. $x \leq 7$
H. $x \geq 7$
J. $x \leq 19$

25. A cylinder has a radius of 7 inches and a height of 10 inches. What is its volume? (Use $\pi \approx 3.14$)

A. 439.6 in^3
B. 1,538.6 in^3
C. 769.3 in^3
D. 219.8 in^3

26. A right triangle has legs of length 16 and 30. What is the length of the hypotenuse?

F. 32
G. 34
H. 36
J. 38

27. What is the value of $(3x + 4)^2$ when $x = 5$?

A. 289
B. 361
C. 400
D. 441

28. The sum of the interior angles of a polygon is 1,260°. How many sides does the polygon have?

F. 7
G. 8
H. 9
J. 10

29. If 4^(x-1) = 256, what is the value of x?

A. 3
B. 4
C. 5
D. 6

30. Which of the following is equivalent to $\sqrt{180}$?

F. $9\sqrt{5}$
G. $6\sqrt{5}$
H. $90\sqrt{2}$
J. $18\sqrt{10}$

31. In an arithmetic sequence, the first term is 11 and the common difference is 6. What is the 12th term?

A. 71
B. 77
C. 83
D. 89

32. If matrix A = [5 3; 2 4] and matrix B = [2 1; 3 2], what is A + B?

F. [7 4; 5 6]
G. [3 2; -1 2]
H. [10 3; 6 8]
J. [7 3; 5 6]

33. A sphere has a radius of 9 cm. What is its volume? (Use $\pi \approx 3.14$ and $V = (4/3)\pi r^3$)

A. 1,017.36 cm^3
B. 2,143.32 cm^3
C. 3,052.08 cm^3
D. 904.32 cm^3

34. What is the value of 7! (7 factorial)?

F. 49
G. 720
H. 5,040
J. 40,320

35. For which value of x is the expression $(x + 4)/(x^2 - 16)$ undefined?

A. x = 4 only
B. x = -4 only
C. x = 0
D. x = 4 or x = -4

36. If the angles of a triangle are in the ratio 2:5:8, what is the measure of the largest angle?

F. 24°
G. 60°
H. 72°
J. 96°

37. What is the domain of the function $f(x) = \sqrt{(x - 9)}$?

A. $x \geq 9$
B. $x > 9$
C. $x \geq 0$
D. All real numbers

38. If $\log_6(x) = 4$, then $x = ?$

F. 24
G. 216
H. 1,296
J. 64

39. A rectangular prism has dimensions 6 cm × 8 cm × 15 cm. What is its volume?

A. 29 cm^3
B. 90 cm^3
C. 720 cm^3
D. 360 cm^3

40. What is the least common multiple (LCM) of 14 and 21?

F. 7
G. 42
H. 84
J. 294

41. If $f(x) = 5x - 8$ and $g(x) = x^2 + 2$, what is $f(g(3))$?

A. 43
B. 47
C. 51
D. 55

42. The arithmetic mean of eight numbers is 42. If seven of the numbers are 38, 45, 40, 43, 39, 44, and 46, what is the eighth number?

F. 41
G. 42
H. 43
J. 44

43. In an isosceles triangle, the vertex angle measures 50°. What is the measure of each base angle?

A. 40°
B. 50°
C. 65°
D. 80°

44. If x varies directly with the square of y, and x = 20 when y = 2, what is x when y = 5?

F. 50
G. 100
H. 125
J. 150

45. What is the greatest common factor (GCF) of 108 and 144?

A. 12
B. 18
C. 24
D. 36

3 3

READING TEST

40 Minutes—36 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 short story "Simple Recipes" by Madeleine Thien (©2002 by Madeleine Thien). Publisher: Little, Brown.

There is a simple recipe for making rice. My father taught it to me when I was a child. Back then, I used to sit up on the kitchen counter watching him, how he sifted the grains in his hands, sure and quick, removing pieces of dirt or sand, tiny imperfections. He swirled his hands through the water and it turned cloudy. When he scrubbed the grains clean, the sound was as big as a field of insects. Over and over, my father rinsed the rice, drained the water, then filled the pot again.

The instructions are simple. Once the washing is done, you measure the water this way—by resting the tip of your index finger on the surface of the rice. The water should reach the bend of your first knuckle.

My father did not need instructions or measuring cups. He closed his eyes and felt for the waterline. Sometimes I still dream of my father, his bare feet flat against the floor, standing in the middle of the kitchen. He wears old buttoned shirts and faded sweatpants drawn at the waist. Surrounded by the gloss of the kitchen counters, the sharp angles of the stove, the fridge, the shiny sink, he looks out of place. This memory of him is so strong, sometimes it stuns me, the detail with which I can see it.

Every night before dinner, my father would perform this ritual—rinsing and draining, then setting the pot in the cooker. When I was older, he passed this task on to me but I never did it with the same care. I went through the motions, splashing the water around, jabbing my finger down to measure the water level. Some nights the rice was a mushy gruel. I worried that I could not do so simple a task right. "Sorry," I would say to the table, my voice soft and embarrassed. In answer, my father would keep eating, pushing the rice into his mouth as if he never expected anything different, as if he noticed no difference between what he did so well and I so poorly. He would eat every last mouthful, his chopsticks walking quickly across the plate. Then he would rise, whistling, and clear the table, every motion so clean and sure, I would be convinced by him that all was well in the world.

My father is standing in the middle of the kitchen. In his right hand he holds a plastic bag filled with water. Caught inside the bag is a live fish.

The fish is barely breathing, though its mouth opens and closes. I reach up and touch it through the plastic bag, trailing my fingers along the gills, the soft, muscled body, pushing my

finger overtop the eyeball. The fish looks straight at me, flopping sluggishly from side to side.

My father fills the kitchen sink. In one swift motion he overturns the bag and the fish comes sailing out with the water. It curls and jumps. We watch it closely, me on my tiptoes, chin propped up on the counter. The fish is the length of my arm from wrist to elbow. It floats in place, brushing up against the sides of the sink.

I keep watch over the fish while my father begins the preparations for dinner. The fish folds its body, trying to turn or swim, the water nudging overtop. Though I ripple tiny circles around it with my fingers, the fish stays still, bobbing side to side in the cold water.

For many hours at a time, it was just the two of us. While my mother worked and my older brother played outside, my father and I sat on the couch, flipping channels. He loved cooking shows. We watched *Wok with Yan*, my father passing judgement on Yan's methods. I was enthralled when Yan transformed orange peels into swans. My father sniffed. "I can do that," he said. "You don't have to be a genius to do that." He placed a sprig of green

onion in water and showed me how it bloomed like a flower. "I know many tricks like this," he said. "Much more than Yan."

Still, my father made careful notes when Yan demonstrated Peking Duck. He chuckled heartily at Yan's punning. "Take a wok on the wild side!" Yan said, pointing his spatula at the camera.

"Ha ha!" my father laughed, his shoulders shaking. "*Wok* on the wild side!"

In the mornings, my father took me to school. At three o'clock, when we came home again, I would rattle off everything I learned that day. "The brachiosaurus," I informed him, "eats only soft vegetables."

My father nodded. "That is like me. Let me see your forehead." We stopped and faced each other in the road. "You have a high forehead," he said, leaning down to take a closer look. "All smart people do."

I walked proudly, stretching my legs to match his steps. I was overjoyed when my feet kept time with his, right, then left, then right, and we walked like a single unit.

1. Based on the passage, it could be assumed that the narrator learned to make rice by:

A. carefully following the complicated process her father taught her.
B. studiously watching cooking shows with her father.
C. following her father's steps in a half-hearted way that led to unsatisfying results.
D. reading about the process in books her father left her.

2. In the context of the passage, which of the following statements most strongly foreshadows the joy and connection the narrator feels in the last paragraph?

F. "There is a simple recipe for making rice" (line 1).
G. "When I was older, he passed this task on to me but I never did it with the same care" (lines 23–24).
H. "Then he would rise, whistling, and clear the table, every motion so clean and sure, I would be convinced by him that all was well in the world" (lines 32–34).
J. "My father sniffed. 'I can do that,' he said. "You don't have to be a genius to do that" (lines 59–60).

3. The passage suggests that in walking to match her father, the daughter:

A. folded her body, trying to turn away.
B. found joy in copying his movements.
C. felt inferior to her father in every way.
D. did not find Yan's puns as amusing as her father did.

4. Which of the following is true of the fish after the father has put it into the sink?

I. It does not respond to the narrator touching the water.
II. It is as long as the narrator's arm from wrist to elbow.
III. It looks straight at the narrator while flopping sluggishly.
IV. It brushes against the sides of the sink.

F. III and IV only
G. I, II, and IV only
H. II, III, and IV only
J. I and II only

5. Which of the following best paraphrases the narrator's comments in lines 5–7?

A. The rice her father made was better prepared than that of Chef Yan.
B. She viewed the many rice kernels as so many individual insects.
C. She was concerned that her father's repetitious actions signaled a mental disorder.
D. Her father was very thorough in preparing the rice for cooking.

6. As it is used in line 39, the word *trailing* most nearly means:

F. pursuing.
G. tracing.
H. losing.
J. hanging.

7. The narrator suggests that her father ate her rice out of:

A. pleasure; it was nearly as good as one of his own meals.
B. obligation; it was important never to waste any food.
C. consideration; he wanted his daughter to have the feeling that all was well.
D. embarrassment; otherwise, he would have to admit her incompetence.

8. Based on the passage, it's most logical to conclude that the fish is:

F. ill and dying.
G. restless and fearful.
H. confined and sluggish.
J. alert and watchful.

9. According to the passage, the father regarded *Wok with Yan* as:

A. providing some information worthy of his attention.

B. irrelevant to an accomplished chef like himself.
C. the primary source of his own cooking methods.
D. the funniest cooking show on television.

10. The narrator states that she is sometimes stunned by:

F. her father's ability to make rice without instructions or measuring cups.
G. the way her father dressed when he cooked.
H. the contrast between her father's appearance and that of the kitchen.
J. how detailed her memory of her father is.

Passage II

SOCIAL SCIENCE: Passage A is adapted from "Fertilizer History" by Gary Hergert, Rex Nielsen, and Jim Margheim (©2015 by University of Nebraska-Lincoln). Passage B is adapted from "Fertilizers, a Boon to Agriculture, Pose Growing Threat to U.S. Waterways" by Tatiana Schlossberg (©2017 by The New York Times Company).

Passage A by G. Hergert, R. Nielsen, and J. Margheim

For thousands of years after agriculture came into existence, manure was the main source of fertilizer. But sometime in the 18th century, it became common knowledge that ground-up bones provided crop nutrients. It wasn't until the 19th century that ground-breaking research, done by several innovative scientists, finally ushered in the modern era of soil chemistry and plant nutrition. One of the most prominent of these chemists was Justus von Liebig (1803–1873), a German chemist who did pioneering research in organic and biological chemistry.

Ammonia and nitric acid, basic components of many chemical fertilizers, could be manufactured by the early 20th century, but until the middle of the century, use of chemical fertilizer was limited.

However, this would all change.

With the start of World War II, there was a tremendous increase in nitrogen production, mainly because nitrogen is a principal ingredient in explosives. After World War II, the need to manufacture war munitions was replaced with the need to restore food supplies in Europe and the United States.

The development of high-tech equipment has led to "pre-

cision" and "best-management" farming practices, which have resulted in the ability to apply various fertilizer types to a given crop in site-specific amounts. Technological advances in various fields of study, including crop genetics and breeding, plant and soil testing, and the development of techniques to monitor the movement of nutrients and water within the soil profile have allowed today's farmers to use fertilizers more effectively and efficiently, in addition to being better stewards of the land and environment.

Manure is still an important source of plant nutrients; however, during the last 75 years, its use has been surpassed by the large-scale production and use of chemical fertilizers. In the mid- to late 1940s, about 2 million tons of chemical fertilizers were used per year. By 1960, over 7 million tons were used each year and by 2014 over 20 million tons were used.

There is still much to learn about the complex interactions involving fertilizer use in differing soil and plant ecosystems; however, we have made historical progress since the first use of manure—progress that has been foundational to feeding our nation and providing food and hope to other parts of the world.

Passage B by Tatiana Schlossberg

Nitrogen-based fertilizers, which came into wide use after World War II, helped prompt the agricultural revolution that has allowed the Earth to feed its seven billion people.

But that revolution came at a cost: artificial fertilizers, often applied in amounts beyond what crops need to grow, are carried in runoff from farmland into streams, lakes and the ocean. New research suggests that climate change will substantially increase this form of pollution, leading to more damaging algae blooms and dead zones in American coastal waters.

A study published Thursday in *Science* concludes that eutrophication, excessive nutrient enrichment, is likely to increase in the continental United States as a result of the changes in precipitation patterns brought by climate change. Heavier rains caused by warmer temperatures will cause more agricultural runoff, sluicing more nutrients into rivers, lakes and oceans.

The authors found that future climate change-driven increases in rainfall in the United States could boost nitrogen runoff by as much as 20 percent by the end of the century.

"When we think about climate change, we are used to thinking about water quantity—drought, flooding, extreme rainfall and things along those lines," said Anna Michalak, a professor of global ecology at the Carnegie Institution for Science in Stanford, Calif., and one of the authors of the study. "Climate change is just as tightly linked to issues related to water quality, and it's not enough for the water to just be there, it has to be sustainable."

Excess nitrogen from the fertilizers can cause eutrophication in the ocean, which can lead to harmful algae blooms or hypoxia—reduced levels of oxygen that create conditions in which organisms can't survive.

Questions 11–14 ask about Passage A.

11. In Passage A, the primary purpose of the details about the "ground-breaking research" (line 5) is to:

A. show that few fertilizers were successful until the development of chemical fertilizers.
B. demonstrate how manure replaced ground-up bones as the main source of fertilizer in the 18th century.
C. connect prominent scientists to their contributions to the agricultural industry.
D. provide details that show how knowledge of effective fertilizers grew over time.

12. According to Passage A, one reason for the development of chemical fertilizers was that:

F. the United States needed a practical use for nitrogen leftover from the war.
G. wartime industry created a way to mass-produce the components necessary for the fertilizer.
H. soldiers coming home from the war were able to return to their jobs as chemists.
J. farming practices provided crucial technologies which allowed nitrogen production to expand dramatically.

13. In the context of Passage A, the authors use the description of technological advances and techniques (lines 23–29) most nearly to:

A. critique farmers for their reliance on technology.
B. present factors that improved the application of chemical fertilizers.

C. list the strategies that farmers rely on to increase their harvests.
D. explain different technologies that are used to monitor water usage on a farm.

14. The main idea of the sixth paragraph (lines 30–35) is that chemical fertilizers:

F. are twice as effective as manure is for large-scale agricultural production.
G. have begun to be used by farmers only in the last 75 years.
H. are becoming more widely used compared to other common types of fertilizers.
J. have become more important, but still have yet to surpass manure in annual usage.

Questions 15–17 ask about Passage B.

15. It can reasonably be inferred from Passage B that a major factor in the reshaping of global agriculture was:

A. an increase in the use of chemical fertilizers.
B. a revolutionary fertilizing technique that maximized crop yields.
C. the discovery of a farming method that encouraged crop growth while avoiding ecological consequences.
D. a focus on lessening the impacts of the agricultural industry on climate change.

16. In the context of Passage B, the statement "But that revolution came at a cost" (line 44) most nearly refers to the way that chemical fertilizers:

F. place financial burdens on those who commit to using them.
G. increase the amount of money required to feed 7 billion people.
H. have environmental disadvantages in addition to economic advantages.
J. are less effective in coastal regions than in plains regions.

17. Passage B most nearly suggests that, compared to concerns about water quantity, concerns about water quality are:

A. equally connected to effects of climate change.
B. less important for those in urban areas than for those in rural areas.
C. more important on a global scale.
D. more heavily focused on saltwater bodies.

Questions 18–20 ask about both passages.

18. Both passages suggest that the agricultural industry has been significantly impacted by types of fertilizer that were:

F. impractical.
G. artificially manufactured.
H. naturally produced.
J. ammonia-based.

19. Which of the following statements best compares the ways the authors of Passage A and Passage B use details about the effects of incorporating nitrogen-based fertilizers into agriculture?

A. Passage A looks to the fertilizer as a source of hope for the future, while Passage B considers it a source of concern.

B. Passage A uses the fertilizer as one example in a discussion of farming advances, while Passage B focuses exclusively on the fertilizer.

C. Passage A considers the effects of the fertilizer on land, while Passage B considers the effects of the fertilizer on aquatic life.

D. Both passages discuss the effects of the increased fertilizer use on the environment.

20. To support their claims about the impact of increasing use of nitrogen-based fertilizers, the authors of both passages:

F. define key terms related to ecology.

G. quote experts in a related field.

H. provide statistics to support a point.

J. outline a specific timeline of development.

Passage III

HUMANITIES: This passage is adapted from the article "And where are the lilacs?" by Andrew Motion (©2004 by *The Guardian*).

Pablo Neruda couldn't hold a tune. "My ear," he admitted, "could never recognise any but the most obvious melodies, and even then, only with difficulty." This is remarkable: Neruda's cadences are crucial to his writing. No one reading his poems in their original Spanish would want to separate their sense from their sound. Even translated into English, their meaning is inseparable from their melody.

Adam Feinstein's new biography is fuelled by an infectious enthusiasm for Neruda's poems, but it also has an admirable patience with his life's dizzying details. It's difficult to think of a 20th-century poet who did more than Neruda. He wrote a huge number of books, he travelled like a man possessed, he loved and lost many women, he collected a host of famous friends. Some of these things are grist to the biographer's mill: Feinstein's account is crammed with adventure stories, narrow scrapes, passionate encounters. Others are harder to deal with: globe-trottings have to be logged but risk becoming a list of place-names. By pacing the story so as to give pre-eminence to the writing and the adventuring, while recording the duller passages more briefly, Feinstein creates his own sympathetic

music. His book turns Neruda's life into an opera—a blend of aria and recitative.

Sensibly, he relies a good deal on Neruda's own *Memoirs*. These are packed with marvellous details that give colour to the story, as well as providing a way of understanding how Neruda's fascination with real things gives shape to even his most vatic poems. At a parting with a grief-stricken girlfriend, for instance: "She kissed my arms, my suit, in a kind of ritual, and suddenly slipped down to my shoes, before I could stop her. When she stood up again, the chalk polish of my white shoes was smeared like flour all over her face."

Feinstein is too thorough to accept the *Memoirs* at face value, wonderful as they are. He understands that an author's reminiscences are a way of creating disguises as well as revealing secrets, and regularly checks them against available evidence, amplifying the many complicated or contentious issues hushed up by Neruda himself. Feinstein acknowledges, from the first, that Neruda grew up among secrets and was therefore likely to enjoy them later.

Leaving his hometown for the relatively cosmopolitan

Santiago, Neruda's interests expanded to accommodate social as well as family matters, and to create a more suggestive style. He relied on French symbolist poetry to stretch his imagination, combining his own fidelity to facts with surrealist touches and impressionistic overviews. The result was a fusion previously unseen in Chilean poetry—or poetry anywhere—and his success was meteoric. But his exploded imagination needed a larger canvas, and the cultural and economic conditions of Chile both compelled and exasperated him.

Consular activity served as his means of escape. By 1927 he was in Rangoon, then moved on through France, Japan, China, Ceylon and Java (where he met his first wife, Maria), before returning home in 1932. By this time his Spanish was apparently "quite odd...very much influenced by his solitude," and his sense of himself much altered. But these were not changes which threatened his audience: they added authority to his originality.

They didn't, however, do much for his political conscience, which began to develop during his posting to Spain in the early 1930s, when he fell in love with Delia del Carril. Delia persuaded him to become a communist—a process which meant

that he inflicted a great deal of pain on his first wife and their sickly daughter, while producing poems that exalted the suffering masses. It confronts Feinstein with the classic biographer's dilemma—how to respect the work while dealing with a contradictory private life—and he copes with it by presenting the facts rather than wagging his finger, and by foregrounding the writing. As the scenery changes from France to Chile again, we see Neruda the romantic lyricist turning into Neruda the "truth-teller and exposer of the world's injustices."

Neruda spent the late 30s and early 40s travelling round South America, converting his experience of other people's suffering into poems, standing as a senator, and defending the new emphasis of his work. Given the political climate, it was bound to end in trouble—or rather, trouble and adventure. In 1949 Neruda made a daring escape from Chile over the Andes into Buenos Aires, then soon set off again, speaking for the oppressed everywhere while neglecting Delia in favour of Matilde, who eventually became his third wife.

These paradoxes bring their own difficulties—but their tensions are intensified by fault-lines in Neruda's politics.

21. The primary function of the first paragraph is to:

A. clarify misunderstandings about what made Neruda so talented as a Spanish singer and musician.
B. outline how Neruda wrote his poems.
C. tell a story from Neruda's youth.
D. contrast a statement of Neruda's with a characteristic of his poetry.

22. Based on the passage, which of the following best describes the passage author's opinion of Neruda's poetry?

F. He prefers Neruda's *Memoirs* to Neruda's poetry.
G. He considers Neruda's poetry to be original.
H. He thinks Neruda's poetry is too heavily based on his own life.
J. He believes that Neruda's poetry shows faults and weaknesses.

23. The "melody" mentioned in lines 6–7 most nearly refers to:

A. the aria for Neruda's opera that was discovered by Adam Feinstein.
B. the effect Neruda's word choice and pacing has on a reader's understanding of his poems.
C. the connection between Neruda's life and his poetry discussed by the passage author.
D. the many adventures, narrow scrapes, and passionate encounters Neruda had during his life.

24. The passage most strongly suggests that a reader might appreciate Feinstein's treatment of the "dizzying details" (lines 9–10) of Neruda's life because Feinstein:

F. is critical of Neruda's many travels and adventures.
G. concentrates on explaining Neruda's writing process rather than focusing on his life.
H. never elaborates on why Neruda was a globe-trotter and prolific writer.
J. keeps dull passages brief to ensure the reader does not lose interest.

25. As it is used in line 17, the word *logged* most nearly means:

A. cut.
B. completed.
C. recorded.
D. harvested.

26. According to the passage, Neruda's reminiscences as related in his autobiography:

F. amplified contentious issues.
G. should be studied as literature.
H. create disguises and reveal secrets.
J. were a guide for Feinstein's writing style.

27. The passage indicates that Feinstein addresses Neruda's conversion to communism by:

A. avoiding the topic of politics as much as possible.
B. contradicting Neruda's own account of that time period.
C. respecting Neruda's first wife and sickly daughter to ensure the biography does not cause pain.
D. recording information truthfully without passing judgment on it.

28. According to Feinstein, Neruda's Spanish became "quite odd" (line 54) during his:

F. travels to Rangoon and other countries.
G. studies of French symbolist poetry.
H. escape from consular activity.
J. marriage to Delia del Carril.

29. The passage author indicates that Feinstein's treatment of Neruda's contradictions allows Feinstein to:

A. muddle the picture of Neruda's life.
B. show the downside of Neruda's exuberance.
C. let readers draw their own conclusions.
D. make Neruda appear less noble.

30. As it is used in line 86 the word *work* refers to Neruda's:

F. poetry.
G. biography.
H. travels.
J. marriage.

Passage IV

NATURAL SCIENCE: This passage is adapted from the essay "The Higgs at Last" by Michael Riordan, Guido Tonelli, and Sau Lan Wu (©2013 by Scientific American).

The Higgs boson is the cornerstone of the Standard Model, an interwoven set of theories that constitute modern particle physics. This particle's existence had been suggested in 1964 by Peter W. Higgs of the University of Edinburgh as the result of a subtle mechanism—independently conceived by François Englert and Robert Brout in Brussels plus three theorists in London—that endows elementary particles with mass. The Higgs boson is the physical manifestation of an ethereal fluid (called the Higgs field) that permeates every corner of the cosmos and imbues particles with distinctive masses.

Although theorists asserted that the Higgs boson—or something like it—must exist, they could not predict what its mass might be. For this and other reasons, researchers had few clues about where to look for it. An early candidate, weighing in at less than nine times the proton mass, turned up in 1984 at a refurbished, low-energy electron-positron collider in Hamburg, Germany. Yet the evidence withered away after further study.

Most theorists agreed that the Higgs mass should be 10 to 100 times higher. If so, discovering it would require a much larger and more energetic particle collider than even the Fermi National

Laboratory's Tevatron, a collider completed in 1983. That same year CERN began building the billion-dollar Large Electron Positron (LEP) collider, boring a 27-kilometer circular tunnel that crossed the French-Swiss border four times near Geneva. Although LEP had other goals, the Higgs boson was high on its target list. Discoveries and precision measurements made at LEP and the Tevatron soon implied that the Higgs boson should be no more than 200 GeV, which put it potentially within reach of these colliders. (GeV is the standard unit of mass and energy in particle physics, about equal to a proton mass.) In over a decade of searching, however, physicists found no lasting evidence for Higgs-like data bumps.

During the final LEP runs in the summer of 2000, physicists decided to push the collision energy beyond what the machine was designed to handle. That is when hints of a Higgs boson began appearing. After a heated debate, CERN's then-director Luciano Maiani decided to shut LEP down and begin its planned conversion into the LHC, a machine designed to find the Higgs boson.

The LHC is the most spectacular collection of advanced technology ever assembled. Built inside the original LEP tun-

nel, it uses little left from that collider. Its principal components include more than 1,200 superconducting dipole magnets—shiny, 15-meter-long cylinders worth nearly $1 million each. Probably the most sophisticated components ever mass-produced, by firms in France, Germany and Italy, they harbor twin beam tubes that are flanked by niobium-titanium magnet coils bathed in liquid helium at 1.9 kelvins, or –271 degrees Celsius. Inside, twin proton beams circulate in both directions at energies up to 7 TeV and velocities approaching light speed.

Although the LHC is a giant collider feeding multiple experiments, only the two largest ones—ATLAS and CMS—had been tasked with finding the Higgs boson. The ATLAS and CMS experiments couldn't observe a Higgs boson directly—it would decay into other particles far too quickly. They looked for evidence that it was created inside. Depending on the Higgs boson's mass, it could decay into lighter particles in a variety of ways. In 2011, attention began to focus on its rare decays into two photons and four charged leptons, because these signals would stand out starkly against tremendous backgrounds of data. By May 2012, the LHC was producing data 15 times faster than the

Tevatron had ever achieved.

On June 15, 2012, CMS physicists began gathering to hear the preliminary reports. Signals from their data were occurring again in the same vicinity—near 125 GeV—that had so tantalized researchers six months earlier. Scientists realized almost immediately that if they were to combine the new data with the 2011 results, chances were good that CMS could claim a Higgs discovery. Similar revelations occurred in the ATLAS experiment. At the thrilling moment of recognition, one ATLAS group of about a dozen physicists erupted in loud clapping and cries of joy, which echoed down the hallway. CMS and ATLAS independently concluded that the chances that the apparition was a fluke, due to random fluctuations, were less than one in three million. It had to be real.

These results were shared at a public joint seminar at CERN on July 4, 2012. When the camera panned to Dr. Higgs, he could be seen pulling out a handkerchief to wipe his eyes.

Few physicists doubt that a heavy new particle has turned up at CERN, but there is still debate about its exact nature—since July 2012, attention has focused on whether the new particle is indeed "the" Higgs boson predicted by the Standard Model. The particle opens up a fabulous new laboratory for further experimentation. Are its properties exactly as predicted? The apparent discrepancies in the early data could be random fluctuations that disappear in months to come. Or perhaps they are offering subtle hints of intriguing new physics.

31. The overall organization of the passage is best described as a:

A. chronological account of scientists determining the correct mass of various elementary particles.

B. step-by-step explanation of how the Large Hadron Collider was constructed.

C. series of important events leading to the discovery of the Higgs boson.

D. collection of stories describing how the Standard Model of physics evolved over time.

32. The main function of the first paragraph is to:

F. list the information discovered about the Higgs boson by research scientists in Hamburg.

G. demonstrate what led scientists to build larger and more energetic particle colliders.

H. summarize contributions made by theorists in London.

J. explain the origin and importance of the Higgs boson theory.

33. Based on the passage, one similarity between the two particle colliders described in lines 18–32 is that:

A. neither provided lasting evidence that definitively proved the existence of the Higgs boson.

B. both cost upwards of one billion dollars to build.

C. construction for both particle accelerators was completed in the same year.

D. both had the size and energy that enabled them to discover the Higgs boson.

34. The main idea of the last paragraph is that:

F. the properties of the new particle were predicted by the Standard Model only recently and leave physicists' results in doubt.

G. recent research by physicists makes earlier data gathered by scientists look faulty by comparison.

H. few doubt a new heavy particle has been discovered and additional research should explain its properties.
J. the heavy particle discovered weighs far more than originally predicted by scientists.

35. According to the passage, scientists in Brussels and London:

A. suggested in 1964 that the Higgs boson exists.
B. developed an interwoven set of theories for particle physics.
C. discovered the cornerstone of the Standard Model.
D. independently conceived of a subtle mechanism that endows elementary particles with mass.

36. Based on the passage, to make the particle collider functional, French, Italian, and German firms designed the dipole magnets to be capable of:

F. utilizing the principal components from the LEP accelerator and fitting in the original tunnel.
G. accelerating protons to velocities approaching light speed and having the protons circulate in two directions.
H. floating in the air when filled with liquid helium and achieving energies up to 7 TeV.
J. costing under one million dollars each and fitting into a fifteen-meter-long cylinder.

SCIENCE TEST

40 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.

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

Passage I

As substrate is added to an enzyme, *enzyme velocity*, or the rate at which an enzyme can change substrate into products, varies with initial substrate concentration, temperature, and time since the reaction began. Table 1 shows, for each of 4 enzymes (A, B, C, and D), the enzyme velocity 10 seconds after addition of substrate for different substrate concentrations and temperatures.

Table 1

Enzyme	Initial substrate concentration	Enzyme velocity (mmol/s) at a substrate temperature of:		
		20°C	30°C	60°C
A	5 mM	9.1	6.5	4.6
	10 mM	13.2	8.9	6.4
	15 mM	17.6	11.4	7.5
B	5 mM	13.1	7.3	4.9

	10 mM	20.3	10.9	6.9
	15 mM	25.5	13.8	8.6
C	5 mM	20.7	14.3	10.6
	10 mM	30.3	20.8	13.1
	15 mM	35.2	23.1	14.9
D	5 mM	50.2	23.5	14.6
	10 mM	57.6	28.3	18.6
	15 mM	63.3	30.7	19.9

Figure 1 shows how each enzyme's velocity changes over time with an initial substrate concentration of 12 mM at a temperature of 40°C.

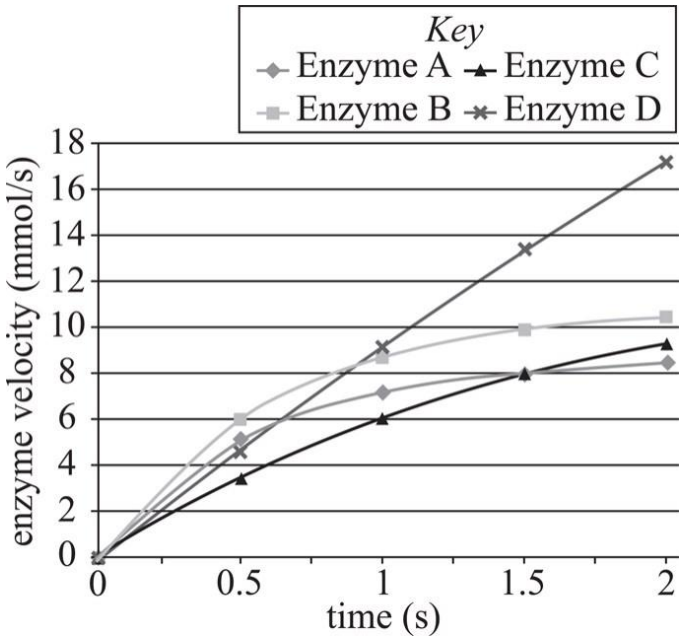
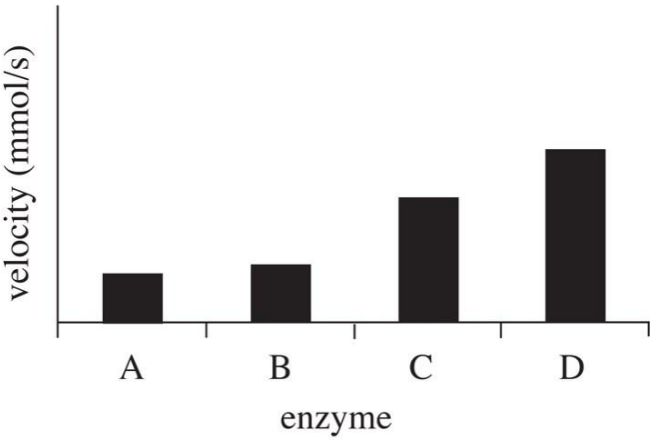


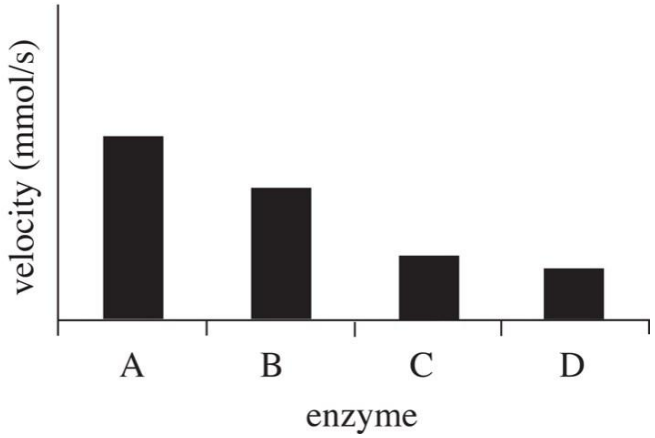
Figure 1

1. According to Table 1, which of the following graphs accurately depicts the velocities of Enzymes A, B, C, and D after 10 seconds at an initial substrate concentration of 5 mM and a temperature of 60°C ?

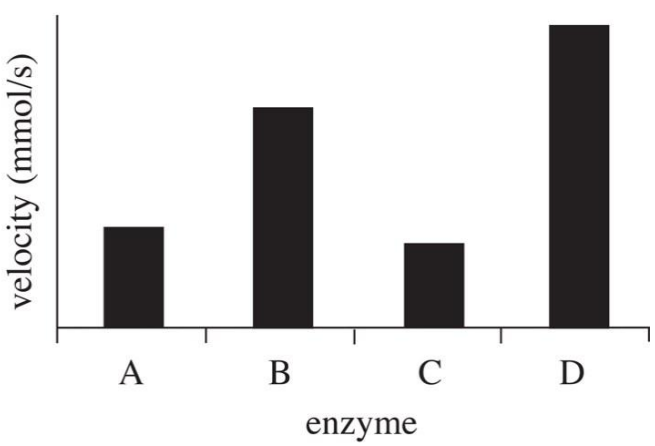
A.



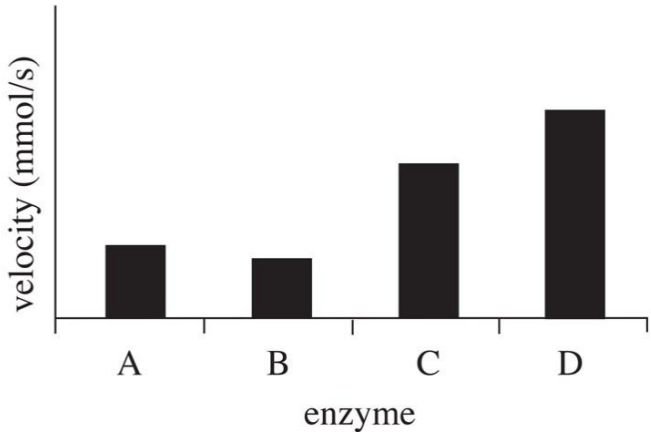
B.



C.



D.



2. Based on Table 1, the enzyme velocity of Enzyme B after 10 seconds in a solution with a substrate concentration of 10 mM at a temperature of 35°C would most likely be:

F. less than 7 mmol/s.
G. between 7 and 11 mmol/s.
H. between 11 and 20 mmol/s.
J. greater than 20 mmol/s.

3. According to Figure 1, which of the following correctly orders the enzymes according to their enzyme velocities from highest to lowest after 1 second at a substrate concentration of 12 mM and a temperature of 40°C ?

A. Enzyme A, Enzyme B, Enzyme C, Enzyme D
B. Enzyme A, Enzyme C, Enzyme D, Enzyme B
C. Enzyme D, Enzyme A, Enzyme B, Enzyme C
D. Enzyme D, Enzyme B, Enzyme A, Enzyme C

4. According to Figure 1, at a substrate concentration of 12 mM and a temperature of 40°C, which of the enzymes had the highest enzyme velocity after 0.75 seconds?

F. Enzyme A
G. Enzyme B
H. Enzyme C
J. Enzyme D

5. Based on Table 1, the enzyme velocity for Enzyme C in a solution with an 8 mM substrate concentration at 60°C after 10 seconds would likely be approximately:

A. 12.0 mmol/s.
B. 13.5 mmol/s.
C. 14.5 mmol/s.
D. 16.0 mmol/s.

6. According to Figure 1, which enzyme takes the *shortest* amount of time to reach an enzyme velocity of 6 mmol/s in a solution with a substrate concentration of 12 mM at a temperature of 40°C ?

F. Enzyme A
G. Enzyme B
H. Enzyme C
J. Enzyme D

Passage II

Ozone (O_3) is an inorganic gas found primarily in the stratosphere of Earth's atmosphere. Stratospheric ozone is formed naturally when UV (*ultraviolet*) light breaks apart an oxygen molecule to form two highly reactive oxygen atoms. The oxygen atoms each then collide with another oxygen molecule to form ozone. Though ozone makes up a very small percentage of the gas in the stratosphere, it is the primary absorber of the sun's UV-B rays, allowing only a small percentage of these harmful rays to reach Earth's surface. Ozone also absorbs light in the infrared spectrum, as does carbon dioxide (CO_2).

A researcher performed three studies on the behavior of ozone and CO_2.

Study 1

The researcher modeled the transmittance of both O_3 and CO_2 at their average concentrations in the atmosphere at various wavelengths in the UV spectrum from 0.25–0.35 microns (μm) and in the infrared spectrum from 2.5–11 μm. The *transmittance* of a gas is the percent of incoming solar radiation that is transmitted through that gas towards Earth's surface. The model is shown below in Figure 1.

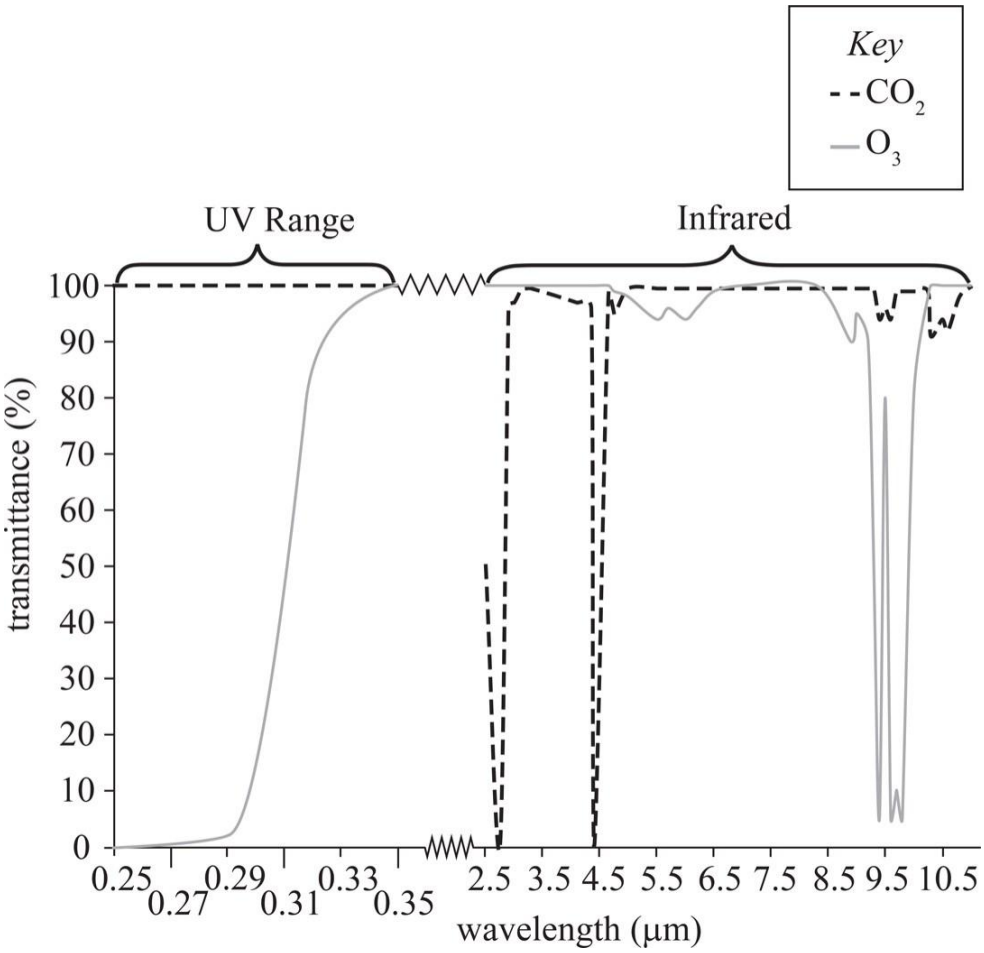


Figure 1

Study 2

Ozone levels vary throughout the stratosphere by both location and season. The researcher modeled the transmittance through the stratosphere at five different concentrations of ozone, in milligrams per cubic meter (mg/m^3), at a wavelength of 0.31 microns (see Figure 2).

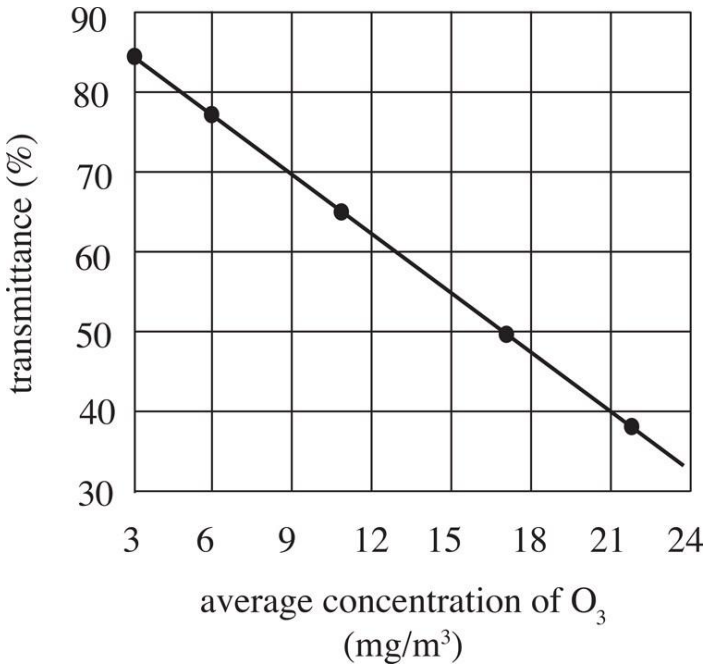


Figure 2

Study 3

The researcher also estimated the average stratospheric ozone concentration, in mg/m^3, at five different locations (Locations 1–5) on a particular day. The concentrations were estimated at standard temperature and pressure. The results are shown in Table 1.

Table 1

Location	Concentration (mg/m^3)
1	10
2	6
3	21
4	14
5	9

7. Based on the data in Figure 2, the transmittance at 0.31 microns at a concentration of 18 mg/m^3 would most likely be:

A. less than 45%.
B. between 45 and 50%.
C. between 50 and 55%.
D. greater than 55%.

8. In Study 2, as the concentration of ozone increased from 3 to 24 mg/m^3, the transmittance at 0.31 microns:

F. increased only.
G. decreased only.
H. increased and then decreased.
J. decreased and then increased.

9. Based on the model in Study 2, which of the locations in Study 3 likely has the greatest transmittance at 0.31 microns?

A. Location 1
B. Location 2
C. Location 3
D. Location 5

10. According to the passage, which of the following pairs of equations represents the production of ozone in the stratosphere?

F. O_2 + UV light = 2 O
2 O + 2 O_2 = 2 O_3

G. 2 O + UV light = O_3
O_3 + 3 O_2 = 3 O_3

H. O_2 + UV light = 2 O

$O_3 + O = 2\ O_2$

J. $O_2 + O = O_3$
$O_3 + \text{UV light} = 3\ O$

11. The researcher plans to repeat Study 2, but this time he wants to study the effects on transmittance of different CO_2 concentrations instead of O_3 concentrations. Based on Figure 1, should he measure the transmittance at 4.3 microns or at 9.5 microns?

A. At 4.3 microns; the transmittance of CO_2 is lower at this wavelength than it is at 9.5 microns.
B. At 4.3 microns; the transmittance of CO_2 is higher at this wavelength than it is at 9.5 microns.
C. At 9.5 microns; the transmittance of CO_2 is lower at this wavelength than it is at 4.3 microns.
D. At 9.5 microns; the transmittance of CO_2 is higher at this wavelength than it is at 4.3 microns.

12. Planet *Z* has the same atmospheric make-up as Earth, except that the concentration of carbon dioxide is higher and there is no ozone. Would the total transmittance of sunlight on Planet *Z* at a wavelength of 0.3 microns likely be higher or lower than the transmittance on Earth at a wavelength of 0.3 microns?

F. Higher; the transmittance of CO_2 is higher than the transmittance of O_3 at 0.3 microns.
G. Higher; the transmittance of CO_2 is lower than the transmittance of O_3 at 0.3 microns.
H. Lower; the transmittance of CO_2 is higher than the transmittance of O_3 at 0.3 microns.

J. Lower; the transmittance of CO_2 is lower than the transmittance of O_3 at 0.3 microns.

13. Based on Table 1, assuming that the atmospheric gases are uniformly mixed in the stratosphere, what would be the approximate mass of O_3, in *grams*, in 100 cubic meters of stratospheric air at Location 3 on the date of the study?

A. 0.21
B. 2.1
C. 210
D. 2,100

Passage III

Ocean depth affects both temperature and dissolved oxygen levels. In Figure 1, the values of temperature, *t*, in degrees Celsius, and dissolved oxygen, *D.O.*, in milligrams per liter (mg/L), are graphed versus depth, *d*, in meters below the ocean's surface. Five distinct ocean zones are also identified in Figure 1.

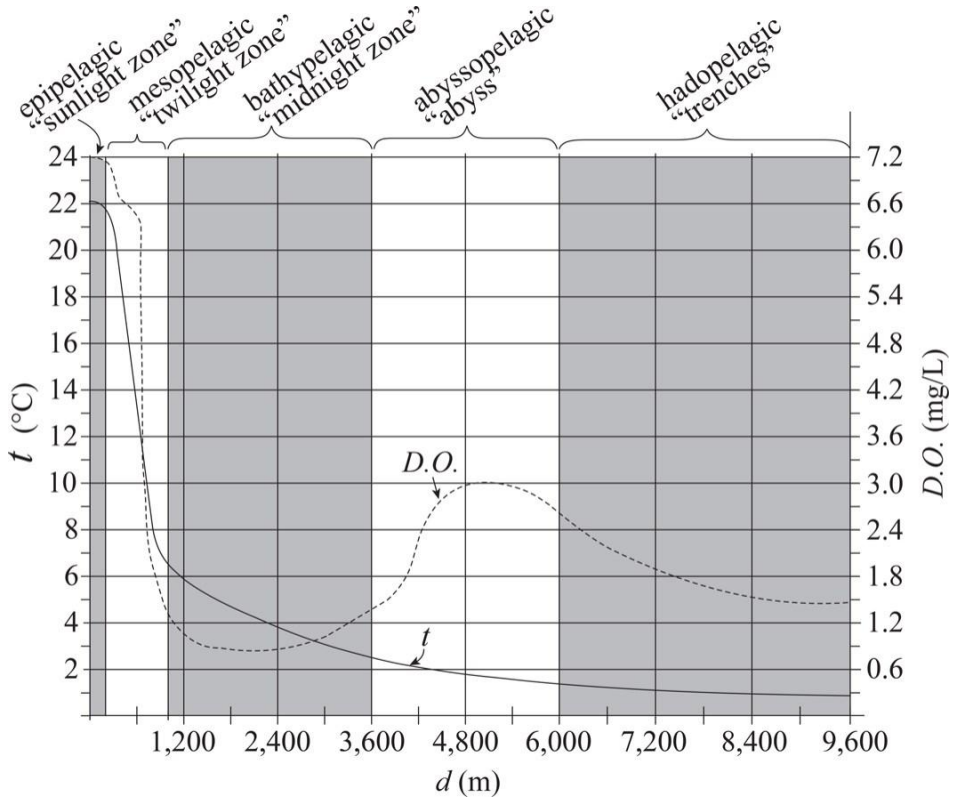


Figure 1

Approximately 98% of marine life is located in the epipelagic, mesopelagic, and bathypelagic zones. Figure 2 shows the percent of marine life that is located between sea level and a given depth within these three zones. For example, 20% of all marine life is located between sea level and a depth of 50 meters.

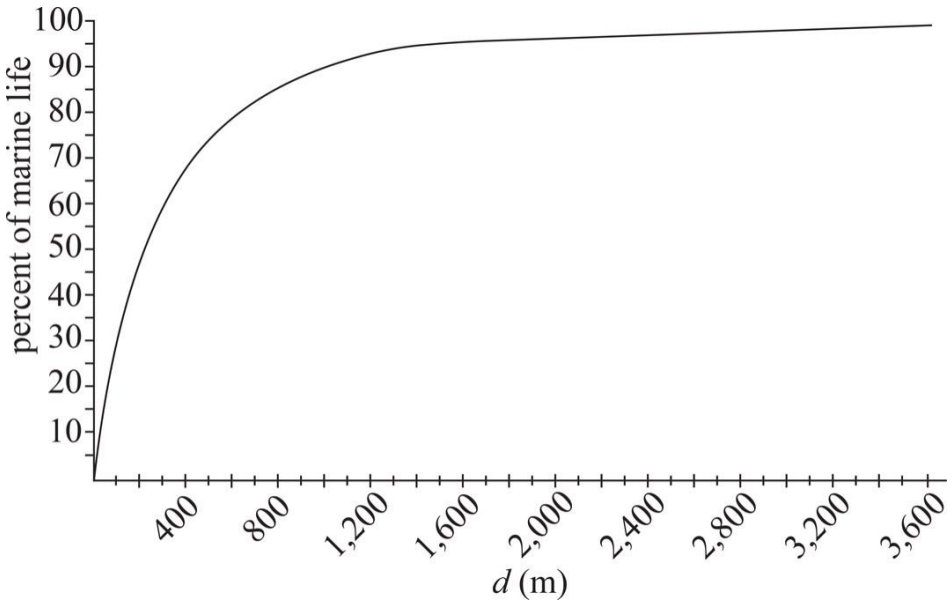


Figure 2

14. The range of a zone refers to the difference in depth between the top and the bottom of that zone. According to Figure 1, which two zones have similar ranges?

F. Epipelagic and mesopelagic
G. Mesopelagic and bathypelagic
H. Mesopelagic and abyssopelagic
J. Bathypelagic and abyssopelagic

15. Figure 2 indicates that approximately 35% of marine life lives between $d = 0$ m and:

A. $d = 50$ m.
B. $d = 100$ m.
C. $d = 300$ m.
D. $d = 500$ m.

16. According to the information in Figures 1 and 2, the bathypelagic zone extends to a depth of approximately:

F. 1,000 m.
G. 1,500 m.
H. 3,600 m.
J. 6,000 m.

17. Based on Figure 1, the dissolved oxygen levels at d = 10,000 m would most likely be:

A. less than 0.3 mg/L.
B. between 0.3 and 0.9 mg/L.
C. between 0.9 and 1.2 mg/L.
D. between 1.2 and 1.5 mg/L.

18. Depths below 1,000 meters are considered *aphotic* because no sunlight penetrates that deep. Based on Figure 2, the aphotic zones account for approximately what percentage of marine life?

F. 2%
G. 10%
H. 90%
J. 98%

19. Colder ocean water is denser than warmer ocean water. A scientist compares the masses of two 1-liter samples of water: one collected at d = 1,000 m and one collected at d = 3,600 m. Based on Figure 1, which of the samples of water, if either, would have a lower mass?

A. The sample at d = 3,600 m has a lower mass because the water temperature is lower and the density is higher.
B. The sample at d = 1,000 m has a lower mass because the water temperature is higher and the density is lower.
C. Both samples have the same mass because the density is the same for both samples.

D. Both samples have the same mass because the volume is the same for both samples.

Passage IV

Fibromyalgia is a central nervous system disorder characterized by chronic widespread pain and a heightened pain response. Four students each propose a theory of what causes fibromyalgia.

Student 1

Fibromyalgia is caused only by an abnormal immune response to an infection or injury. When the body detects damaged tissue, white blood cells release chemicals called cytokines that direct blood flow to the damaged cells and cause inflammation. The inflammation aggravates the nerves and makes the infected area more sensitive to pain. Usually the increased sensitivity goes away after the inflammation subsides, but sometimes the inflammation causes irreparable physical damage to the nerve cells. Fibromyalgia is the result of the damaged nerve cells disrupting the normal functioning of the central nervous system.

Student 2

Fibromyalgia is caused only by the overproduction of excitatory neurotransmitters. Neurons transmit pain signals by firing chemicals called neurotransmitters that bind to pain receptors on another neuron. The most prevalent of these neurotransmitters is glutamate. When the nerve cells chronically overproduce glutamate, the pain receptors adapt by physically changing shape to more readily absorb the signals. This change makes neurons more sensitive to pain, which results in fibromyalgia. Injury and illness can cause nerve damage to specific neurons, but they do not create the widespread pain of fibromyalgia.

Student 3

Fibromyalgia is caused only by abnormal estrogen or thyroid hormone levels. These hormones affect the production of serotonin and norepinephrine, two inhibitory neurotransmitters that suppress pain transmission through the central nervous system. When levels of these

inhibitory neurotransmitters are low, the body is unable to suppress pain transmission, and fibromyalgia is the result. While it is true that some people do overproduce glutamate, sufficient levels of serotonin and norepinephrine neutralize the excess glutamate before it interacts with any pain receptors.

Student 4

Fibromyalgia results only from a diet low in L-tryptophan, an essential amino acid necessary for the production of serotonin. Serotonin helps the brain interpret pain signals. When serotonin levels drop due to inadequate L-tryptophan intake, the brain is unable to properly interpret various pain signals, causing fibromyalgia. Nerve damage from injury only creates localized pain. Excess glutamate is harmless because it is not absorbed by the pain receptors. Estrogen and thyroid hormone imbalances do not limit the production of serotonin.

20. Which of the students theorized that fibromyalgia is triggered by neurons that are in some way physically altered?

F. Student 1 only
G. Student 4 only
H. Students 1 and 2 only
J. Students 2 and 3 only

21. A researcher discovers that female fibromyalgia patients report a higher incidence of pain during pregnancy and menopause when estrogen levels are rapidly changing. This discovery best supports which student's theory?

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

22. Based on the information provided by Student 4, people consume L-tryptophan through foods containing which of the following?

F. Carbohydrates
G. Protein
H. Saturated fat
J. Unsaturated fat

23. Substance P is an excitatory neurotransmitter similar in function to glutamate. Which student, if any, would be most likely to predict that people that produce higher-than-average levels of Substance P have a higher than average risk of developing fibromyalgia within their lifetimes?

A. None of the students
B. Student 1
C. Student 2
D. Student 3

24. Which of the students theorized that fibromyalgia is the result of low levels of certain neurotransmitters?

F. Students 1 and 2 only
G. Student 3 only
H. Students 2 and 3 only
J. Students 3 and 4 only

25. Which of the following research findings, if true, best supports Student 4's theory?

A. Patients with fibromyalgia have higher levels of thyroid hormone than patients that do not have fibromyalgia.
B. Patients with fibromyalgia have lower levels of thyroid hormone than patients that do not have fibromyalgia.

C. The prevalence of fibromyalgia is higher than average among people that consume diets low in L-tryptophan.

D. The prevalence of fibromyalgia is lower than average among people who consume diets low in L-tryptophan.

26. Prescription *C* is a powerful anti-inflammatory medication often prescribed to patients recovering from serious injury. A study examined the incidence of fibromyalgia following serious injury and found that the likelihood of developing fibromyalgia was the same among patients treated with Prescription *C* and patients that were not treated with any anti-inflammatory medications. These study results *weaken* the viewpoint(s) provided by which student(s)?

F. Student 1 only

G. Students 1 and 2 only

H. Student 3 only

J. Students 2 and 3 only

Passage V

Sufficient nitrogen levels in soil are necessary for crops to grow. Often, fertilizers rich in ammonium (NH_4^+) are applied to fields to increase crop yields, and nitrogen-fixing bacteria convert the applied ammonium into nitrate (NO_3) in a process known as *nitrification.* Nitrate is susceptible to loss through leaching before crops are able to use it, so nitrogen inhibitors are often used to prevent the conversion of ammonium into nitrate. Three studies examined the rates of nitrification in several regions using different nitrogen inhibitors: N-1, N-2, and N-3.

Soil samples of 3 cubic meters were collected from five different biomes (grassland, desert, tropical forest, coniferous forest, and deciduous forest). The samples were immediately placed in a sealed container in a cooler kept at a constant 20°C before they were transported to the same greenhouse. Each sample was thoroughly mixed, tested for the ammonium levels, and then divided evenly into three 1-cubic-meter plots in the same greenhouse. The plots had a mesh bottom to allow for drainage of the soils. The plots were each irrigated once with 2 L of water and then maintained at 20°C with constant humidity for one week before the fertilizer and nitrogen inhibitors were applied.

Study 1

The following procedures were performed for one plot from each biome. A 50 g sample of crystallized N-1 was added to 5 L of liquid fertilizer and the mixture was stirred until there were no remaining solids suspended in the mixture. The mixture was then sprayed uniformly along the top of each soil plot. For the next 8 weeks, the plots were watered once weekly with 2 L of water and the greenhouse remained at 20°C with constant humidity. After 8 weeks, the soil was analyzed to determine the percentage of the applied ammonium that was converted to nitrate over the 8-week period. The results are shown in Figure 1.

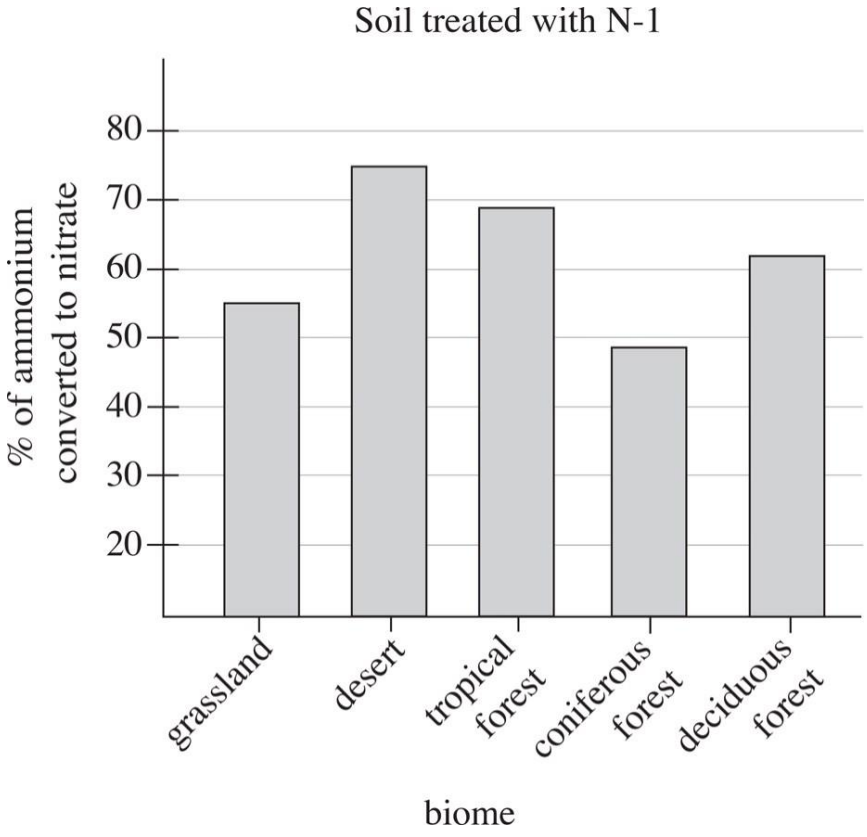


Figure 1

Study 2

Study 1 was repeated with a 50 g sample of crystallized N-2 substituted for the crystallized N-1 (see Figure 2).

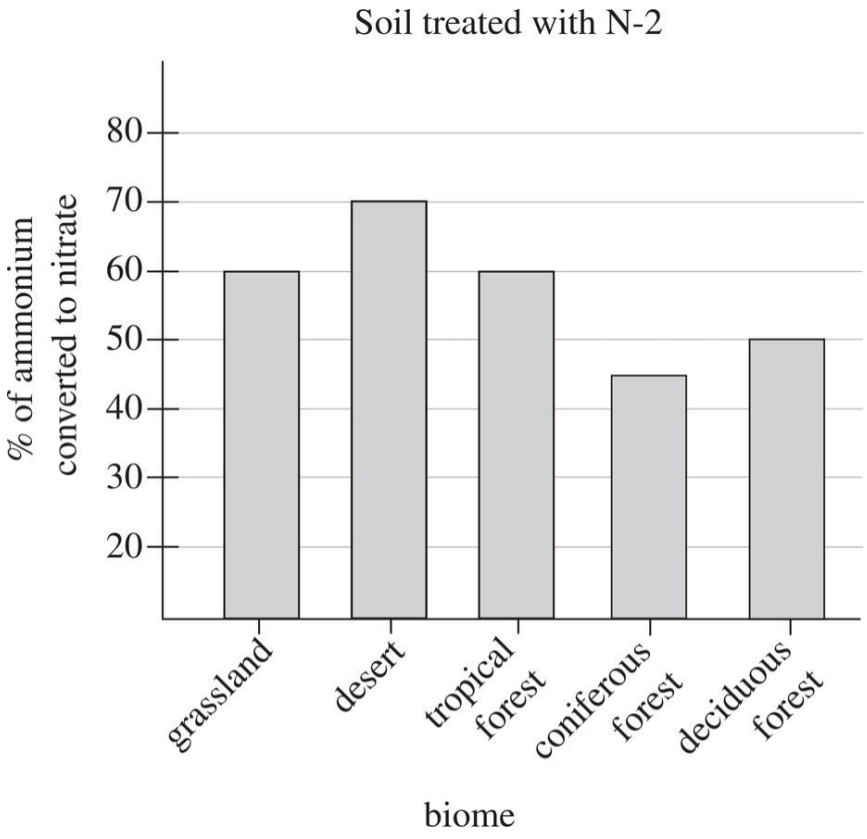


Figure 2

Study 3

Study 1 was repeated with a 50 g sample of crystallized N-3 substituted for the crystallized N-1 (see Figure 3).

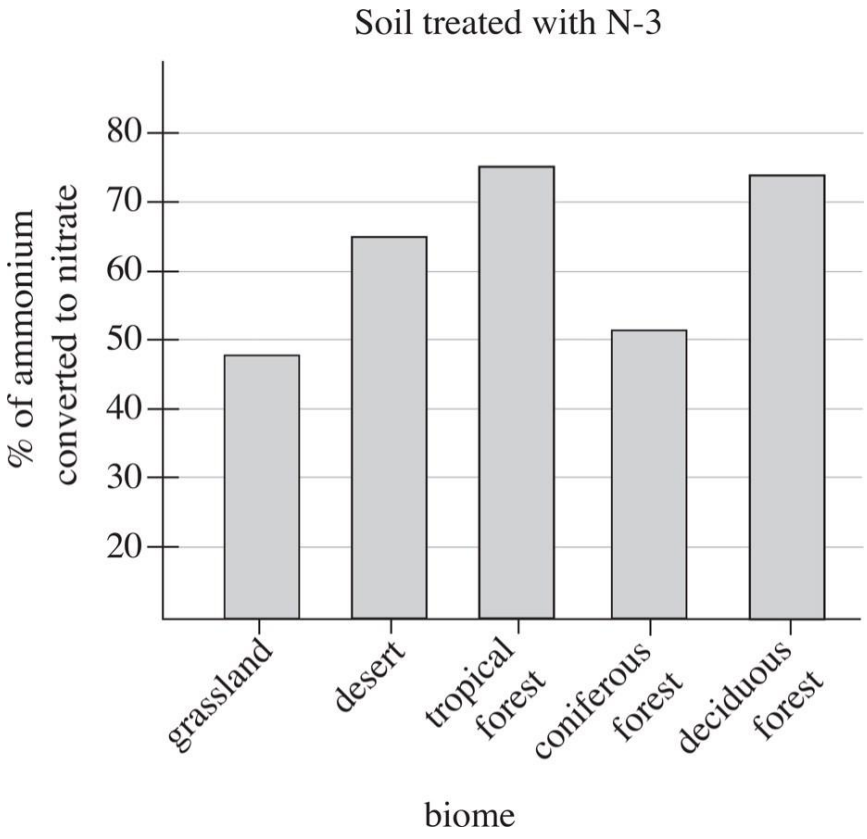


Figure 3

27. According to the results of the studies, the soil from which of the five biomes had the lowest percentage of ammonium converted to nitrate after treatment with N-1, N-2, and N-3, respectively?

	N-1	N-2	N-3
A.	coniferous forest	coniferous forest	grassland
B.	coniferous forest	deciduous forest	grassland
C.	desert	desert	tropical forest
D.	tropical forest	desert	deciduous forest

28. According to the results of Study 2, the percent of ammonium converted to nitrate in the soils treated with N-2, averaged across all 5 biomes, was closest to which of the following?

F. 40%

G. 50%
H. 60%
J. 70%

29. Do the results of Studies 1 and 3 support the statement "A greater percentage of applied ammonium was converted to nitrate in the tropical forest soil treated with N-3 than the same soil treated with N-1"?

A. No; 63% of the applied ammonium was converted to nitrate in N-1, whereas only 47% was converted to nitrate in N-3.
B. No; 75% of the applied ammonium was converted to nitrate in N-1, whereas only 68% was converted to nitrate in N-3.
C. Yes; 63% of the applied ammonium was converted to nitrate in N-3, whereas only 47% was converted to nitrate in N-1.
D. Yes; 75% of the applied ammonium was converted to nitrate in N-3, whereas only 68% was converted to nitrate in N-1.

30. Which of the following correctly identifies the independent (experimental) variable across the three studies?

F. Biome
G. Concentration of ammonia
H. Type of nitrogen inhibitor
J. Concentration of nitrate

31. The concentration of applied ammonium ions was reduced by less than 50% in the deciduous forest soil treated with which, if any, of the inhibitors?

A. None of the inhibitors
B. N-2 only
C. N-1 and N-3 only
D. All of the inhibitors

32. Is the mixture of N-1 and liquid fertilizer a solution when it is applied to the soil?

F. Yes, because the N-1 dissolved in the liquid fertilizer.
G. Yes, because the N-1 was suspended in the liquid fertilizer.
H. No, because the N-1 dissolved in the liquid fertilizer.
J. No, because the N-1 was suspended in the liquid fertilizer.

33. In soil, nitrogen-fixing bacteria are inactive in temperatures below 12°C. Which of the following steps was incorporated in the experimental design to ensure that the bacteria in all five soils were active?

A. The soil samples were all gathered when the outside temperature was 20°C.
B. The soil samples were tested for nitrate levels before the fertilizer was applied.
C. The soil samples were transported and maintained at 20°C throughout the study.
D. The soil samples were tested for ammonium levels before the fertilizer was applied.

Passage VI

Yeast cells exhibit *bipolar growth*: they grow in length from both tips in a straight-rod shape. However, the presence of an external electrical field can affect the growth patterns of yeast cells. Two researchers created a genetically modified strain of the fission yeast *Schizosaccharomyces pombe* (*S. pombe*). The genetically modified (GMO) strain was deficient in one of the proteins used to regulate the intracellular pH.

The researchers conducted two experiments to examine how an electric field affects the growth of both the non-GMO yeast cells (*S. pombe – N*) and the GMO yeast cells (*S. pombe – GM*).

Experiment 1

The researchers put a sugar-based agar into four square petri dishes (designated A, B, C, and D). Three *S. pombe* cells were placed into each of the dishes. The yeast placed in Dishes A and B were all *S. pombe – N* cells, and the yeast placed in Dishes C and D were all *S. pombe – GM*. A battery was used to generate a current through Dishes B and D. Figure 1 shows the growth of the cells in all four petri dishes and the direction of the electric fields (where present). The shaded portion of the cell represents the original shape of the cell when it was placed in the dish, while the dotted lines indicate the size and shape of the cell after 3 days at a constant temperature of 20°C. The nucleus is also shown for each cell.

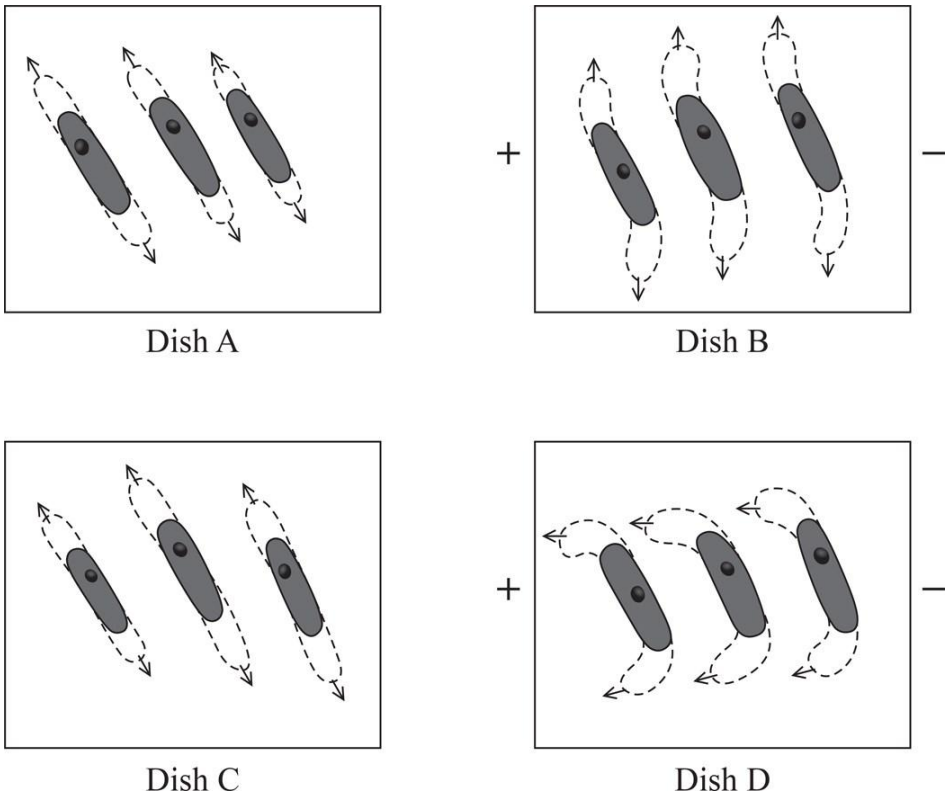


Figure 1

Experiment 2

A sugar-based agar was placed into four new petri dishes (designated W, X, Y, and Z). Three *S. pombe* cells were placed into each dish: *S. pombe – N* cells in Dishes W and X, and *S. pombe – GM* cells in Dishes Y and Z. A battery was used to generate a current through all four dishes. After 3 days at a constant temperature of 20°, the researchers measured the length, *L*, from tip to tip of each yeast cell along the axis parallel to the orientation of the cell body as shown for one particular yeast cell in Figure 2.

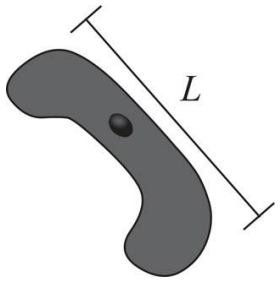


Figure 2

Dishes W and Y were moved to a room with a constant temperature of 15°C while Dishes X and Z were moved to a second room with a constant temperature of 30°C. The researchers measured each cell's length every 12 hours for the following three days. The results of the average cell lengths in each dish are shown in Figure 3.

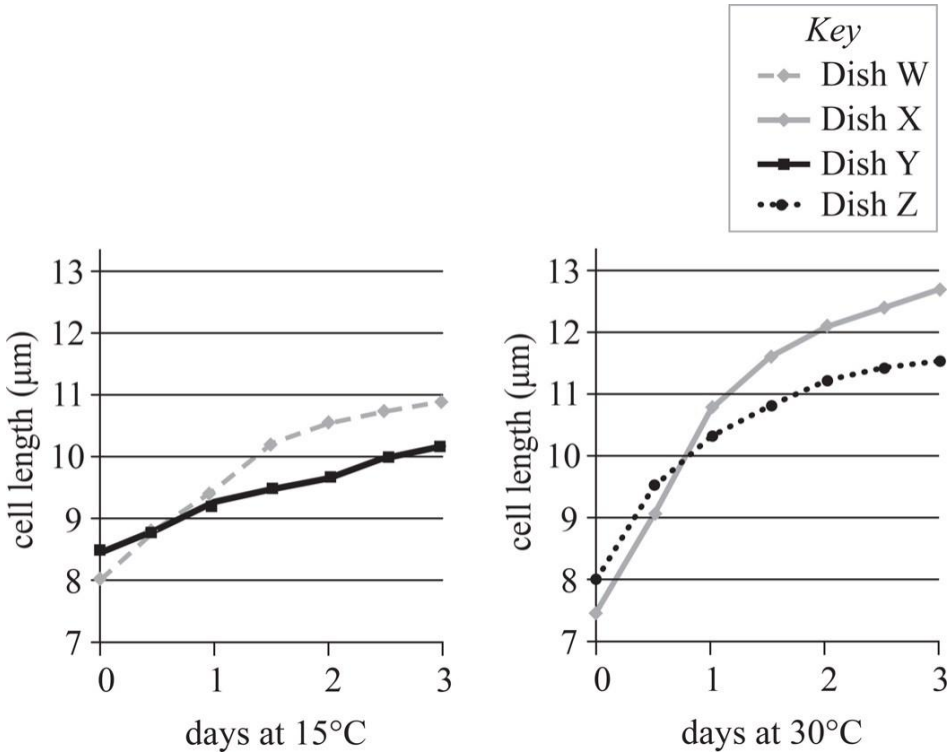
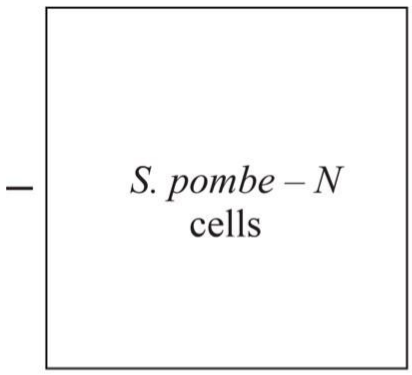


Figure 3

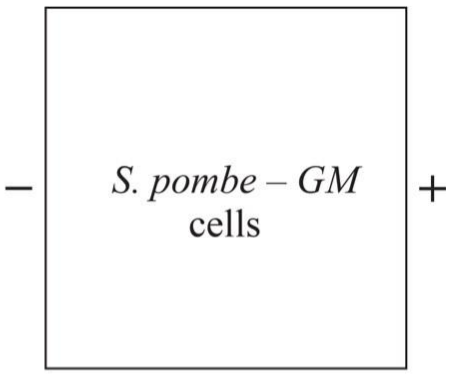
34. The cell shown in Figure 2 is oriented exactly how it appeared in its dish. Which of the following diagrams most likely represents the petri

dish from which this cell is found?

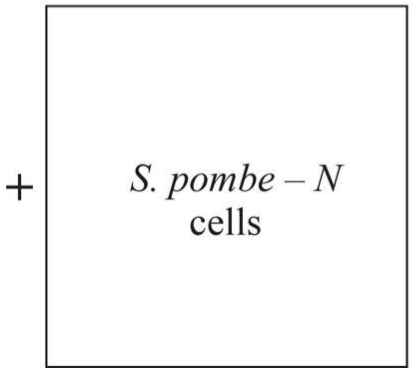
F.



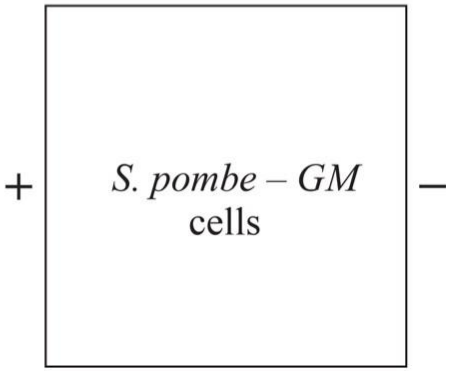
G.



H.



J.



35. Before Dish X was moved to a higher temperature room, the cells in Dish X likely exhibited growth most similar to the cells in which of the dishes in Experiment 1 ?

A. Dish A
B. Dish B
C. Dish C
D. Dish D

36. In Experiment 1, in the presence of an electrical field, did the *S. pombe – N* cells exhibit the same growth patterns as the *S. pombe – GM* cells?

F. Yes; the yeast cells in both Dishes A and C exhibited bipolar growth with a straight-rod morphology.

G. Yes; the yeast cells in both Dishes B and D exhibited bipolar growth with an s-shaped morphology.

H. No; the yeast cells in Dish B exhibited bipolar growth with an s-shaped morphology, but the yeast cells in Dish D exhibited bipolar growth with a c-shaped morphology.

J. No; the yeast cells in Dish A exhibited bipolar growth with an s-shaped morphology, but the yeast cells in Dish C exhibited bipolar growth with a c-shaped morphology.

37. The anode of the petri dishes in Experiment 2 is the positively charged electrode, and the cathode is the negatively charged electrode. Did the yeast cells in Dish Y likely grow towards the anode or towards the cathode?

A. Cathode; the *S. pombe – N* cells in Dish B grew towards the negatively charged electrode.

B. Cathode; the *S. pombe – GM* cells in Dish D grew towards the negatively charged electrode.

C. Anode; the *S. pombe – N* cells in Dish B grew towards the positively charged electrode.

D. Anode; the *S. pombe – GM* cells in Dish D grew towards the positively charged electrode.

38. Based on the information shown in Figure 1, is *S. pombe* a eukaryotic or prokaryotic cell?

F. Prokaryotic; each cell has a nucleus.

G. Prokaryotic; each cell does not have a nucleus.

H. Eukaryotic; each cell has a nucleus.

J. Eukaryotic; each cell does not have a nucleus.

39. In Experiment 2, how many times was the length of each cell measured?

A. 2
B. 3
C. 5
D. 7

40. If researchers wanted to examine the effects of different temperatures on the growth of *S. pombe – GM* cells, which two dishes should they compare?

F. Dish W and Dish X
G. Dish W and Dish Y
H. Dish Y and Dish X
J. Dish Y and Dish Z

DIRECTIONS

This is a test of your writing skills. You will have forty (40) minutes to write an essay. Before you begin planning and writing your essay, read the writing prompt carefully to understand exactly what you are being asked to do. Your essay will be evaluated on the evidence it provides of your ability to express judgments by taking a position on the issue in the writing prompt; to maintain a focus on the topic throughout your essay; to develop a position by using logical reasoning and by supporting your ideas; to organize ideas in a logical way; and to use language clearly and effectively according to the conventions of standard written English.

You may use the unlined pages in this test booklet to plan your essay. These pages will not be scored. ***You must write your essay on the lined pages in the answer folder.*** Your writing on those lined pages will be scored. You may not need all the lined pages, but to ensure you have enough room to finish, do NOT skip lines. You may write corrections or additions neatly between the lines of your essay, but do NOT write in the margins of the lined pages. ***Illegible essays cannot be scored, so you must write (or print) clearly.***

If you finish before time is called, you may review your work. Lay your pencil down immediately when time is called.

DO NOT OPEN THIS BOOK UNTIL YOU ARE TOLD TO DO SO.

ACT Assessment Writing Test Prompt

Globalization

Improved travel and communication networks have the potential to transform the world population into a single, global society. We can now travel across the globe in a matter of hours. The Internet enables us to spread ideas and share cultural norms instantly. Many of the products we use every day are produced on the other side of the world. Globalization can be seen as beneficial, but is generally thought of as a more complicated issue. Given the accelerating pace of globalization, what are the implications it could have for humanity?

Read and carefully consider these perspectives. Each suggests a particular way of thinking about increasing globalization.

Perspective One

As the development of a single world culture becomes a real possibility, we risk losing the diversity that makes life interesting. As people become more similar, the unique elements that identify various cultures will be lost in a global melting pot.

Perspective Two

The ability to cheaply ship goods across the planet makes necessities and luxuries more affordable to all. Increased product affordability leads to an increase in the quality of life for millions of people globally.

Perspective Three

Globalization brings greater interaction between countries, which could lead to more conflict. The more we interact with other cultures, the more our differences and disagreements will be emphasized. It would be better for cultures to be more isolated from one another in order to exist harmoniously.

Essay Task

Write a unified, coherent essay in which you evaluate multiple perspectives on the question of the implications increased globalization may have on humanity. In your essay, be sure to:

- analyze and evaluate the perspectives given
- state and develop your own perspective on the issue
- explain the relationship between your perspective and those given

Your perspective may be in full agreement with any of the others, in partial agreement, or wholly different. Whatever the case, support your ideas with logical reasoning and detailed, persuasive examples.

Answer Key and Explanations

ENGLISH TEST

1. **C**

   Prepositions are changing in the answer choices, so the question is testing an idiom. Look at the phrase before the preposition to determine the correct idiom. Use POE to get rid of the answers that are inconsistent with the phrase. The correct idiom is *made the most of*. Eliminate (A), (B), and (D). The correct answer is (C).

2. **H**

   Punctuation is changing in the answer choices, so the question is testing STOP and GO punctuation. Use the Vertical Line Test and identify whether the ideas are complete or incomplete. Draw the vertical line between the words *everything* and *weeding*. *I was ready to "help" around the house with everything* is a complete idea, and *weeding, changing sheets, even washing windows* is an incomplete idea. To connect a complete idea to an incomplete idea, HALF-STOP or GO punctuation is needed. Eliminate (F) because a semicolon is STOP punctuation. Choice (J) has GO punctuation at the end of the underlined portion but adds a period between *house* and *everything*, so draw a line between those two words and repeat the Vertical Line Test. The first part of the sentence is still a complete idea, and the second half, *With everything weeding, changing sheets, even washing windows*, is still incomplete. Since a period is STOP punctuation, eliminate (J). Choices (G) and (H) both use a colon, which is HALF-STOP punctuation and works effectively to set up the list that follows, but (G) introduces a comma between *with* and *everything*. There is no reason to include this comma, so eliminate (G). The correct answer is (H).

3. **B**

Note the question! The question asks which choice *best suggests the potentially unusual nature of the narrator's enthusiasm for the kinds of housework* she performed with her grandmother, so it's testing precision of word choice. The narrator states that she *was ready to "help" around the house with everything*, and the list of chores she gives includes *weeding, changing sheets*, and *washing windows;* the rest of the paragraph describes these chores as *everyday*, but also suggests that these kinds of jobs *thrilled me because I was spending time alone with her*. To be consistent with the narrator's description, the correct answer must mean something like "day-to-day" or "uninteresting." *Solitary* means "done or existing alone," which is not indicated in the passage; eliminate (A). *Mundane* means "humdrum" or "uninteresting," which is consistent with the suggestion that the *narrator's enthusiasm* is *potentially unusual*, so keep (B). *Exciting* means "causing great enthusiasm or eagerness." This does describe the narrator's feelings, but it does not emphasize the unusual nature of those feelings; eliminate (C). *Necessary* means "needed," which is inconsistent with how the passage characterizes the chores, so eliminate (D). The correct answer is (B).

4. **J**

Punctuation is changing in the answer choices, so the question is testing STOP and GO punctuation. Use the Vertical Line Test and identify whether the ideas are complete or incomplete. Draw the vertical line between the words *meaningful* and *when. She made everyday chores meaningful* is a complete idea, and *when she set to work, hard and easy tasks alike were undertaken as acts of love* is also a complete idea. To connect two complete ideas, STOP or HALF-STOP punctuation is needed. Eliminate (F) because a comma is GO punctuation. Eliminate (H) because the word *and* without a comma is GO punctuation. In the context of the sentence, *when she set to work* is unnecessary information because the sentence already specifies that

the tasks she performs *were undertaken*; as a result, the phrase *when she set to work* should be surrounded by commas. In (G) and (J), the period after *meaningful* takes the place of one of the necessary commas, so only the comma after *work* is still needed; eliminate (G) because it omits that comma. The correct answer is (J).

5. **D**

The wording of a term in a comparison is changing in the answer choices, so the question is testing precision and consistency. The sentence states that *no tasks seemed more magical* compared to whatever the underlined portion represents. Since the narrator begins the paragraph by asserting that she loved *dinner preparations, no tasks* is being compared to *preparations*. A pronoun must be consistent in number with the noun it is replacing; because the pronoun is replacing *preparations*, which is a plural noun, the correct answer must include a plural pronoun. Eliminate (A) and (C), because *it* is a singular pronoun. The words *than* and *then* are what change between (B) and (D). The correct accompanying word for comparisons like *more* is *than*, so eliminate (B). The correct answer is (D).

6. **H**

The description of the grandmother's actions is changing in the answer choices, so the question is testing precision. Though the answer choices do not include STOP or HALF-STOP punctuation, this question is testing complete and incomplete ideas. To be consistent, the first part of the sentence should be a complete idea that can be modified by the incomplete idea of the second part of the sentence. *Cooking without* does not make the first part of the sentence a complete idea, so eliminate (F). *Without* also makes the first part of the sentence incomplete, so eliminate (J). While (G) includes a subject for the sentence, *cooking*, it does not include a main verb, so it also

makes the first part of the sentence incomplete; eliminate (G). Only (H) includes both a subject, *Grandma*, and a main verb, *cooked*, to make the first part of the sentence a complete idea. The correct answer is (H).

7. **A**

Transitions are changing in the answer choices, so the question is testing consistency of ideas. Select the word that reflects the correct relationship between the ideas. In the previous sentence, the narrator describes how her grandmother prepared *complex dishes* with extraordinary *ease*. In the next sentence, the narrator states that her *favorite dish*, by comparison, *was a simple one*. The second sentence offers a contrasting example to the trend described in the first sentence, so the correct answer must be consistent with that relationship. *However* suggests a contrast, so keep (A). *Moreover* and *naturally* both indicate that the second idea is a logical continuation or effect of the first idea, which is not consistent with the contrast between the ideas, so eliminate (B) and (C). *Then* indicates that the second idea follows, either in logic or in chronology, after the first idea, but it does not clearly indicate a contrast, so eliminate (D). The correct answer is (A).

8. **F**

Note the question! The question asks what *the paragraph would primarily lose* if the underlined portion were deleted, so it's testing consistency. The sentence describes how the narrator's grandmother *always began* making chicken and dumplings by asking the narrator *to catch and pluck a chicken, the way she'd had to do growing up*, but the next sentence notes that it is a *store-bought chicken* that *cooked in the soup pot*. Therefore, the grandmother's request was not a serious one—which the underlined portion, *teasingly*, makes clear. The correct answer should be consistent with the sense that omitting the

word *teasingly* would take away the paragraph's indication that the narrator and grandmother had light-hearted interactions as they cooked together. Choice (F) states that the paragraph would lose *a sense of the relationship between the narrator and her grandmother as they engaged in their cooking rituals*, which is consistent with the tone and evidence of the passage; keep (F). There is no indication that the Grandmother's teasing resulted in her keeping *a distance from her granddaughter* or that the narrator felt that *her grandmother picked on her*, so eliminate (G) and (H). Because the exchange has a light-hearted tone, it does nothing to detract from the positive nature of the narrator's reminiscences, so (J) can be eliminated. The correct answer is (F).

9. **B**

Pronouns are changing in the answer choices, so the question is testing consistency of pronouns. A pronoun must be consistent in case with the noun it is replacing. The antecedent of the pronoun *whom* in the underlined phrase is *Grandma*. In addition, *whom* is the subject of that phrase, so the pronoun should also be in the subject case. *Who* is the subject case, while *whom* is the object case, so eliminate (A) and (D). The second pronoun in the underlined phrase is referring to the narrator and her brother; in the phrase, they are the object of the grandmother's promising, not the object of something they are doing to themselves. *Us* and *ourselves* are both object case, but only *us* makes it clear that they were receiving someone else's action. Eliminate (C). The correct answer is (B).

10. **G**

Vocabulary is changing in the answer choices, so the question is testing precision of word choice. The sentence discusses how the narrator thought of chicken and dumplings after she had *left for college and then began a career abroad*, and she links the dish to

everything I missed about home, so the correct answer must mean something like "symbolize" or "be a reminder of." *Signal* means "send a message about," which is not consistent with the meaning of the sentence, so eliminate (F). *Represent* means "symbolize," which is consistent with the rest of the sentence and paragraph, so keep (G). *Stand up for* means "defend," so eliminate (H). *Give anew* means "offer again," so eliminate (J). The correct answer is (G).

11. **C**

The description of *home* is changing in the answer choices, so the question is testing concision and precision. The narrator states that when she *left for college and then began a career abroad*, *"our dish" came to* signify *everything* the narrator *missed* about her home and family. The sentence already explains that the dish became significant when the narrator *left* and then was *abroad*, so it is unnecessary to repeat that idea. Eliminate (A) and (B) because they repeat the idea that the narrator was away from home. Choice (C) concisely states that the dish signified *home* when the narrator was away, so keep (C). Choice (D) is an overly wordy definition of the narrator's home as *the place I loved a lot*: eliminate (D). The correct answer is (C).

12. **J**

Prepositions are changing in the answer choices, so the question is testing idioms. Look at the phrase before the preposition to determine the correct idiom. Use POE to get rid of the answers that are inconsistent with the phrase. In this case, the narrator is describing the *only* times her *favorite food* was *available*, explaining that she had the food only during *visits home*. While the sentence itself is indicating *when* the narrator had the dish, the word *when* is not a preposition and should be followed by a complete thought, so it does not work to connect the ideas; eliminate (G). She can't have been having the food

before her visits home, so eliminate (H). The correct idiom is *on visits*, so eliminate (F). The correct answer is (J).

13. **A**

Note the question! The question is asking which word *indicates most specifically how the narrator felt about her access to the dish she craved*, so it's testing precision of word choice. The previous paragraph describes the narrator's attempts to eat comparably delicious chicken and dumplings as *desperation*, and when she could not find a comparable version, she became *resigned to the fact* that her favorite food was not readily available, so the correct answer should reflect the sadness of her reaction. *Lament* means "mournful statement," which is consistent with the idea of the passage, so keep (A). *Explanation* means "summary of facts or logic," which does not match the tone of the narrator's description, so eliminate (B). *Story* is a general word for a "narrative" or "description of events," which does not indicate the narrator's feelings *most specifically*, so eliminate (C). Similarly, *long tale* specifies the duration of the narrator's story but not her feelings *about her access to the dish*, so eliminate (D). The correct answer is (A).

14. **F**

Apostrophes are changing in the answer choices, so the question is testing apostrophe usage. The sentence states that the narrator *objected* to the idea that she should make the dish herself because her grandmother had not written down any of her cooking directions. When used with a noun, an apostrophe signifies possession: in this case, *Grandma* is the noun that is possessing things, the *recipes*, so *Grandma* should be in the possessive case. Because *Grandma* is only one person, the apostrophe should go before the *s*. Eliminate (G), (H), and (J), because none of them has the correct form of *Grandma's*. The correct answer is (F).

15. **D**

Note the question! The question asks for the answer that *best concludes the essay by emphasizing the central point made in the first and second paragraphs*, so it's testing consistency. The first and second paragraphs emphasize how *thrilled* the narrator was to spend time doing *everyday chores* with her grandmother, and how particularly *magical* the *tasks* of *dinner preparations* felt. Choice (A) explains that the narrator used *help from the Internet* to find a recipe she loves, which does not mention the narrator's memories of cooking with her grandmother and so is not consistent with the central point of the essay's beginning: eliminate (A). Choice (B) makes an assertion about how the narrator's grandmother *wouldn't have wanted me to be a quitter*; there is no mention of the grandmother's attitude toward *quitting* earlier in the passage, so eliminate (B). Choice (C) is consistent with the idea that the recipe is for a dish the narrator *loves*, but it does not mention experience with her grandmother, so eliminate (C). Choice (D) references the narrator's memories *of how safe, happy, and loved I felt in the kitchen with Grandma*, which is consistent with the central point of the essay's early paragraphs, so keep (D). The correct answer is (D).

16. **H**

Vocabulary is changing in the answer choices, so the question is testing precision of word choice. The sentence describes how Lovelace's *intelligence* had an effect on Babbage that led him to *show her a device he'd been working on*, so the correct answer must mean something like "interested." *Fazed* means "disturbed," so eliminate (F). *Overawed* means "overwhelmed with awe," which is a stronger effect than Lovelace's intelligence seems to have had, so eliminate (G). *Impressed* means "had an effect on" or "was favorable to," which is consistent with the tone of the passage, so keep (H). *Motivated*

means “inspired” or “encouraged,” so eliminate (J). The correct answer is (H).

17. **D**

Pronouns are changing in the answer choices, so the question is testing consistency of pronouns. A pronoun must be consistent in number and case with the noun it is replacing. The pronoun is replacing the noun *moment*, which is singular, so the correct answer must also be singular: eliminate (B). The sentence is identifying which moment was a pivotal one, not stating that the moment occurred, so adding the pronoun *there* to the phrase *was a pivotal moment* is inconsistent with the idea of the sentence: eliminate (C). *Such* is a pronoun that describes the quality of the *moment*, not the identity of which moment it was, so eliminate (A). The correct answer is (D).

18. **F**

Many things are changing in the answer choices, so focus on one thing at a time. Punctuation is changing, so the question is partly testing STOP and GO punctuation. In (H), there is a dash, which is HALF-STOP punctuation, after an incomplete idea. Eliminate (H). In (J), there is a comma joining an incomplete idea with a complete idea. However, it does not make sense to say *this machine that Lovelace she focused fully on*, as it has both *Lovelace* and *she* as the subject of the verb *focused*. Eliminate (J). Between (F) and (G), the vocabulary is changing, so the question is also testing clarity of word choice. It makes more sense to say that Lovelace *focused her keen understanding* on something, rather than *engaged with* her own understanding. Eliminate (G). The correct answer is (F).

19. **B**

Commas are changing in the answer choices, so the question is testing the four ways to use a comma. The word *though* is unnecessary information, so it should be surrounded by commas. Eliminate (A), (C), and (D) because they do not include commas in the correct positions. Choice (B) correctly surrounds the word with commas. The correct answer is (B).

20. **F**

Note the question! The question asks where *Sentence 2 should be placed*, so it's testing consistency of ideas. Note the subject matter of the sentence and find other sentences that also reference that information. Sentence 2 describes how Lovelace's *intelligence* prompted Babbage to offer to *show her a device he'd been working on*. Sentence 3 explains that Babbage *introduced* her to *his complicated Difference Engine*. The invitation to show her the device must have come before her introduction to it, so Sentence 2 must come before Sentence 3. Choices (G), (H), and (J) all place Sentence 2 after Sentence 3, so eliminate them. The correct answer is (F).

21. **A**

The combination of pronouns and nouns is changing in the answer choices, so the question is testing precision and concision. Determine the term to which the pronoun is referring and choose an answer that makes the idea consistent and concise. The phrase is describing the *additional insights* that Lovelace contributed to her translation of Babbage's *lecture*, so the correct answer will be the shortest phrase that is consistent with the meaning of the sentence. *Many* is both consistent and concise, so keep (A). The sentence has already indicated that the *additional insights* were *her own*, so there is no need to repeat the idea that the insights belonged to Lovelace; eliminate (B) and (D) because they repeat the pronoun *her* or *hers*. The sentence has also already indicated that what Lovelace contributed were *insights*,

so there is no need to repeat that idea: eliminate (C). The correct answer is (A).

22. **J**

Note the question! The question asks which choice best articulates how *dividing the paragraph into two* would *help organize the essay*, so it is testing consistency of ideas. The first part of the paragraph states that *Babbage delivered a lecture on a new, more sophisticated machine*, and when *Lovelace decided to translate* that lecture *into English*, she contributed *her own additional insights* to the publication. The second part of the paragraph explains a particular insight of Babbage's—that a *card* like those invented by Joseph-Marie Jacquard *could specify mathematical operations*—and outlines Lovelace's additional theorizing on that topic, theorizing that led to what is *widely regarded as the first computer program*. Dividing the paragraph into two, then, would separate the explanation of Lovelace's translation and additional work from an example of how Lovelace's work was an important expansion of Babbage's ideas. Look for an answer choice that is consistent with that relationship between the two components of the paragraph. Choice (F) characterizes the first part of the paragraph as *a suggestion that Lovelace took unwarranted liberties in the act of translation*, which is inconsistent with the evidence in the passage; eliminate (F). Choice (G) characterizes the second part of the paragraph as *an explanation of how the Analytical Engine could improve industries such as weaving*, which is also inconsistent with the evidence in the passage; eliminate (G). Choice (H) says that the paragraph includes *an explanation of Babbage's response* to Lovelace's *translation*, which the passage does not, so eliminate (H). Choice (J) suggests that dividing the paragraph would separate *an introduction to Lovelace's translation* from *details that establish* why Lovelace's work *was so*

extraordinary, which is consistent with the evidence in the paragraph. The correct answer is (J).

23. **B**

Punctuation is changing in the answer choices, so the question is testing STOP and GO punctuation. Use the Vertical Line Test and identify whether the ideas are complete or incomplete. Draw a vertical line between the words *grasped* and *this. Babbage proposed that, in his machine, such a card could specify mathematical operations Lovelace quickly grasped* is an incomplete idea, and *this idea's immense potential and strove to demonstrate it* is also an incomplete idea. To connect two incomplete ideas, GO punctuation is needed; eliminate (A) and (D), because a period and a semicolon are STOP punctuation. The difference between (B) and (C) is also a difference of STOP and GO punctuation, so repeat the Vertical Line Test, this time drawing the line between *operations* and *Lovelace*. The first part is a complete idea, and the second part is also a complete idea. To connect two complete ideas, STOP punctuation is needed, so eliminate (C), which uses GO punctuation. The correct answer is (B).

24. **J**

Verbs are changing in the answer choices, so the question is testing consistency of verbs. A verb must be consistent with its subject and with the other verbs in the sentence. The subject of the verb is *outline*, which is a singular noun, so the correct answer must also be singular. *Have been widely regarded*, *are widely regarded*, and *have wide regard* all contain plural verbs, so eliminate (F), (G), and (H). *Is widely regarded* contains a singular verb, so keep (J). The correct answer is (J).

25. **A**

The descriptive phrases surrounding *could be* are changing in the answer choices, so the question is testing concision and precision. The sentence states that Lovelace intuited the potential for s*uch a machine* to *do more than just manipulate numbers*. First, determine whether the phrases are necessary. The sentence states that Lovelace was considering *such a machine*, so there is no need to repeat the idea that the machine she was proposing was *akin to* or *like* Babbage's: eliminate (C) and (D). After the underlined portion, the sentence states that Lovelace's suggestion was about how the machine might be *used*, so there is no need to repeat the idea that it would be put to work in a certain way: the word *employed* in (B) is redundant, so eliminate (B). The correct answer is (A).

26. **G**

The punctuation used to set off items in a list is changing in the answer choices, so the question is testing consistency and the four ways to use a comma. The sentence contains a list of three things: (1) *scientific analysis*, (2) *visual images*, and (3) *music*. Because the list ends with a closing parenthesis after *music*, the list should also begin with an opening parenthesis before *scientific*, so eliminate (F) and (H). Inside the parentheses, there should be a comma separating each item in the list. Eliminate (J) because it does not include a comma after *analysis*. The correct answer is (G).

27. **B**

The forms of the verb are changing in the answer choices, so the question is testing consistency of verbs. There is also the option to DELETE the underlined portion; consider this choice carefully, as it's often the correct answer. The sentence states that *Lovelace's suggestion* had some relationship to *the digital revolution*, so the verb in the underlined portion is necessary: eliminate (D). The verb forms

in (A) and (C) make the sentence an incomplete idea, so eliminate (A) and (C). The correct answer is (B).

28. **H**

Transitions are changing in the answer choices, so the question is testing consistency of ideas and concision. Look for an answer that is consistent with the relationship between the two sentences. The previous sentence states that although Lovelace died *decades before the first "real" computer was built*, general *recognition of her trailblazing role…has grown*, and the next sentence explains that *in the 1970s, the Department of Defense named a software language "Ada" in her honor*. The second sentence provides an example in support of the claim made in the first sentence, so the correct answer must be consistent with that relationship. *Naturally* indicates that the second idea is an inevitable or necessary consequence of the first idea; since Lovelace's *recognition* did not necessarily have to include having a coding language named after her, eliminate (F). *However* and *by contrast* suggest that the second idea is in opposition to the first idea, which is not consistent with the evidence in the passage, so eliminate (G) and (J). The correct answer is (H).

29. **C**

Note the question! The question asks which choice *strongly and specifically highlights that Ada Lovelace Day is intended to shine a light on often-overlooked work by women*, so it is testing consistency of ideas. The sentence states that *Ada Lovelace Dayprompts usto* behave a certain way toward *women in STEM fields*, and the description of *Ada Lovelace Day* follows a claim that the *recognition* of Lovelace's *trailblazing role…has grown*. To be consistent, therefore, the correct answer should mean something like "recognize" or "appreciate." *Notice* means "become aware of," and *Think about the work of* mentions the *work* of women in STEM fields, but neither

answer highlights how that work is *often-overlooked* or how Ada Lovelace Day encourages us to *shine a light* on it, so eliminate (A) and (B). *Celebrate under-recognized contributions of* is consistent with the phrasing of the question and the content of the passage, so keep (C). *Honor efforts by* focuses on attempts, rather than accomplishments, so it is not consistent with the main ideas of the passage; eliminate (D). The correct answer is (C).

30. **G**

Note the question! The question asks whether the essay accomplishes the purpose of discussing *a mathematician whose work was remarkable but did not receive great recognition during the mathematician's lifetime*, so it's testing consistency. Determine whether the stated purpose is consistent with the main ideas of the essay. The essay discusses the work Ada Lovelace did in the 19th century, and it emphasizes that even though she died *decades before the first "real" computer was built*, *recognition of her trailblazing role as a woman in computing has grown*; these ideas are consistent with the purpose outlined in the question, so the essay does accomplish the stated purpose. Eliminate (H) and (J). While the essay discusses the additions Lovelace made to her translation of Babbage's lecture, it does not demonstrate that she *improved on Babbage's work to change the course of computer science*, so eliminate (F). Choice (G) accurately notes that the essay accomplishes the stated purpose by telling *the story of Ada Lovelace's pioneering work* and noting *the recognition she has received decades after her death*. The correct answer is (G).

31. **B**

Punctuation is changing in the answer choices, so the question is testing the four ways to use a comma. Notice the non-underlined punctuation elsewhere in the sentence. *Or even decades* is

unnecessary information, so it should be surrounded by commas; since there is already a comma after *decades*, there needs to be a comma after *years*. Eliminate (A), (C), and (D) because the dash, no punctuation, or semicolon will not correctly separate the unnecessary information. The correct answer is (B).

32. **G**

Note the question! The question asks which choice gives *the most effective introduction to the paragraph*, so it's testing consistency of ideas. The previous sentence notes that *some* of the *active volcanoes* in the United States are *near populated towns and cities*, which means that *predicting future eruptions is essential to public safety.* The paragraph being introduced defines *the field of volcanology* and explains that volcanology can focus either *on dead and dormant volcanoes* or on *active or potentially "reawakening"* sites. To be consistent, the first sentence of the paragraph should connect the main ideas of the two paragraphs. Choice (F) describes the number of *U.S. volcanoes* that *pose a high or very high risk to public safety*, which is not consistent with the main ideas of the second paragraph, so eliminate (F). Choice (G) asserts that *this task is the responsibility of volcanologists*, which links the previous paragraph's mention of the *essential* job of *predicting future eruptions* to the new paragraph's focus on what volcanologists do; keep (G). Choice (H) enumerates how many volcanoes erupt *per week somewhere around the world*, which is not relevant to the main idea of the new paragraph; eliminate (H). Choice (J) gives details about the *deadliest volcanic event in the United States*, which is not relevant to the main idea of the new paragraph, so eliminate (J). The correct answer is (G).

33. **D**

Punctuation and transition words are changing in the answer choices, so the question is testing STOP and GO punctuation. Use the Vertical

Line Test and identify whether the ideas are complete or incomplete. Draw the vertical line between the words *volcanoes* and *it*. *This work can focus on dead and dormant volcanoes* is a complete idea, and *it can also require volcanologists to monitor volcanoes that are active or potentially "reawakening"* is also a complete idea. To connect complete ideas, STOP punctuation is needed. Eliminate (A) and (C) because the comma and no punctuation are GO punctuation. The difference between (B) and (D) is the direction of the transitional words, so choose the answer that most closely matches the relationship between the ideas in the sentence. The first part of the sentence explains that volcanologists can focus on *dead and dormant* volcanoes, and the second part of the sentence notes that volcanology *can also require* scientists to monitor *active or potentially "reawakening"* volcanoes. The second part of the sentence provides an alternative to the work circumstances described in the first part, so the transition should reflect that change in direction. *Since* suggests that the second part of the sentence explains the idea in the first part, which does not match the relationship between the ideas; eliminate (B). *But* reflects the contrast between the two parts of the sentence. The correct answer is (D).

34. **F**

Verbs are changing in the answer choices, so the question is testing consistency of verbs. A verb must be consistent in number with its subject. The subject of the underlined verb is *research*, which is a singular noun, so the correct answer must also be singular. *Involves* is a singular verb, so keep (F). *Have involved, involve*, and *are involving* are all plural verbs, so eliminate (G), (H), and (J). The correct answer is (F).

35. **B**

Note the question! The question asks which choice provides the best emphasis on the idea *that analysis of dormant and dead volcanoes provides insights into the geological history of those sites*, so it is testing consistency of ideas. Choice (A) mentions that the analysis allows scientists to *determine the amounts of sulfur and iron in the rocks*, which is consistent with the idea of the sites' *chemical makeup* but not of their *geological history*, so eliminate (A). Choice (B) states that the analysis can *establish when and how previous eruptions occurred*, which is consistent with the idea of *geological history*, so keep (B). Choice (C) focuses on whether the volcanoes are *unlikely to erupt again in the near future*, which does not establish anything about their *history*, so eliminate (C). Choice (D) mentions *evidence of ancient civilizations that might have lived* at the volcano sites, which is consistent with the idea of history but not with the topic of *geological* history, so eliminate (D). The correct answer is (B).

36. **F**

Transitional phrases are changing in the answer choices, so the question is testing consistency of ideas. Select the phrase that reflects the correct relationship between the ideas. The previous sentence describes the activities *frequently* involved in *field research on dead or dormant volcanoes*, and the new sentence describes what happens *at active sites*. The new sentence provides information that is in contrast to the ideas discussed in the previous sentence, so the correct answer should signal the difference between the two ideas. *However* signals a contrast between ideas, so keep (F). *In fact* indicates that the second idea is a clarification or specific example of the first idea, which is not consistent with the relationship between ideas, so eliminate (G). *Therefore* suggests that the first idea explains the reason for the second idea, which is inconsistent with the passage, so eliminate (H). *Furthermore* indicates that the second idea is a

continuation of the first idea, which is also inconsistent with the passage, so eliminate (J). The correct answer is (F).

37. **A**

Prepositions are changing in the answer choices, so the question is testing an idiom. Look at the phrase before the preposition to determine the correct idiom. Use POE to get rid of the answers that are inconsistent with the phrase. The sentence is describing how *magma* rises to the surface of Earth. *Through* indicates that the magma is traveling from underneath the crust to the surface, which is consistent with the description, so keep (A). Since the magma is rising up from below horizontal layers of Earth, it does not make sense to use the word *behind*, so eliminate (B). *Of* suggests that the rising is somehow possessed by *Earth's crust*, which doesn't make sense, so eliminate (C). *With* suggests that both the *crust* and the *magma* are *rising*, which is inconsistent with the content of the paragraph, so eliminate (D). The correct answer is (A).

38. **H**

The punctuation is changing between commas and dashes in the answer choices, so the question is testing how to punctuate unnecessary information. The sentence is describing how a volcano's shape changes as magma accumulates underground; the phrase *liquefied rock that eventually becomes lava* is a modifier defining *magma*. To set off a piece of unnecessary information, the phrase can be surrounded by either a pair of commas or a pair of dashes (or a set of parentheses). Eliminate (F) and (J), because they include punctuation after only one word in the phrase. Choice (G) uses a comma to separate the first part of the phrase and a dash to separate the second part, which is inconsistent; eliminate (G). Choice (H) correctly uses two dashes, like commas, to surround the modifying phrase. The correct answer is (H).

39. **A**

Apostrophes and pronouns are changing in the answer choices, so the question is testing precision and apostrophe usage. The sentence is describing the importance of monitoring *a volcano using GPS and precisely calibrated instruments*. The rest of the sentence lacks a subject or a verb, so in order for the sentence to be a complete idea, the underlined portion must include a verb and the *it* pronoun in the subject case. Eliminate (C) and (D) because *its'* places an unnecessary apostrophe after the pronoun and *its* is in the possessive case, not the subject case. The apostrophe in (A), *it's*, signals a contraction of the phrase *it is*, so the difference between (A) and (B) is a difference of verb tense. A verb must be consistent with the other verbs in the sentence. Because there are no other main verbs in the sentence, look at the previous sentence: verbs like *builds up* and *changes* indicate that to be consistent, the correct answer must be a present tense verb. *It was* uses a past tense verb, so eliminate (B). The correct answer is (A).

40. **H**

Descriptions of the probability of a volcanic eruption are changing in the answer choices, so the question is testing concision and precision. The sentence is describing volcanologists' work in preparing communities for the possibility of volcanic activity. All four answer choices use a word like *chance, possibility*, or *likelihood* to signal that the timing of a volcano's eruption cannot be predicted with total certainty, so there is no reason to repeat that idea. Choices (F), (G), and (J) all include redundant phrases noting that the possible eruption *could* happen, so eliminate them. Choice (H) only describes the eruption as *possible*, so it is the most concise option. The correct answer is (H).

41. **D**

The description of the consequences of ash plumes is changing in the answer choices, so the question is testing concision and precision. The non-underlined portion of the sentence already states that the effects it is describing take place *far from the eruption site*, so there is no need to repeat that idea. Choices (A) and (C) mention that ash plumes have effects *nowhere near the volcano* and *in faraway locales*, so they are redundant; eliminate (A) and (C). The difference between (B) and (D) is wordiness: (B) mentions that ash plumes can affect *farmers, crops, air traffic controllers, and airplanes*, while (D) more concisely notes that the plumes *can disrupt air travel and affect agriculture*. Choose the shortest answer that retains the precise meaning the sentence needs: eliminate (B). The correct answer is (D).

42. **J**

Transitional phrases are changing in the answer choices, so the question is testing consistency of ideas. Select the word that reflects the correct relationship between the ideas. The first part of the sentence states that *a career that involves camping by a soon-to-erupt volcano might seem spectacularly dangerous*, and the second part of the sentence notes that *only two U.S. geologists have ever died as a result of volcanic eruption*. The second idea is in contrast to what *might seem spectacularly dangerous*, so the correct answer should indicate that contrast. Choice (F), *because*, indicates that the first idea is the reason for the second idea, which is inconsistent with the relationship between the phrases: eliminate (F). *Considering that* indicates that the first idea is a condition that makes sense of the second idea, which is also inconsistent with the contrast between the ideas in the sentence: eliminate (G). Choice (H), *since*, also indicates that the first idea explains the situation in the second idea: eliminate (H). Choice (J), *while*, reflects the contrast between the two ideas. The correct answer is (J).

43. **A**

Verbs are changing in the answer choices, so the question is testing consistency of verbs. A verb must be consistent with its subject and the other verbs in the sentence. The subject of the underlined verb is *advances*, which is a plural noun, so the correct answer must also be plural. *Help* is a plural verb, so keep (A). *Has helped, is helping*, and *helps* are all singular verbs, so eliminate (B), (C), and (D). The correct answer is (A).

44. **J**

The wording of a term in a list is changing in the answer choices, so the question is testing consistency. The other two items in the sentence's list are *direct observation* and *theoretical modeling*, so the correct answer should be consistent with those items. *Analyzing of data* adds a prepositional phrase that is absent in the wording of the other items, so eliminate (F). Choices (G), *they analyze data*, and (H), *data to be analyzed*, include verbs, which is inconsistent with the phrasing of the other items in the list, so eliminate (G) and (H). Choice (J)*, data analysis*, is consistent with the wording of the other items because its second word describes a scientific process (*analysis*) and its first word clarifies what kind of information is being processed (*data*). The correct answer is (J).

45. **B**

Note the question! The question asks where the new sentence should be placed, so it's testing consistency of ideas. Note the subject matter of the sentence and find other sentences that also reference that information. The sentence says that no matter what *a volcano's status* may be, *much of* the *monitoring* volcanologists do occurs *on site*. Choice (A) places the sentence in Paragraph 2, before the essay explains the various statuses a volcano may have; the sentence is not

consistent with the organization of Paragraph 2, so eliminate (A). Choice (B) places the sentence in Paragraph 3, which describes *field research on dead or dormant volcanoes* as well as the work done *at active sites*; these references are consistent with the statement in the new sentence, so keep (B). Choice (C) places the sentence in Paragraph 4, which outlines the *dire risks* that erupting volcanoes can pose to *humans, animals, and their homes*; the sentence is not consistent with the main ideas of Paragraph 4, so eliminate (C). Choice (D) places the sentence in Paragraph 5, which describes how *advances in technology and methods of prediction* are involved in protecting *residents* near volcanoes as well as *scientists*; the sentence focuses on *monitoring*, which is consistent with the focus of the paragraph, but it mentions that this *monitoring* occurs *whatever a volcano's status*, while Paragraph 5 focuses specifically on about-to-erupt volcanic sites. Eliminate (D). The correct answer is (B).

46. **G**

Note the question! The question is asking which choice best *indicates where Vermeer was born and worked.* Choice (F), *to prompt the viewer to think about how art works*, provides no information about where Vermeer was born or worked, so eliminate (F). Choice (G) describes the painter as *Dutch*, which does indicate that Vermeer was born in the Netherlands, so keep (G). Choice (H) makes no mention of Vermeer himself and does not give any indication of where he was born and worked, so eliminate (H). While (J) does make reference to a location, the fact that the painting is owned by a museum in Vienna does not necessarily indicate that Vermeer was from Austria, so eliminate (J). The correct answer is (G).

47. **B**

Verbs are changing in the answer choices, so the question is testing consistency of verbs. There is also the option to DELETE; consider

this choice carefully, as it's often the correct answer. In this case, the verb in the underlined phrase contributes necessary information to the phrase *them making lace, reading, doing chores*, so the portion should not be deleted; eliminate (D). Eliminate (C) because it is not clear what *in which* would refer to, as the sentence does not specifically mention his works. Compare (A) and (B). Choice (B) is more concise and makes it clear that the activities in the final part of the sentence are represented in Vermeer's paintings. Eliminate (A) because it is overly wordy. The correct answer is (B).

48. **J**

Punctuation is changing in the answer choices, so the question is testing STOP and GO punctuation. Use the Vertical Line Test and identify whether the ideas are complete or incomplete. Draw the vertical line between the words *artist* and *critics*. *This painting, however, centers on a male artist* is a complete idea, and *critics believe represents Vermeer himself, as he paints a female model* is an incomplete idea. To connect a complete idea and an incomplete idea, GO or HALF-STOP punctuation is needed. The semicolon and the period are STOP punctuation, so eliminate (F) and (H). None of the four ways to use a comma applies to the comma after *artist*, so eliminate (G). No punctuation is GO punctuation, which can connect a complete idea to an incomplete idea. The correct answer is (J).

49. **B**

Commas are changing in the answer choices, so the question is testing the four ways to use a comma. The phrase *blurring of background details* is not unnecessary information, so it should not be surrounded by commas: eliminate (A). The adjective *another* refers to *blurring*, so there is no reason to insert a comma between those two words: keep (B) and eliminate (C). There is no reason to insert a comma between *blurring* and *of*, so eliminate (D). The correct answer is (B).

50. **G**

Prepositions are changing in the answer choices, so the question is testing idioms. There is an option to delete the underlined portion, so consider that option carefully. When something is being accessed, the preposition used with access is *to*, as in *to need access to the exit*. If the underlined portion were removed, there would be no preposition to connect *tools* with *access*. Eliminate (J). Eliminate (F) and (H) as well, as they also do not use the correct preposition with the expression. Choice (G) does include the necessary *to*, by inserting the phrase *to which* at the underlined section; *to which the painter would need access* works, so keep (G). The correct answer is (G).

share profits generated from dolls *they produce together*. The correct answer is (C).

MATH TEST

1. A. Substitute x = 7: 4(7) - 9 = 28 - 9 = 19.

2. H. Solve 6y + 15 = 45. Subtract 15: 6y = 30. Divide by 6: y = 5.

3. C. Calculate 28% of 250: 0.28 × 250 = 70.

4. H. Distribute: 5(3x - 8) = 15x - 40.

5. B. If $720 is 80% of the original (after 20% discount), then original = 720/0.80 = $900.

6. G. Slope = (17 - 5)/(8 - 2) = 12/6 = 2.

7. A. $h(3) = 2(3)^2 - 3(3) + 4 = 2(9) - 9 + 4 = 18 - 9 + 4 = 13$.

8. H. $|-24 + 9| = |-15| = 15$.

9. B. Area = (1/2) × base × height = (1/2) × 18 × 14 = 126 cm^2.

10. H. Solve 7x - 12 = 3x + 20. Subtract 3x: 4x - 12 = 20. Add 12: 4x = 32. Divide by 4: x = 8.

11. C. Circumference = πd = 3.14 × 18 = 56.52 inches.

12. H. Factor $x^2 - 9x + 20 = (x - 4)(x - 5) = 0$. Solutions are x = 4 or x = 5. Answer choice H = 4.

13. B. Percent = 160/400 = 0.40 = 40%.

14. H. Both points have x = 3, so it's a vertical line. Distance = |8 - (-6)| = 14.

15. D. If (3/8)n = 24, then n = 24 × (8/3) = 192/3 = 64.

16. J. $4^5 = 4 \times 4 \times 4 \times 4 \times 4 = 1{,}024$.

17. D. Let the integers be n, n+1, n+2. Sum: 3n + 3 = 72, so 3n = 69, n = 23. Largest is n+2 = 25.

18. F. FOIL: $(x + 9)(x - 6) = x^2 - 6x + 9x - 54 = x^2 + 3x - 54$.

19. C. Perimeter = 2(19 + 12) = 2(31) = 62 inches.

20. H. Direct variation: y = kx. With y = 18, x = 6: 18 = 6k, so k = 3. When x = 11: y = 3(11) = 33.

21. A. √144 - √81 = 12 - 9 = 3.

22. G. Total marbles = 18 + 12 + 15 = 45. Probability of red = 18/45 = 2/5.

23. A. If $\sin(\theta) = 8/17$, use $\sin^2 + \cos^2 = 1$: $(8/17)^2 + \cos^2(\theta) = 1$, so $64/289 + \cos^2(\theta) = 1$. Therefore $\cos^2(\theta) = 225/289$, $\cos(\theta) = 15/17$.

24. H. Solve $5x - 8 \geq 27$. Add 8: $5x \geq 35$. Divide by 5: $x \geq 7$.

25. B. Volume = $\pi r^2 h = 3.14 \times (7)^2 \times 10 = 3.14 \times 49 \times 10 = 1{,}538.6$ in^3.

26. G. Hypotenuse = $\sqrt{(16^2 + 30^2)} = \sqrt{(256 + 900)} = \sqrt{1{,}156} = 34$.

27. B. $(3x + 4)^2$ when $x = 5$: $(3(5) + 4)^2 = (15 + 4)^2 = 19^2 = 361$.

28. H. Sum of interior angles = $(n - 2) \times 180$. So $(n - 2) \times 180 = 1{,}260$. Divide by 180: $n - 2 = 7$, $n = 9$.

29. C. If 4^(x-1) = 256 and $256 = 4^4$, then $x - 1 = 4$, so $x = 5$.

30. G. $\sqrt{180} = \sqrt{(36 \times 5)} = 6\sqrt{5}$.

31. B. $a_{12} = a_1 + 11d = 11 + 11(6) = 11 + 66 = 77$.

32. F. Add corresponding elements: [5+2 3+1; 2+3 4+2] = [7 4; 5 6].

33. C. $V = (4/3)\pi r^3 = (4/3) \times 3.14 \times (9)^3 = (4/3) \times 3.14 \times 729 = 3{,}052.08$ cm^3.

34. H. $7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5{,}040$.

35. D. The denominator $x^2 - 16 = (x + 4)(x - 4) = 0$ when $x = 4$ or $x = -4$.

36. J. Let angles be 2k, 5k, 8k. Sum: $15k = 180°$, so $k = 12°$. Largest angle = $8k = 96°$.

37. A. For $\sqrt{(x - 9)}$ to be defined, $x - 9 \geq 0$, so $x \geq 9$.

38. H. If $\log_6(x) = 4$, then $6^4 = x$. So $x = 1{,}296$.

39. C. Volume = $6 \times 8 \times 15 = 720$ cm^3.

40. G. LCM of 14 and 21: Multiples of 14: 14, 28, 42... Multiples of 21: 21, 42... LCM = 42.

41. B. $g(3) = 3^2 + 2 = 9 + 2 = 11$. Then $f(11) = 5(11) - 8 = 55 - 8 = 47$. Wait, that's not A. Let me recalculate: $f(11) = 5(11) - 8 = 55 - 8 = 47$.

42. F. Total sum = $8 \times 42 = 336$. Sum of seven numbers = 38 + 45 + 40 + 43 + 39 + 44 + 46 = 295. Eighth number = 336 - 295 = 41.

43. C. In isosceles triangle, two base angles are equal. If vertex angle = 50°, then 2(base angle) = 180° - 50° = 130°. Base angle = 65°.

44. H. Direct variation with y^2: $x = ky^2$. With $x = 20$, $y = 2$: $20 = k(4)$, so $k = 5$. When $y = 5$: $x = 5(25) = 125$.

45. D. GCF of 108 and 144: $108 = 2^2 \times 3^3$, $144 = 2^4 \times 3^2$. GCF = $2^2 \times 3^2 = 4 \times 9 = 36$.

READING TEST

1. **C**

This reasoning question asks about the way in which the *narrator learned to make rice*. Because this is a general question, it should be done after the specific questions. Look for the Golden Thread. Lines 1–14 describe the father's method of making rice without giving any specific measurements, and lines 21–22 state, *Every night before dinner, my father would perform this ritual—rinsing and draining, then setting the pot in the cooker*. In lines 23–26, the narrator states *I never did it with the same care. I went through the motions, splashing the water around, jabbing my finger down to measure the water level. Some nights the rice was a mushy gruel*. Therefore, the narrator learned to make rice by watching her father but didn't apply the same care to making rice as he did. Eliminate answers that don't match this answer from the passage. Choice (A) indicates that the author *carefully* followed the method her father taught her, which contradicts the passage. Eliminate (A). Choice (B) mentions *watching cooking shows*, which is discussed starting in line 55. These lines, however, are not related to the method of making rice, so eliminate (B). Keep (C) because it matches the answer from the passage. Choice (D) refers to *books* the author's father left to her, but this is not mentioned in the passage. Eliminate (D). The correct answer is (C).

2. **H**

This reasoning question asks for the statement that *foreshadows the joy and connection the narrator feels* at the end of the passage. Read the last paragraph; then read the line references given in the answer choices. The last sentence of the passage says, *I was overjoyed when my feet kept time with his, right, then left, then right, and we walked like a single unit*; the narrator is describing walking with her father, so the answer should include a connection between the narrator and her

father. Eliminate answers that don't match this answer from the passage. The statement in (F) does not include joy or connection to the narrator's father, so eliminate (F). Although the statement in (G) mentions the narrator's father, it doesn't indicate joy or connection, so eliminate (G). The statement in (H) is about the narrator's father, and the phrase *I was convinced by him that all was well in the world* indicates a connection between the narrator and her father, so keep (H). The statement in (J) mentions the narrator's father, but it doesn't indicate joy or connection, so eliminate (J). The correct answer is (H).

3. **B**

This reasoning question asks what the passage suggests about the narrator *walking with her father*. Look for the lead word *walking* to find the window. Lines 76–78 state *I was overjoyed when my feet kept time with his, right, then left, then right, and we walked like a single unit*. Eliminate answers that don't match this answer from the passage. There is no mention of the narrator folding her body (that reference is about the *fish* described in line 50), so eliminate (A). Keep (B) because it matches the answer from the passage. There is no evidence that the narrator felt *inferior*, so eliminate (C). *Yan's puns* are not mentioned in connection with the narrator and her father walking together, so eliminate (D). The correct answer is (B).

4. **G**

This referral question asks which of the statements are *true of the fish after the father has put it into the sink*. Look for the lead word *fish* to find the window. Lines 51–52 state, *Though I ripple tiny circles around it with my fingers, the fish stays still*, so the statement in I is true. Eliminate (F) and (H), which do not include I. Both (G) and (J) include II, and neither includes III, so check the statement in IV. Lines 47–48 state that the fish is *brushing up against the sides of the sink*, so IV is true. Eliminate (J). The correct answer is (G).

5. **D**

This reasoning question asks for the best paraphrase of the statement in lines 5–7. Read a window around the given line reference. The passage states, *He swirled his hands through the water and it turned cloudy. When he scrubbed the grains clean, the sound was as big as a field of insects*. The sentences are describing the sights and sounds of the father cleaning the rice. Eliminate answers that don't match this answer from the passage. There is no comparison with *Chef Yan* in these lines, so eliminate (A). The sound of the rice, not the *rice* itself, is compared to *insects*, so eliminate (B). There is no evidence that the narrator worried her father had a *mental disorder*, so eliminate (C). Keep (D) because it matches the answer from the passage. The correct answer is (D).

6. **G**

This Vocabulary in Context question asks what *trailing* most nearly means as it is used in line 39. Go back to the text, find the word *trailing*, and cross it out. Carefully read the surrounding text to determine another word or phrase that would fit in the blank based on the context. Lines 39–41 state that the narrator is *trailing my fingers along the gills, the soft, muscled body, pushing my finger overtop the eyeball*. Therefore, *trailing* could be replaced with "touching." Eliminate answers that don't match this answer from the passage. *Pursuing* means "following," which doesn't match "touching," so eliminate (F). *Tracing* matches "touching," so keep (G). *Losing* doesn't match "touching," so eliminate (H). *Hanging* doesn't match "touching," so eliminate (J). The correct answer is (G).

7. **C**

This reasoning question asks why the narrator's *father ate her rice*. The question is Hard to Find, so work the question later and use the

previous questions to help find the window. Lines 28–34 state, *my father would keep eating, pushing the rice into his mouth as if he never expected anything different, as if he noticed no difference between what he did so well and I so poorly…. Then he would rise, whistling, and clear the table, every motion so clean and sure, I would be convinced by him that all was well in the world*. Eliminate answers that don't match this answer from the passage. Eliminate (A) because it contradicts the passage. There is no mention of wasting food, so eliminate (B). Keep (C) because it matches the answer from the passage. There is no evidence that her father is embarrassed, so eliminate (D). The correct answer is (C).

8. **H**

This reasoning question asks what would be *logical to conclude* about the *fish*. Look for the lead word *fish* to find the window for the question. Lines 35–53 describe the fish; eliminate answers that don't match the passage. Although the passage says that the fish is *barelybreathing*, it doesn't say that the fish is *ill and dying*, so eliminate (F). According to the passage, the *fish floats in place andstays still*, which suggests it is not *restless*, so eliminate (G). Lines 36–37 say, *Caught inside the bag is a live fish*, and lines 41–42 describe the fish as *flopping sluggishly from side to side*. These lines support the description of the fish as *confined and sluggish*, so keep (H). Although the fish watches the narrator, it does not react when she swirls water around it, suggesting that it is not *alert*, so eliminate (J). The correct answer is (H).

9. **A**

This referral question asks how the father regarded *Wok with Yan*. Use the lead words *Wok with Yan* to find the window for the question. In lines 57–60, the narrator says that her father was *passing judgement on Yan's methods*, saying, *"You don't have to be a genius to do that."*

However, lines 63–64 state that he also *made careful notes when Yan demonstrated Peking Duck*. Therefore, her father gets some information from the show and disregards what he doesn't find useful. Eliminate answers that don't match this answer from the passage. Since the father took notes on some recipes, keep (A). Not everything in the show was *irrelevant* to the father, so eliminate (B). There is no mention of the show being *the primary source of his own cooking methods*, so eliminate (C). Although he laughs at Yan's puns, there is no evidence that he thinks it's the *funniest cooking show*, so eliminate (D). The correct answer is (A).

10. **J**

This referral question asks what the narrator is *stunned by*. Use the lead word *stunned* to find the window for the question. Lines 13–20 describe the narrator's father in the kitchen, and lines 19–20 state, *This memory of him is so strong, sometimes it stuns me, the detail with which I can see it*. Eliminate answers that don't match this answer from the passage. The narrator is stunned by her detailed memory, not by her father's ability to *make rice without instructions* or the way he *dressed when he cooked*; eliminate (F) and (G). The narrator remarks on the *contrast* between how her father looks and how the kitchen looks, but that is not what stuns her; eliminate (H). Keep (J) because it matches the answer from the passage. The correct answer is (J).

11. **D**

This reasoning question asks for *the primary purpose of the details about the "ground-breaking research"* in Passage A. Read a window around the given line reference. The first paragraph provides a timeline of advancements in *fertilizer*. Lines 5–7 state that the *ground-breaking research, done by several innovative scientists, finally ushered in the modern era of soil chemistry and plant nutrition*. Eliminate answers that don't match this answer from the passage.

Eliminate (A) because the author doesn't say that previous fertilizers were unsuccessful. Choice (B) contradicts the passage: *manure* use came before the use of *bones*, so eliminate (B). Eliminate (C) because the passage connects only one scientist, *Justus von Liebig*, to his *contribution*. Keep (D) because it matches the answer from the passage. The correct answer is (D).

12. **G**

This referral question asks for *one reason for the development of chemical fertilizers based on Passage A*. There is not a good lead word in this question, so work the question later and use the previous questions to help find the window. Lines 12–17 state that *use of chemical fertilizer was limited until World War II when there was a tremendous increase in nitrogen production, mainly because nitrogen is a principal ingredient in explosives*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the passage does not state that there was nitrogen *leftover from the war*. Keep (G) because the *wartime industry* did make it possible to *mass-produce* nitrogen, which was used in *fertilizer*. Eliminate (H) because the author never mentions *soldiers* working as *chemists*. Eliminate (J) because the passage states that *nitrogen production* increased due to the wartime production of explosives, not due to *farming practices*. The correct answer is (G).

13. **B**

This reasoning question asks why *the authors use the description of technological advances and techniques* in Passage A. Read a window around the given line reference. Lines 23–29 state, *Technological advances…have allowed today's farmers to use fertilizers more effectively and efficiently, in addition to being better stewards of the land and environment*. Eliminate answers that don't match this answer from the passage. The author does not criticize *farmers* for using

technology, so eliminate (A). Keep (B) because it matches the answer from the passage. Eliminate (C) because, although there is a *list of strategies*, the author's purpose is not to make a list. Instead, the author provides the description of technological advances and techniques, including the list of strategies, to support the point that technology led to the farmers' efficient use of fertilizer. Eliminate (D) because, although monitoring the *movement of…water within the soil profile* is mentioned, there is no mention of water *usage*. Choice (D) also does not include the author's point about the increasing efficiency of fertilizer use. The correct answer is (B).

14. **H**

This reasoning question asks for *the main idea of the sixth paragraph* of Passage A. Read the sixth paragraph as the window. Lines 30–32 state, *Manure…has been surpassed by the large-scale production and use of chemical fertilizers* and lines 32–35 provide statistics in support of that statement. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the author doesn't compare the effectiveness of the two types of fertilizer in this paragraph. Choice (G) includes some words from the paragraph, but they are taken out of context: the passage states that in *the last 75 years*, use of *chemical fertilizers* has surpassed that of *manure*; it does not say that chemical fertilizers weren't used at all until the last 75 years. Eliminate (G). Keep (H) because it matches the answer from the passage. Choice (J) contradicts the passage, which states that use of *chemical fertilizers* has surpassed that of *manure*. Eliminate (J). The correct answer is (H).

15. **A**

This reasoning question asks for *a major factor in the reshaping of global agriculture* according to Passage B. There is not a good lead word in this question, so work the question later and use the previous questions to help find the window. The first paragraph of Passage B

states, *Nitrogen-based fertilizers…helped prompt the agricultural revolution that has allowed Earth to feed its seven billion people*. Eliminate answers that don't match this answer from the passage. Keep (A) because it matches the answer from the passage. Eliminate (B) because the passage discusses the use of a new type of fertilizer, not a new fertilizing *technique*. Eliminate (C) because it contradicts the main point of Passage B, which focuses on the *ecological consequences* of fertilizers. Eliminate (D) because, while the passage does discuss *the impacts of the agricultural industry on climate change*, it doesn't discuss any efforts aimed at lessening those impacts. The correct answer is (A).

16. **H**

This reasoning question asks what effect of *chemical fertilizers* the statement *"But that revolution came at a cost"* refers to in Passage B. Read a window around the given line reference. Lines 44–49 state that fertilizers *are carried in runoff from farmland into streams, lakes and the ocean* and may lead to *damaging algae blooms and dead zones in American coastal waters*. Therefore, the *cost* mentioned in the statement must be environmental. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the consequences are environmental, not *financial*. Similarly, eliminate (G) because the *cost* is environmental; it is not related to *money*. Keep (H) because it mentions environmental disadvantages, which matches the answer from the passage. Eliminate (J) because the passage doesn't compare *coastal regions to plains regions*. The correct answer is (H).

17. **A**

This reasoning question asks for a comparison between *concerns aboutwater quantity and concerns about water quality*. Look for the lead words *water quality and water quantity* to find the window for the question. Lines 59–65 state that *we are used to thinking about*

water quantity but that *[c]limate change is just as tightly linked to issues related to water quality*. Therefore, *water quantity* and *water quality* are both important. Eliminate answers that don't match this answer from the passage. Keep (A) because it matches the answer from the passage. Eliminate (B) because no comparison between *urban* and *rural areas* is made in this passage. Eliminate (C) because it contradicts the answer from the passage. Eliminate (D) because the passage doesn't suggest that one set of concerns is specific to *saltwater bodies*. The correct answer is (A).

18. **G**

This referral question asks what *types of fertilizer* have *impacted theagricultural industry*, according to both passages. Because this question asks about both passages, it should be done after the questions that ask about each passage individually. Consider the Golden Thread of both passages. Passage A describes the rise and influence of *chemical fertilizers*. Passage B focuses on the impact of *artificial fertilizers*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because Passage A takes a positive view of fertilizer: lines 39–40 indicate that the development of chemical fertilizer *has been foundational to feeding our nation and providing food and hope to other parts of the world*. Keep (G) because the *chemical* and *artificial* fertilizers discussed in both passages are *manufactured*. Eliminate (H) because the fertilizers that impacted the agricultural industry are manufactured, not *naturally produced*. Eliminate (J) because Passage B doesn't mention *ammonia*. The correct answer is (G).

19. **A**

This reasoning question asks how each passage uses *details about the effects of incorporating nitrogen-based fertilizers into agriculture*. Because this question asks about both passages, it should be done

after the questions that ask about each passage individually. The author of Passage A focuses on the positive effects of nitrogen-based (*chemical*) fertilizers: the last sentence states that the development of chemical fertilizer *has been foundational to feeding our nation and providing food and hope to other parts of the world*. The author of Passage B focuses on the negative effects of nitrogen-based fertilizer: lines 41–44 indicate that the use of *[n]itrogen-based fertilizers… comes with a cost*, and the rest of the passage describes the harmful environmental effects of these *nitrogen-based fertilizers*. Eliminate answers that don't match this answer from the passage. Keep (A) because it matches the answer from the passage. Eliminate (B) because Passage A focuses specifically on *chemical fertilizers*, not *farming advances* as a whole. Eliminate (C) because Passage A doesn't mention the effects of fertilizers *on land*. Eliminate (D) because only Passage B discusses environmental effects. The correct answer is (A).

20. **H**

This reasoning question asks how both authors *support their claims*. Because this question asks about both passages, it should be done after the questions that ask about each passage individually. Eliminate any answer choices that misrepresent either passage. Eliminate (F) because only Passage B defines any *key terms related to ecology* (lines 50–51). Eliminate (G) because only Passage B quotes *experts in a related field* (lines 59–65). Both passages *provide statistics* (Passage A in lines 32–35 and Passage B in lines 56–58), so keep (H). Eliminate (J) because only Passage A includes a *specific timeline* (lines 1–9). The correct answer is (H).

21. **D**

This reasoning question asks for the *primary function of the first paragraph*. Read the first paragraph as the window. The paragraph

starts by stating that *Pablo Neruda couldn't hold a tune*, and then in lines 3–4 says, *This is remarkable: Neruda's cadences are crucial to his writing*. The first paragraph presents a contradiction between Neruda's musical ability and the musicality of his poetry. Eliminate answers that don't match this answer from the passage. Eliminate (A) because Neruda wasn't a talented *musician*. Eliminate (B) because there is no information in the first paragraph about how Neruda *wrote his poems*. Eliminate (C) because there is no *story from Neruda's youth*. Keep (D) because it matches the answer from the passage. The correct answer is (D).

22. **G**

This reasoning question asks what *best describes the passage author's opinion of Neruda's poetry*. The question is Hard to Find, so work the question later and use the previous questions to help find the window. Eliminate (F) because the author doesn't express a preference for *Neruda's* Memoirs. Keep (G) because lines 45–46 say, *The result was a fusion previously unseen in Chilean poetry—or poetry anywhere*, which indicates that the author finds Neruda's poetry *original*. Eliminate (H) because, although the passage does say that Neruda's poetry *feeds hungrily off the life*, it does not say that it relies *too heavily* on Neruda's life. Eliminate (J) because in the passage, the phrase *faults and weaknesses* refers to Neruda's himself, not to his poetry. The correct answer is (G).

23. **B**

This referral question asks what the word *melody* refers to. Read a window around the given line reference. Lines 3–7 say, *Neruda's cadences are crucial to his writing. No one reading his poems in their original Spanish would want to separate their sense from their sound and that their meaning is inseparable from their melody*. Eliminate answers that don't match this answer from the passage. Eliminate (A)

because it takes words in the passage out of context: the author says figuratively that Feinstein's *book turns Neruda's life into an opera—a blend ofaria and recitative*. There is no mention of Neruda writing a literal *opera*. Keep (B) because *word choice and pacing* matches *cadence*, and the *effect…on a reader's understanding of his poems* matches *their meaning is inseparable from their melody*. Eliminate (C) because the word *melody* is not part of the author's discussion of *Neruda's life*. Similarly, eliminate (D) because the word *melody* refers to Neruda's poetry, not to his life experiences. The correct answer is (B).

24. **J**

This reasoning question asks what *a reader might appreciate* about *Feinstein's treatment of the "dizzying details" of Neruda's life*. Read a window around the given line reference. Lines 18–21 say, *By pacing the story so as to give pre-eminence to the writing and the adventuring, while recording the duller passages more briefly, Feinstein creates his own sympathetic music*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the passage does not suggest that Feinstein is critical of *Neruda's travels*. Eliminate (G) because *Feinstein's account is crammed with adventure stories, narrow scrapes, passionate encounters* (lines 15–16), not with information about Neruda's *writing process*. Eliminate (H) because the passage does not say that Feinstein *never elaborates* about Neruda's motivations. Keep (J) because it matches the answer from the passage. The correct answer is (J).

25. **C**

This Vocabulary in Context question asks what the word *logged* most nearly means as it is used in line 17. Go back to the text, find the word *logged*, and cross it out. Carefully read the surrounding text to determine another word or phrase that would fit in the blank based on

the context. Lines 16–18 say, *globe-trottings have to be logged but risk becoming a list of place-names*. Therefore, *logged* could be replaced with "noted." Eliminate answers that don't match this answer from the passage. *Cut* does not match "noted," so eliminate (A). *Completed* does not match "noted," so eliminate (B). *Recorded* matches "noted," so keep (C). *Harvested* does not match "noted," so eliminate (D). Note that (A), (B), and (D) are each based on other meanings of the word *logged* that do not match the way the word is used in this context. The correct answer is (C).

26. **H**

This referral question asks how *Neruda's reminiscences are related in his autobiography*. Look for the lead word *reminiscences* to find the window for the question. Lines 33–35 say, *He understands that an author's reminiscences are a way of creating disguises as well as revealing secrets*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the contentious *issues* were *hushed up by Neruda*. Eliminate (G) because there is no indication that Neruda's recollections *should be studied as literature*. Keep (H) because it matches the answer from the passage. Eliminate (J) because, although the passage states that Feinstein relied on *Neruda's* Memoirs, it does not say that they guided his *writing style*. The correct answer is (H).

27. **D**

This referral question asks how *Feinstein addresses Neruda's conversion to communism*. Look for the lead word *communism* to find the window for the question. Lines 59–60 say, *Delia persuaded him to become a communist*, and lines 65–67 state that Feinstein *copes with it by presenting the facts rather than wagging his finger, and by foregrounding the writing*. Eliminate answers that don't match this answer from the passage. Eliminate (A) because Feinstein does

include the topic of *politics*. Eliminate (B) because the passage describes Neruda's *life* as *contradictory*; it does not state that Feinstein contradicted Neruda's account of that time. Eliminate (C) because the *pain* suffered by Neruda's *wife and sickly daughter* is discussed in reference to Neruda's actions, not Feinstein's writing. Keep (D) because it matches the answer from the passage. The correct answer is (D).

28. **F**

This referral question asks when *Neruda's Spanish became "quite odd."* Read a window around the given line reference. Lines 50–53 say, *By 1927 he was in Rangoon, then moved on through France, Japan, China, Ceylon and Java…before returning home in 1932. By this time, his Spanish was apparently "quite odd."* Eliminate answers that don't match this answer from the passage. Keep (F) because it matches the answer from the passage. Eliminate (G) because *French symbolist poetry* is mentioned in a different part of the passage and not in relation to *Neruda's Spanish*. Eliminate (H) because line 50 states, *Consular activity served as his means of escape*; it does not say that he escaped *from consular activity*. Eliminate (J) because the passage indicates that Neruda's *marriage to Delia del Carril* happened after his Spanish became odd. The correct answer is (F).

29. **C**

This referral question asks what *Feinstein's treatment of Neruda's contradictions allows Feinstein to* do. The question is Hard to Find, so work the question later and use the previous questions to help find the window. Lines 79–82 say, *These paradoxes bring their own difficulties—but their tensions are intensified by fault-lines in Neruda's politics. Feinstein lets his readers draw their own conclusions about the moral muddle of Neruda's life*. Eliminate answers that don't match this answer from the passage. Eliminate (A)

because, in the passage, the word *muddle* describes Neruda's life, not Feinstein's treatment of Neruda's contradictions. Eliminate (B) because there is no mention of the *downsides of Neruda's exuberance*. Keep (C) because it matches the answer from the passage. Eliminate (D) because Feinstein *lets his readers draw their own conclusions*; he does not *make Neruda appear less noble*. The correct answer is (C).

30. **F**

This Vocabulary in Context question asks what the word *work* most nearly means as it is used in line 86. Go back to the text, find the word *work*, and cross it out. Carefully read the surrounding text to determine another word or phrase that would fit in the blank based on the context. Lines 85–87 say, *The faults and weaknesses are plain to see, but so is the undimmed exuberance and generosity of the work, which feeds hungrily off the life and yet stands as a thing apart*. The phrase *faults and weaknesses* refers to the *moral muddle* of Neruda's life. Therefore, the author is contrasting Neruda's life with his writing, so the word *work* refers to Neruda's poetry. Eliminate answers that don't match this answer from the passage. Keep (F) because it matches the answer from the passage. Eliminate (G) because *biography* refers to Feinstein's biography of Neruda, rather than to Neruda's poetry. Eliminate (H) and (J) because *travels* and *marriage* refer to aspects of Neruda's life, rather than his writing. The correct answer is (F).

31. **C**

This reasoning question asks for *the overall organization of the passage*. Because this is a general question, it should be done after the specific questions. The passage proceeds chronologically, starting with 1964 in the first paragraph and leading to 2012 at the end of the passage. It describes the events leading up to and the eventual discovery of the *Higgs boson*. Eliminate answers that don't match this

answer from the passage. The passage is *chronological*, but the focus isn't finding the *mass of various elementary particles*, so eliminate (A). Choice (B) includes some words from the passage, but the focus of the passage is not the *construction* of the *Large Hadron Collider*, so eliminate (B). The *eventsleading to the discovery of the Higgs boson* is a close match, so keep (C). There's no *collection of stories* or discussion of how the *Standard Model of physics evolved*, so eliminate (D). The correct answer is (C).

32. **J**

This reasoning question asks for *the main function of the first paragraph*. Read the first paragraph as the window. The first paragraph states that a scientist suggested that the *Higgs boson* existed *in 1964* and explains briefly what the Higgs boson is, calling it the *cornerstone of the Standard Model*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because it answers the wrong question: discoveries made in *Hamburg* are mentioned in the second, not first, paragraph. Eliminate (G) because the first paragraph doesn't talk about scientists building *particle colliders*. The paragraph is focused on the *Higgs boson*, not the *theorists*, so eliminate (H). The focus is the *Higgs boson* and its *importance*, so keep (J). The correct answer is (J).

33. **A**

This referral question asks for a *similarity between the two particle collidersdescribed in lines* 18–32. Read a window around the given line reference. The paragraph states that the *Tevatron and Large Electron Positron* colliders both provided *precision measurements* that *implied that the Higgs boson should be no more than 200 GeV*. But according to the last sentence, the scientists *found no lasting evidence*. Eliminate answers that don't match this answer from the passage. Keep (A), which matches the answer from the passage. Eliminate (B)

because the cost of the Tevatron is not discussed. Eliminate (C) because the Tevatron was completed in 1983, but the LEP only began to be built that year. Eliminate (D) because it contradicts the last sentence of the paragraph. The correct answer is (A).

34. **H**

This reasoning question asks for the *main idea of the last paragraph*. Read the last paragraph as the window. The first sentence of the last paragraph states, *Few physicists doubt that a heavy new particle* has been discovered, but *there is still debate about its exact nature*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because the paragraph doesn't say the particle's properties were predicted *only recently*. In fact, earlier the passage states that the Higgs boson was predicted decades ago. Eliminate (G) because the paragraph doesn't mention *recent research*. Choice (H) matches the answer from the passage, so keep it. Eliminate (J) because the paragraph doesn't say that the particle weighs *more than originally predicted*. The correct answer is (H).

35. **D**

This referral question asks for information about *scientists in Brussels and London*. Look for the lead words *Brussels* and *London* to find the window for the question. Lines 3–7 indicate that two scientists from Brussels and three theorists in London both *independently conceived* of the *subtle mechanism* that *endows elementary particles with mass*. Eliminate answers that don't match this answer from the passage. Choice (A) answers the wrong question: it was *Peter W. Higgs*, not the *scientists in Brussels and London*, who suggested the particle's existence, so eliminate (A). Eliminate (B) because it describes the S*tandard Model*, which isn't credited to these scientists. The *cornerstone of the Standard Model* is the Higgs boson, and that isn't

what these scientists discovered, so eliminate (C). Choice (D) matches the answer from the passage, so keep it. The correct answer is (D).

36. **G**

This referral question asks what the *dipole magnets* were *capable of*. Look for the lead words *dipole magnets* to find the window for the question. Lines 41–49 state that inside the *dipole magnets, twin proton beams circulate in both directions…approaching light speed*. Eliminate answers that don't match this answer from the passage. Eliminate (F) because it contradicts the passage, which says that there was *little left* from the LEP collider. Keep (G) because it matches the answer from the passage. Eliminate (H) because the passage doesn't indicate that the dipole magnets float *in the air*, and it is the *proton beams* that circulate at *energies up to 7 TeV*, not the *dipole magnets*. Eliminate (J) because the dipole magnets are cylinders; they don't *fit into* cylinders. The correct answer is (G).

SCIENCE TEST

1. **A**

   The question asks which graph best represents the enzyme velocities of Enzymes A, B, C, and D in solutions with *an initial substrate concentration of 5 mM* at *60°C* after *10 seconds*, based on Table 1. According to the description above Table 1, 10 seconds is a constant for all measurements in Table 1. Look at Table 1 and find the enzyme velocity of each enzyme at 60°C with an initial substrate concentration of 5 mM. Under these conditions, Enzymes A, B, C, and D have velocities of 4.6, 4.9, 10.6, and 14.6 mmol/s, respectively, so Enzyme A has the smallest enzyme velocity. Eliminate (B), (C), and (D) because these graphs do not show Enzyme A as having the smallest enzyme velocity. The correct answer is (A).

2. **G**

   The question asks for the most likely enzyme velocity if Enzyme B solution had *a substrate concentration of 10 mM* at *35°C*, based on Table 1. Look for the data for Enzyme B at an initial substrate

concentration of 10 mM. The enzyme velocity is listed for substrate temperatures of 20°C, 30°C, and 60°C. The enzyme velocity decreases with higher temperatures. Thus, the enzyme velocity at 35°C will fall between the values for 30°C and 60°C. At 30°C the enzyme velocity is 10.9 mmol/s, and at 60°C the enzyme velocity is 6.9 mmol/s. Therefore, the enzyme velocity at 35°C will be between 10.9 mmol/s and 6.9 mmol/s. The correct answer is (G).

3. **D**

The question asks for the enzyme velocities from *highest to lowest* after 1 second with a *substrate concentration of 12 mM* at 40°C, based on Figure 1. The description for Figure 1 states that the graph shows the change in enzyme velocity over time at a substrate concentration of 12 mM and a temperature of 40°C. Find 1 second on the horizontal axis and draw a vertical line from 1 second on the *x*-axis to the enzyme velocity curves for all four enzymes. Enzyme D has the highest enzyme velocity at 1 second, so eliminate (A) and (B). Enzyme B has the second highest enzyme velocity, so eliminate (C). The correct answer is (D).

4. **G**

The question asks which enzyme *had the highest enzyme velocity after 0.75 seconds* with a *substrate concentration of 12 mM* at *40°C*, according to Figure 1. The description for Figure 1 states that the graph shows the change in enzyme velocity over time at a substrate concentration of 12 mM and a temperature of 40°C. Find 0.75 seconds on the horizontal axis, and draw a vertical line from 0.75 seconds on the *x*-axis to the enzyme velocity curves for all four enzymes. Enzyme B has the highest enzyme velocity at 0.75 seconds. The correct answer is (G).

5. **A**

The question asks for the enzyme velocity for Enzyme C *after 10 seconds* at an *8 mM substrate concentration at 60°C*, based on Table 1. According to the description above Table 1, 10 seconds is a constant for all measurements in Table 1. Look for the data for Enzyme C at 60°C. The enzyme velocity is listed for initial substrate concentrations of 5 mM, 10 mM, and 15 mM. The enzyme velocity increases with higher substrate concentrations. Thus, the enzyme velocity at an 8 mM substrate concentration will fall between the values for 5 mM and 10 mM. At 5 mM the enzyme velocity is 10.6 mmol/s, and at 10 mM the enzyme velocity is 13.1 mmol/s. Therefore, the enzyme velocity will be between 10.6 mmol/s and 13.1 mmol/s. The only value between 10.6 mmol/s and 13/1 mmol/s is 12.0 mmol/s in (A). The correct answer is (A).

6. **G**

The question asks for the enzyme that *takes the shortest amount of time to reach an enzyme velocity of 6 mmol/s*, given that the substrate concentration is 12 mM and the temperature is 40°C, according to Figure 1. The description for Figure 1 states that the graph shows the change in enzyme velocity over time at a substrate concentration of 12 mM and a temperature of 40°C. Find the enzyme velocity of 6 mmol/s on the vertical axis. Draw a horizontal line from 6 mmol/s on the *y*-axis. The first enzyme to reach an enzyme velocity of 6 mmol/s is Enzyme B at 0.5 seconds. The correct answer is (G).

7. **B**

The question asks for *the transmittance at 0.31 microns at a concentration of 18 mg/m^3*, based on Figure 2. According to the description for Study 2, Figure 2 shows the transmittance at 0.31 microns at various average concentrations of O_3. Look at Figure 2 for the transmittance at a concentration of 18 mg/m^3. At 18 mg/m^3, the

transmittance is approximately 48%, which is between 45 and 55%. The correct answer is (B).

8. **G**

The question asks how *the transmittance at0.31 micronsvaried* as *the concentration of ozone increased from 3 to 24 mg/m^3*, based on Study 2. According to the description for Study 2, Figure 2 shows the transmittance at 0.31 microns at various average concentrations of O_3. Use Figure 2 and look for the relationship between transmittance and average concentration of O_3. Figure 2 shows an inverse relationship between concentration and transmittance. As the concentration increased, the transmittance decreased. The correct answer is (G).

9. **B**

The question asks which of the five locations has the *greatest transmittance at 0.31 microns*, according to Studies 2 and 3. According to the description for Study 2, Figure 2 shows the transmittance at 0.31 microns at various average concentrations of O_3. Study 3 shows the *average stratospheric ozone concentration*, and the results of Study 3 are shown in Table 1. Use Figure 2 and look for the relationship between transmittance and average concentration of O_3. Figure 2 shows an inverse relationship between concentration and transmittance. As the concentration increased, the transmittance decreased. The question asks for the *greatest transmittance*, so this would be found at the location with the lowest concentration. Table 3 indicates that the lowest concentration is at Location 2. The correct answer is (B).

10. **F**

The question asks which equations represent *the production of ozone in the stratosphere*, based on the passage. Use the information in the

first paragraph to determine the equations. The passage states that *ozone is formed naturally when UV light breaks apart an oxygen molecule to form two highly reactive oxygen atoms.* Eliminate (G) and (J) because ozone (O_3) is not involved in same reaction as UV light. The passage then states that *oxygen atoms collide with another oxygen molecule to form ozone.* This means that the oxygen atoms (O) and the oxygen molecules (O_2) should be on one side of the equation and ozone (O_3) should be alone on the other side of the equation. Eliminate (H) since ozone (O_3) should be the only product. The correct answer is (F).

11. **A**

The question asks, based on Figure 1, whether the researcher should measure the transmittance at *4.3 microns or at 9.5 microns*, given that the researcher wants to repeat Study 2 to study the effects on transmittance of different *CO_2concentrations instead of O_3concentrations.* Look at Figure 1 and determine the CO_2 transmittance at 4.3 microns and 9.5 microns. The CO_2 transmittance is approximately 0% at 4.3 microns and approximately 95% at 9.5 microns. Eliminate (B) and (C) because these incorrectly state that the transmittance is lower at 9.5 microns. Now, consider the original wavelength used in Study 2. The transmittance of O_3 varied from approximately 0% to 100% between 0.27 and 0.35 microns, and the researchers used a wavelength in the middle of this range. Similarly, a wavelength of 4.3 microns is in the middle of a range of wavelengths where the transmittance of CO_2 varies from approximately 0% to 100%. The correct answer is (A).

12. **F**

The question asks whether *the total transmittance of sunlight on Planet Z at a wavelength of 0.3 microns* would be higher or lower

than the transmittance on *Earth at a wavelength of 0.3 microns*, given that Planet Z has a *higher* concentration of carbon dioxide and there is *no ozone*. The relationship between wavelength and transmittance is shown in Figure 1. Look at Figure 1 to determine the transmittance of CO_2 and O_3 at 0.3 microns. According to Figure 1, at a wavelength of 0.3 microns the transmittance of CO_2 is approximately 100%, and the transmittance of O_3 is approximately 20%. Eliminate (G) and (J) because both indicate that the transmittance of CO_2 is lower than the transmittance of O_3. Since Planet Z has more CO_2 and less O_3 than Earth does and CO_2 has a higher transmittance at 0.3 microns than O_3, the total transmittance of sunlight on Planet Z would likely be higher overall. The correct answer is (F).

13. **B**

The question asks for the mass of O_3, in *grams*, in 100 cubic meters of stratospheric air at Location 3, based on Table 1. Look at Table 1 and find the concentration of O_3 at Location 3. Table 1 shows that Location 3 has a concentration of 21 mg/m^3. Therefore, 100 cubic meters would contain 21 $mg/m^3 \times 100\ m^3 = 2{,}100$ mg of O_3 per 100 cubic meters of stratospheric air. Be careful! The question asks for *grams*, not milligrams, so eliminate (D). Since 1 g = 1,000 mg, a volume of 2,100 mg would be equal to 2.1 g. The correct answer is (B).

14. **J**

The question asks, according to Figure 1, *which two zones have similar ranges*. The question states that the *range refers to the difference in depth between the top and bottom of that zone*. The horizontal axis in Figure 1 shows the depth, so the width of each zone along the horizontal axis would correspond to the range. Use POE. The epipelagic zone is very narrow, indicating a much smaller range

than any of the other zones. Eliminate (F). The mesopelagic zone is larger than the epipelagic zone, but still much smaller than any others, so it is not close in range to any other zone. Eliminate (G) and (H) because both include mesopelagic. Only bathypelagic and abyssopelagic have approximately the same width for their zones in Figure 1. The correct answer is (J).

15. **B**

The question asks, according to Figure 2, for which value of *d* does *approximately 35% of marine life [live] between 0 m and d*. Figure 2 shows the percent of marine life between sea level (0 m) and a given value of *d*. Find 35% on the vertical axis of Figure 2 and draw a horizontal line over until you reach the curve and then down to the horizontal axis. It's hard to tell exactly what the depth is at 35%, but it is definitely less than 200 m, so eliminate (C) and (D) because they are too large. In the description preceding Figure 2, the passage states that *20% of all marine life is located between sea level and a depth of 50 m*. Eliminate (A) since 20% is not 35%. The depth must be somewhere between 50 m and 200 m. The correct answer is (B).

16. **H**

The question asks, according to Figures 1 and 2, to what depth does the bathypelagic zone extend. Figure 1 shows the depths of the different zones of the ocean, so look at Figure 1. The bathypelagic zone (the third zone from the left) starts at 1,000 m and extends to 3,600 m on the horizontal axis (*d*). The correct answer is (H).

17. **D**

The question asks, based on Figure 1, what the dissolved oxygen level is at $d = 10{,}000$ m. In Figure 1, there are two vertical axes, and two curves, *t* and D.O. To answer this question, use the D.O. curve and

make sure to use the vertical axis on the right-hand side of the graph. At d = 9,600 m, the D.O. is between 1.2 and 1.5 mg/L. The curve is increasing very slightly at 9,600 m, so eliminate (A), (B), and (C), which would all indicate a substantial decrease between 9,600 m and 10,000 m. Since the rate of increase is so small, the values will stay between 1.2 and 1.5 mg/L at 10,000 m. The correct answer is (D).

18. **G**

The question asks for the approximate *percentage of marine life* that *the aphotic zones account for.* The question defines *the aphotic zones* as *depths below 1,000 m*. Figure 2 shows *the percent of marine life located between sea level and a given depth*. Find 1,000 m on the horizontal axis and draw a straight line up until the curve and then over to the vertical axis. Approximately 90% of marine life is located between sea level and 1,000 m. The question asked for the percentage of marine life *below* 1,000 m, so there is 10% of marine life remaining at a depth below 1,000 m. The correct answer is (G).

19. **B**

The question asks, based on Figure 1, *which of the samples of water, if either, would have a lower mass*. The two samples are both *1-liter samples of water collected*, and one was *collected at* d = *1,000 m* and the other was *collected at* d = *3,600 m*. Refer to Figure 1. Notice that the temperature, represented by the solid line, is decreasing as the depth increases. Therefore, the water gets colder as the depth increases. The question states that *colder ocean water is denser than warmer ocean water*, so the water at 1,000 m is less dense than the colder water at 3,600 m. Eliminate (C) because the density of the two samples is not the same. To choose between the remaining answers, outside knowledge is necessary: density is equal to mass divided by volume. Since both of these samples have the same volume, the less

dense sample, which is the sample from 1,000 m, must have the smaller mass. The correct answer is (B).

20. **H**

The question asks *which of the students theorized that fibromyalgia is triggered by neurons that are in some way physically altered.* Student 1 states that fibromyalgia results after *irreparable physical damage to nerve cells*, so the answer must include Student 1. Eliminate (G) and (J) because they do not include Student 1. Student 2 states that when there is a chronic excess of glutamate, the pain receptors on neurons *adapt by physically changing shape* and this change *results in fibromyalgia*. Therefore, Student 2 also believes that fibromyalgia is triggered by physically altered neurons. The correct answer is (H).

21. **C**

The question asks which student's theory is best supported by evidence that *female fibromyalgia patientsreport a higher incidence of pain during pregnancy and menopause when estrogen levels are rapidly changing*. Student 3 states that *fibromyalgia is caused only by abnormal estrogen or thyroid hormone levels*. None of the other students believe that estrogen contributes to fibromyalgia. The correct answer is (C).

22. **G**

The question asks which types of foods provide L-tryptophan, based on Student 4's description. Find L-tryptophan in Student 4's description. Student 4 states that L-tryptophan is *an essential amino acid*. Outside knowledge is necessary here: amino acids are the building blocks of proteins. The correct answer is (G).

23. **C**

The question asks which student *would be most likely to predict that people that produce higher than average levels of Substance P have a higher than average risk of developing fibromyalgia*. The question describes Substance P as an *excitatory neurotransmitter similar in function to glutamate*. Student 2 states that *fibromyalgia is caused only by the overproduction of excitatory transmitters, such as glutamate*. If Substance P is similar to glutamate, then Student 2 would believe that higher levels of Substance P would make someone more likely to develop fibromyalgia. The correct answer is (C).

24. **J**

The question asks *which of the students theorized that fibromyalgia is the result of low levels of certain neurotransmitters*. Use POE. Student 3 is in 3 of the answers, so check Student 3's explanation for mention of neurotransmitters. Student 3 states that serotonin and norepinephrine are *two inhibitory neurotransmitters* and that fibromyalgia results *whenthe levels of these inhibitory neurotransmitters are low.* Therefore, the answer must include Student 3. Eliminate (F) because it does not include Student 3. Student 2 states that *fibromyalgia is caused by the overproduction of neurotransmitters*. Overproduction is the opposite of low levels, so Student 2 cannot be in the correct answer. Eliminate (H). Now, determine if the answer needs to include Student 4 or not. Student 4 says that fibromyalgia is caused *whenserotonin levels drop*. Serotonin was previously defined as an *inhibitory neurotransmitter* in Student 3's description, so Student 4 also believes that fibromyalgia is the result of *low levels of neurotransmitters*. The correct answer is (J).

25. **C**

The question asks which of the findings, if true, *bestsupports Student 4's theory*. Student 4 states that *Fibromyalgia results only from a diet low in L-tryptophan*. This would mean that diets low in L-tryptophan

would be associated with a higher number of cases of fibromyalgia. Eliminate (D) which states that *the prevalence of fibromyalgia is* lower *than average* for people who consume diets low in L-tryptophan. Keep (C) as it states the prevalence is higher. Choices (A) and (B) deal with levels of thyroid hormone. Student 4 states that *estrogen and thyroid hormone imbalances do not limit the production of serotonin*. Eliminate (A) and (B). The correct answer is (C).

26. **F**

The question asks which of the students' viewpoints would be weakened by the results of a study involving Prescription *C*, *a powerful anti-inflammatory medication often prescribed to patients recovering from serious injury*. Since the question states that *the likelihood of developing fibromyalgia was the same among patients treatedwith Prescription* C *and patients that were not treated with any anti-inflammatory medications*, viewpoints attributing fibromyalgia to inflammation would be weakened by these results. Scan the viewpoints to see which ones mention inflammation or injury. Student 3 does not mention inflammation or injury, so eliminate (H) and (J). Student 2 mentions injury, but says that injury and illness *do not create the widespread pain of fibromyalgia*. Eliminate (G). Student 1 states that fibromyalgia results when *inflammation causes irreparable physical damage to the nerve cells.* The correct answer is (F).

27. **A**

The question asks which soil samples had *the lowest percentage of ammonium converted to nitrate after treatment with N-1, N-2, and N-3*, according to the results of the studies. Figure 1 shows the results soil samples treated with N-1, Figure 2 shows the results of soil samples treated with N-2, and Figure 3 shows the results of soil samples treated with N-3. Start by looking at Figure 1 to determine which biome sample had the lowest percent of ammonium converted

to nitrate for N-1. Figure 1 shows that the coniferous forest had the smallest percent of ammonium converted to nitrate in soil treated with N-1. Eliminate (C) and (D). Figure 2 shows that the coniferous forest had the lowest percentage of ammonium converted to nitrate for N-2. Eliminate (B). The correct answer is (A).

28. **H**

The question asks for the approximate *percent of ammonium converted to nitrate in the soils treated with N-2, averaged across all 5 biomes*, according to the results of Study 2. The results of Study 2 are shown in Figure 2, so look at Figure 2. In Figure 2, the highest percentage of ammonium converted to nitrate is 70% and the lowest percentage is 45%. Eliminate (F) since the average cannot be less than the smallest value. Eliminate (J) because the average must be smaller than the greatest value. Since the majority of the values are 60% or greater and only one value is less than 50% (45% for the coniferous forest), the average must be closer to 60% than 50%. Eliminate (G). The correct answer is (H).

29. **D**

The question asks whether *a greater percentage of ammonium was converted to nitrate in the tropical forest soil treated with N-3 than the same soil treated with N-1*, based on Studies 1 and 3. Figure 1 shows the soil samples treated with N-1, and Figure 3 shows the soil samples treated with N-3. Start by looking at Figure 1 to determine percent of ammonium converted to nitrate in the tropical forest soil treated with N-1. According to Figure 1, tropical forest soil treated with N-1 had approximately 68% of the ammonium converted to nitrate. Eliminate (A), (B), and (C) because these answers do not identify 68% as the value for the soil sample treated with N-1. The correct answer is (D).

30. **H**

The question asks for the *independent (experimental) variable across the 3 studies.* This question requires outside knowledge. An *independent variable* is also known as a manipulated variable because it is the variable that is manipulated by the experimenter in order to measure the effect on the dependent variable. Since the question asks for the independent variable *across the 3 studies*, consider which variable is different among the 3 studies. The same 5 biomes were used for each study, so eliminate (F). The concentration of ammonia and the concentration of nitrate are both dependent variables, so eliminate (G) and (J). Each of these studies uses a different nitrogen inhibitor, so the experimental variable is the type of nitrogen inhibitor. The correct answer is (H).

31. **A**

The question asks which inhibitor reduced the concentration of applied ammonium ions by less than 50% in the deciduous forest soil. The reduction in the percentage of ammonium ions is another way of saying the percentage of ammonium converted to nitrate, so determine the percent of ammonium converted to nitrate in the deciduous forest soil treated with N-1, N-2, and N-3. These values in the deciduous forest soil are approximately 61% in soil treated with N-1, 50% in soil treated with N-2, and 73% in soil treated with N-3. None of these values are *less* than 50%, so the answer is none of the inhibitors. The correct answer is (A).

32. **F**

The question asks whether *the mixture of N-1 and liquid fertilizer isa solution*. Use POE. Notice that two answers say N-1 was dissolved in the fertilizer, while the other two say that N-1 was suspended. Study 1 uses N-1, so look in the description of Study 1 for reference to *dissolved* or *suspended*. The description of Study 1 states that the *mixture was stirred until there were no remaining solids suspended in*

the mixture. Therefore, the N-1 was not suspended; eliminate (G) and (J). To choose between (F) and (H), outside knowledge is needed. In chemistry, a solution is a homogenous mixture in which all solids are dissolved in the mixture. Since the N-1 was stirred until there were no remaining solids, the mixture is a solution. The correct answer is (F).

33. **C**

The question asks which *step was incorporated in the experimental design to ensure that the bacteria in all five soils were active.* Since the question states that *nitrogen-fixing bacteria are inactive in temperatures below 12°C*, the correct answer must relate to the temperature of the soil. Eliminate (B) and (D), which do not relate to soil temperature. Look at the introduction and study description for information regarding soil temperature. The passage states that the soil samples were *maintained at 20°C* for one week before the studies began and *remained at 20°C* during the studies. The passage never specifies the outside temperature at the time of collection, so eliminate (A). The correct answer is (C).

34. **J**

The question asks which diagram most likely represents the petri dish where the cell in Figure 2 would be found, given that *the cell shown in Figure 2 is oriented exactly how it appeared in its dish*. Look at Figure 1 and determine which cells are most similar in shape to the cell in Figure 2. The cell in Figure 2 most resembles the cells in Dish D in Experiment 1. Eliminate (F) and (G) because the direction of the electric field is reversed from that in Dish D. According to the description for Experiment 1, *the yeast placed in Dishes C and D were all* S. pombe – GM. The correct answer is (J).

35. **B**

The question asks which dish of cells in Experiment 1 had the most similar growth to the cells in Dish X *before Dish X was moved to a higher temperature room.* Look at the description of Experiment 2. The passage states that Dish X contained *S. pombe–N* cells, so eliminate (C) and (D), which both contained *S. pombe– GM* cells. The passage also states that *a battery was used to generate a current through all four dishes.* Since Dish A in Experiment 1 did not have an electric field, eliminate (A). The correct answer is (B).

36. **H**

The question asks whether *the* S. pombe – N *cells exhibit the same growth patterns as the* S. pombe – GM *cells in the presence of an electrical field*, according to Experiment 1. The growth pattern of the *S. pombe* cells is shown in Figure 1. Look at Figure 1 and determine the shape of the S. pombe – N and S. pombe – GM *cells in the presence of an electrical field.* In Experiment 1, Dish B contained *S. pombe–N* cells in an electric field, and Dish D contained *S. pombe–GM* cells in an electric field. Eliminate (F) and (J) because these answers refer to the wrong dishes. Based on Figure 1, the shapes of the cells in Dish B and Dish D differ after 3 days of growth, so eliminate (G). The correct answer is (H).

37. **D**

The question asks whether *the yeast cells in Dish Y likely grew towards the anode or towards the cathode*, according to Experiment 2. The question also states that *the anode of the petri dish is the positively charged electrode, and the cathode is the negatively charged electrode.* Look at the description of Experiment 2. The passage states that Dish Y contained *S. pombe– GM* cells. The passage also states that *a battery was used to generate a current through all four dishes.* Since the yeast cells in Dish Y were *S. pombe– GM* in the presence of an electric field, the cells in Dish Y

would exhibit growth similar to Dish D, which also contained *S. pombe– GM* in the presence of an electric field. Eliminate (A) and (C) because these answers refer to Dish B, rather than Dish D. According to Figure 1, the yeast cells in Dish D grew toward the positively charged electrode, so this is the anode. The correct answer is (D).

38. **H**

The question asks whether *S. pombe* is *a eukaryotic or prokaryotic cell*, based on Figure 1. Look at the description of Experiment 1. The description of Experiment 1 states that *the nucleus is shown for each cell.* Eliminate (G) and (J). To choose between the remaining choices, outside knowledge is necessary. Eukaryotic cells have a nucleus while prokaryotic cells do not. The correct answer is (H).

39. **D**

The question asks *how many times* the length of each cell was measured in Experiment 2. The results of Experiment 2 are shown in Figure 3, so look at Figure 3. Figure 3 shows a data point for each time data was collected during Experiment 2. Each dish has 7 data points, so each cell was measured 7 times. The correct answer is (D).

40. **J**

The question asks which two dishes researchers should compare if they want to *examine the effects of different temperatures on the growth of* S. pombe – GM *cells.* In Experiment 1, the dishes were held *at a constant temperature of 20°C*, and in Experiment 2, the temperature was varied, so look at the description for Experiment 2. Dishes Y and Z contained *S. pombe– GM*, and Dishes W and X contained *S. pombe–N* cells. Since the researchers want to examine *the growth of* S. pombe – GM *cells*, eliminate (F), (G), and (H), which refer to Dishes W and/or X. The correct answer is (J).