Form Z08

(April 2022)

The ACT®

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In response to your request for Test Information Release materials, this booklet contains the test questions, scoring keys, and conversion tables used in determining your ACT scores. Enclosed with this booklet is a report that lists each of your answers, shows whether your answer was correct, and, if your answer was not correct, gives the correct answer.

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Directions

This booklet contains tests in English, mathematics, reading, and science. These tests measure skills and abilities highly related to high school course work and success in college. **Calculators may be used on the mathematics test only.**

The questions in each test are numbered, and the suggested answers for each question are lettered. On the answer document, the rows of ovals are numbered to match the questions, and the ovals in each row are lettered to correspond to the suggested answers.

For each question, first decide which answer is best. Next, locate on the answer document the row of ovals numbered the same as the question. Then, locate the oval in that row lettered the same as your answer. Finally, fill in the oval completely. Use a soft lead pencil and make your marks heavy and black. **Do not use ink or a mechanical pencil.**

Mark only one answer to each question. If you change your mind about an answer, erase your first mark thoroughly before marking your new answer. For each question, make certain that you mark in the row of ovals with the same number as the question.

Only responses marked on your answer document will be scored. Your score on each test will be based only on the number of questions you answer correctly during the time allowed for that test. You will **not** be penalized for guessing. **It is to your advantage to answer every question even if you must guess.**

You may work on each test **only** when the testing staff tells you to do so. If you finish a test before time is called for that test, you should use the time remaining to reconsider questions you are uncertain about in that test. You may **not** look back to a test on which time has already been called, and you may **not** go ahead to another test. To do so will disqualify you from the examination.

Lay your pencil down immediately when time is called at the end of each test. You may **not** for any reason fill in or alter ovals for a test after time is called for that test. To do so will disqualify you from the examination.

Do not fold or tear the pages of your test booklet.

DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO.

ENGLISH TEST

45 Minutes—75 Questions

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

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

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

PASSAGE I

Citizen Scientists Advance Astronomy at Home

Starting in 2007, volunteers around the world began contributing[1] via the Internet to cutting-edge astronomical research. Galaxy Zoo, a website developed at Oxford University, achieved an immediate and extraordinary success, surprising even the astronomers who created it.

Initially, project leaders invited the public to study images gathered by the Sloan Digital Sky Survey (SDSS) in order to classify galaxies as elliptical or spiral. [2]

1. **A.** NO CHANGE
B. world began, contributing
C. world, began contributing
D. world began contributing,

2. At this point, the writer is considering adding the following true statement:

> The Alfred P. Sloan Foundation was created in 1934.

Should the writer make this addition here?

F. Yes, because it clarifies who is responsible for funding the Sloan Digital Sky Survey.
G. Yes, because it indicates that Galaxy Zoo has a long history of foundation support.
H. No, because it suggests that the Sloan Digital Sky Survey did not rely on volunteers.
J. No, because it blurs the paragraph's focus at this point on the tasks performed by volunteers.

In the case of spiral galaxies, by which participants
3
were also to note the direction of the galaxy's

rotation, clockwise, or counterclockwise. During
4
Galaxy Zoo's first year, 150,000 volunteers took a

short online tutorial and began eyeballing the SDSS
5
images on their own computers and submitting their

classifications. Soon after the start of the project, its
6
managers had to upgrade hardware to handle the

contributions, which proved to be a real challenge.
7

Project creators are quick to point out that humans perform some scientific tasks far better than computers do, even in disciplines such as astronomy, however, that
8

rely heavily on technology. [9] The huge database amassed as part of Galaxy Zoo allowed researchers to advance their understanding of galaxy formation,

evolution, and types. [A] Resulting articles appeared
10

in such elaborate locations as the journals of the Royal
11
Astronomical Society. [B] Following Galaxy Zoo's success are other similar projects, such as Galaxy Zoo: Hubble. [C] These online endeavors, which ask for
12
increasing sophistication of judgment from citizen scientists, engaging them in an array of astronomical

3. **A.** NO CHANGE
B. for which participants
C. participants
D. meanwhile,

4. **F.** NO CHANGE
G. rotation—clockwise
H. rotation clockwise;
J. rotation clockwise:

5. **A.** NO CHANGE
B. glaring at
C. viewing
D. noticing

6. **F.** NO CHANGE
G. some of it's
H. its'
J. it's

7. Given that all the choices are accurate, which one most clearly indicates why the actions described in this sentence were taken?

A. NO CHANGE
B. were reaching 70,000 classifications per hour.
C. turned out to be very helpful.
D. they did successfully.

8. **F.** NO CHANGE
G. astronomy, on the other hand,
H. astronomy
J. DELETE the underlined portion.

9. If the writer were to delete the preceding sentence, the essay would primarily lose information that suggests:

A. which data collected by Galaxy Zoo was provided by volunteers.
B. what advancements in astronomy depend on increasingly sophisticated technology.
C. why Galaxy Zoo's creators were reaching out to involve citizen scientists.
D. where technologies used in astronomy projects are available to public participants.

10. **F.** NO CHANGE
G. types understanding increased.
H. types were understood.
J. understanding types.

11. **A.** NO CHANGE
B. elitist avenues of expression
C. prestigious publications
D. upscale printed material

12. **F.** NO CHANGE
G. endeavors asking
H. endeavors ask
J. endeavors

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challenges. [D] "If you're quick," reads the home page of one such website "you may even be the first person in history to see each of the galaxies you're asked to classify." With that kind of encouragement, hundreds of thousands of viewers look for new planets, describe "bubbles" in the Milky Way, and examine the surface of the Moon—tasks each volunteer can perform conveniently on his or her own computer. [15]

13. **A.** NO CHANGE
B. website,
C. website says
D. website, saying

14. Given that all the choices are accurate, which one best ends the essay with an indication of why online projects like Galaxy Zoo sometimes achieve widespread participation?

F. NO CHANGE
G. where astronauts first landed in 1969, advancing the space program immeasurably.
H. a place of craters, lava plains, mountains, and valleys.
J. all without getting paid for their work.

15. The writer wants to divide this paragraph into two in order to separate information about the original Galaxy Zoo from information about other projects. The best place to begin the new paragraph would be at:

A. Point A.
B. Point B.
C. Point C.
D. Point D.

PASSAGE II

Notre Dame Cathedral: Saved By a Book

Every year, thirteen million people visit Notre Dame de Paris on an annual basis. They wait in long lines to view the brilliant stained glass of the famed rose windows, to gaze at the horned and gaping gargoyles, and to feel small beneath the vaulted ceilings and flying buttresses of the cathedral considered by many to be the premier example of French Gothic architecture in the world.

16. **F.** NO CHANGE
G. year after year.
H. annually.
J. DELETE the underlined portion and end the sentence with a period.

17. **A.** NO CHANGE
B. gaze, at the horned,
C. gaze at the horned,
D. gaze at: the horned

18. If the writer were to delete the underlined portion (adjusting the punctuation as needed), the paragraph would primarily lose details that:

F. suggest that a visit to Notre Dame Cathedral is not as dramatic as it is sometimes portrayed.
G. contribute to the description of the architectural wonders of Notre Dame Cathedral.
H. indicate that the popularity of Notre Dame Cathedral peaked in the Middle Ages.
J. suggest that some visitors to Notre Dame Cathedral think it is ready for another renovation.

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There would likely be no cathedral to visit, for instance, if not for Victor Hugo's epic novel *Notre-Dame de Paris*, commonly known as *The Hunchback of Notre-Dame*. In the late 1700s, during the French Revolution, much of the architectural icon was destroyed. What builders and craftsmen, starting in 1163, had then taken more then one hundred fifty years to create were tumbling into ruins in politically tumultuous times. The population of a city engulfed in chaos chose Notre Dame as one of its targets, defacing statues, breaking windows, and smashing furniture in an attempt to remove any vestiges of royalty and of its religion.

Years later, in 1831, Victor Hugo published his novel, the masterpiece offers a sweeping and brutal look at issues of class and power in France. The first novel to have beggars as protagonists, the book also features the cathedral itself as a central character. So popular was the story that one of its effects was to spur the restoration of the cathedral, and Hugo had portrayed as teetering on the brink of utter deterioration. In addition to being exalted as a monumental work of architecture, the cathedral emerging in Hugo's pages as embodying history—history worth preserving with a vengeance. The actual work of restoration was helped by Gothic Revival architect his name is Eugène Emmanuel Viollet-le-Duc.

19. **A.** NO CHANGE
B. last but not least,
C. in other words,
D. though,

20. **F.** NO CHANGE
G. than taken more then
H. taken more than
J. taken more then

21. **A.** NO CHANGE
B. were now
C. was
D. DELETE the underlined portion.

22. **F.** NO CHANGE
G. reading it
H. which
J. it

23. **A.** NO CHANGE
B. features, the cathedral itself,
C. features, the cathedral itself
D. features, the cathedral, itself

24. **F.** NO CHANGE
G. cathedral, which
H. cathedral. In the book,
J. cathedral. The author

25. **A.** NO CHANGE
B. to emerge
C. emerges
D. DELETE the underlined portion.

26. Which choice best indicates that Viollet-le-Duc played a prominent role in the restoration process?

F. NO CHANGE
G. considered important
H. spearheaded
J. noted

27. **A.** NO CHANGE
B. whom is
C. who is
D. DELETE the underlined portion.

The popular sentiment that set the stage for the restoration was fueled by a novel, that like the monument it celebrated, eventually gained international cheers.

28. **F.** NO CHANGE
G. novel that, like
H. novel that like,
J. novel that like

29. **A.** NO CHANGE
B. positive feedback.
C. favoritism.
D. acclaim.

Question 30 asks about the preceding passage as a whole.

30. Suppose the writer's main purpose had been to write an essay about how a masterpiece in one discipline influenced a masterpiece in another discipline. Would this essay accomplish the writer's purpose?

F. Yes, because it indicates that a much-admired book by Hugo led to the construction of Notre Dame Cathedral.
G. Yes, because it indicates that, partly as a result of a great novel, Notre Dame Cathedral survived possible destruction.
H. No, because it does not establish whether the millions of people who visit Notre Dame Cathedral have read Hugo's book about it.
J. No, because it indicates that Hugo wrote many books, only one of which was devoted to architecture.

PASSAGE III

Lobster Lore

In the early seventeenth century, lobsters were plentiful among the New World. They could be gathered by hand in shallow waters or caught by the dozens in nets tossed over the sides of boats. After heavy storms, for example, shorelines were often littered with lobsters, sometimes in piles two feet high. Among European colonists—though—plenitude did not lead to popularity.

Apocryphal stories have overemphasized this idea that lobster was rarely eaten by choice. They claim that servants' contracts specified limits as to how often servants would partake of lobster and that Boston dockworkers

31. **A.** NO CHANGE
B. amid
C. in
D. at

32. **F.** NO CHANGE
G. in contrast,
H. therefore,
J. DELETE the underlined portion.

33. **A.** NO CHANGE
B. colonists, though,
C. colonists, though
D. colonists though

went on strike, fed up with the indignity of being forced to eat lobster as often as three times a week. Snippets of quotations are often spun to bolster such stories of colonists' disdain for the crustacean. When welcoming a new boat of colonists in 1622, William Bradford, governor of Plymouth Colony, confessed, some say, to his humiliation at having to serve lobster. But what he expressed was regret over serving it, "without bread or anything else but a cupp of fair water." The message was this: Lobster was plentiful. It was a good source of protein.

These stories present an exaggerated truth. [38] With so much lobster and so little else, colonists indeed tired of lobster. They preferred using it as fishing bait to seeing them on their dinner tables. In Europe, however, lobster was scarce, expensive, and in high demand.

Soon, technological innovations would soon allow New Englanders to profit from their lobster wealth.

34. **F.** NO CHANGE
G. the colonists
H. colonist's
J. colonists

35. **A.** NO CHANGE
B. having confessed,
C. and confessed,
D. confessing,

36. **F.** NO CHANGE
G. it "without
H. it. "Without
J. it; "without

37. Given that all the choices are true, which one best completes the contrast with the preceding sentence and offers the most logical interpretation of the quotation from Bradford?

A. NO CHANGE
B. Coffee and tea, when available, were popular among the colonists.
C. It could be caught quickly and easily.
D. Other foods were scarce.

38. If the writer were to delete the preceding sentence, the essay would primarily lose a statement that:

F. paraphrases the quotation from Bradford that appears in the preceding paragraph.
G. makes a new assertion about lobsters that is explained later in the essay.
H. reiterates and clarifies the central idea of the second paragraph.
J. suggests the colonists actually enjoyed eating lobster.

39. **A.** NO CHANGE
B. some
C. these
D. it

40. **F.** NO CHANGE
G. In short order, technological
H. Before long, technological
J. Technological

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Specialized boats, called smacks, were constructed (41)
to enable lobstermen to catch and hold large numbers of

live lobsters. With improvements in canning methods in (42)
the mid-1800s meant that lobster could be preserved and

shipped to people far from the New England coast. Lobster (43)
pounds soon dotted the shoreline. The once-plentiful but

poorly appreciated lobster eventually becoming a mainstay (44)

of the New England economy. Who knew? (45)

41. **A.** NO CHANGE
B. usually referred to in the singular as a smack or in the plural as smacks,
C. which were often referred to by most people as smacks,
D. usually called smacks by most people,

42. **F.** NO CHANGE
G. There were improvements
H. Due to improvements
J. Improvements

43. **A.** NO CHANGE
B. New England coast where lobster was plentiful.
C. coastal region of the New England shoreline.
D. coastal areas of the New England region.

44. **F.** NO CHANGE
G. lobster eventually, it became
H. lobster eventually became
J. lobster, eventually

45. Which choice best concludes the paragraph and essay by forming a specific connection between current attitudes toward lobster and those of the colonists?

A. NO CHANGE
B. People credit the current level of New England lobster populations to a strong history of strict controls to avoid overfishing.
C. People say thin-shelled lobster, which does not ship well and is therefore only available on the coast, is the tastiest by far.
D. Today, it's also much more likely to show up as an entrée on a plate than as bait on a fishhook.

PASSAGE IV

Circadian Rhythm and Blues

People who have trouble falling asleep

might potentially have the chance to benefit from (46)
a simple suggestion: turn off the light, especially if it's blue. Though scientists have long known that light levels influence our ability to fall asleep, recent studies suggest

that certain kinds of light effect the body more than others. (47)
Light composed of blue wavelengths, which computers, televisions, and cellular phones emit, is especially effective at causing wakefulness.

46. **F.** NO CHANGE
G. might be people who could potentially benefit
H. might, or might not, benefit and gain
J. might benefit

47. **A.** NO CHANGE
B. affect the body more than
C. effect the body more then
D. affect the body more then

The problem with blue light

is a subject researchers have recently begun to study.
48

48. Given that all the choices are accurate, which one most effectively introduces the subject of the paragraph?

F. NO CHANGE
G. involves the intricate parts of the human eye, such as the cornea, lens, and iris.
H. occurs in places with low levels of ambient light.
J. relates to two functions of the human eye.

One function is, vision—the eye receives the input
49
necessary for sight. Additionally, the eye helps regulate the body, using sensors in the retina that detect variations in daylight. Based on the amount of light the retinas sense, the body sets its internal clock to a twenty-four-hour cycle called the circadian rhythm, which cues body functions,
50
such as digestion and blood pressure.

49. **A.** NO CHANGE
B. is vision:
C. is: vision
D. is vision,

50. **F.** NO CHANGE
G. this rhythm
H. this
J. it

Crucial to the functioning of the circadian rhythm is melatonin, a light-sensitive hormone secreted by the brain. Melatonin promotes sleep. When the retina detects bright light, the body suppresses melatonin to encourage wakefulness. Still, melatonin production increases when
51

51. **A.** NO CHANGE
B. Nevertheless,
C. Specifically,
D. Conversely,

light levels drop, inducing drowsiness. Blue wavelengths
52

52. **F.** NO CHANGE
G. drop, which induced
H. dropped, inducing
J. drop inducing

of light are particularly adept at slowing melatonin release.
53

53. **A.** NO CHANGE
B. is found to be
C. has been
D. is

The widespread use of technology is another reason that blue light is problematic. For example, blue light-emitting diodes are replacing lightbulbs that emit other wavelengths of light. Also, many people are using high-tech devices these days. [54]

54. The writer is considering revising the underlined portion to the following:

long after nightfall.

Should the writer make this revision?

F. Yes, because it more clearly conveys the fact that many people use high-tech devices.
G. Yes, because it more clearly implies how people's use of technology can interfere with sleep.
H. No, because it does not relate to the paragraph's discussion of light-emitting diodes.
J. No, because it removes a detail that outlines how technology has changed.

All its [55] extra blue light can disrupt the circadian rhythm of technophiles.

55. **A.** NO CHANGE
B. these
C. this
D. it's

Aware of the blue light problem, [56] some technology designers are working to better control [57] circadian rhythms.

56. **F.** NO CHANGE
G. problematic lighting,
H. lighting,
J. it,

57. Which choice best indicates that technology designers want to reduce the impact their products have on people's natural circadian rhythms?

A. NO CHANGE
B. accommodate
C. manipulate
D. change

Hoping [58] to invent lights and screens that can emit different wavelengths of light depending on the hour of the day. Meanwhile, experts suggest turning off technological devices an hour before bed to promote melatonin release and a healthy circadian rhythm. Melatonin is important to circadian rhythms. [59]

58. **F.** NO CHANGE
G. Their hope being
H. Their hoping
J. They hope

59. **A.** NO CHANGE
B. Blue light may interfere with circadian rhythms.
C. Eyes help regulate circadian rhythms.
D. DELETE the underlined portion.

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Question 60 asks about the preceding passage as a whole.

60. Suppose the writer's primary purpose had been to propose a series of solutions to a problem that affects many people. Would this essay accomplish that purpose?

- **F.** Yes, because it explains that technology designers are working to create lighting that doesn't alter circadian rhythms.
- **G.** Yes, because it outlines several steps that the body takes to mitigate blue light's effect on sleep.
- **H.** No, because it suggests that blue light's potential problems are limited to a small portion of the population.
- **J.** No, because it focuses on how blue light can significantly alter the body's ability to fall asleep.

PASSAGE V

Reviving a Tradition

When Donald Yellowbird Montileaux first began to make art, he adopted the traditions of his Lakota ancestors, painting images of tribal life on buffalo hides that he tanned himself. It was when he discovered a second tradition, one begun after buffalo grew scarce on the plains, that he started to develop his own artistic style on the pages of antique ledgers. In contrast, he joined a growing number of contemporary artists in reviving ledger art.

61. **A.** NO CHANGE
- **B.** life in the tradition of his ancestors, using buffalo hides that he
- **C.** life, when he first started out, on buffalo hides that he
- **D.** life on buffalo hides that he painted and

62. **F.** NO CHANGE
- **G.** this was when
- **H.** after which
- **J.** DELETE the underlined portion.

63. **A.** NO CHANGE
- **B.** In particular,
- **C.** In doing so,
- **D.** Instead,

[1] White traders, who carried (64) with them ledgers: accounting books filled with records of financial transactions. [2] Ledger art originated in the mid-nineteenth century, when Plains Indian tribes came into increasing contact with white settlers moving west. [3] Plains artists found that the ledger paper, with it's (65) high silk content, allowed them to create more detailed drawings than buffalo hide did. [4] Using ledgers filled up or left behind, the artists provided richly illustrated accounts of their (66) individual and tribal histories—important gatherings—symbolic (67) dreams, and triumphs in battle. [68]

Using pages from these same ledgers, Montileaux faithfully sets down his tribe's history in a style drawn from original ledger art, (69) creating scenes of warriors and buffalo, horse herds and camping sites, in a style modeled closely on that (70) of the original ledger artists. [71] By expertly blending

64. **F.** NO CHANGE
G. traders, while carrying
H. traders carrying
J. traders carried

65. **A.** NO CHANGE
B. paper with it's
C. paper, with its
D. paper with its

66. **F.** NO CHANGE
G. richly illustrated accounts of there
H. rich illustration accounts of their
J. rich illustrated accounts of there

67. **A.** NO CHANGE
B. histories: important gatherings,
C. histories; important gatherings,
D. histories, important gatherings;

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

F. where it is now.
G. after Sentence 2.
H. after Sentence 3.
J. after Sentence 4.

69. **A.** NO CHANGE
B. Lakota history, including dreams and battle scenes,
C. history on antique ledger pages,
D. history,

70. **F.** NO CHANGE
G. sights, in a style modeled closely on these
H. sights, in a style modeled closely on this
J. sites, in a style modeled closely on them

71. Given that all the following statements are true, which one, if added here, would provide the most effective transition from the preceding sentence to the next sentence of the essay?

A. As the lifestyles of the Lakota changed, so did their ledger art; farming, courtship, and domestic life became more common subjects.
B. Though mentored by the famous ledger artist Herman Red Elk, Montileaux is primarily self-taught.
C. The Lakota, like many Northern Plains Indian tribes, were nomadic, following the buffalo across the land.
D. He augments the tradition by using a full range of modern art tools and techniques.

multiple layers of pencil in colors not available in the nineteenth century he is able to produce rich, complex, [72] hues. Against a backdrop of faded numbers and signatures, his distinctive figures, rendered in fiery reds, earthy yellows, and powdery blues, seems to lift [73] off the page.

Though firmly committed to tradition, Montileaux aims [74] to inspire modern Lakota generations to blaze new paths. His dual motivations are, perhaps, best reflected in the painting *Looking Beyond One's Self*. In it, three Plains youths stand together, the vast star field above them representing their path to the future, a landscape of ledger lines their link to the past.

72. **F.** NO CHANGE
G. century, he is able to produce rich, complex
H. century, he is able to produce rich complex,
J. century he is able to produce rich complex

73. **A.** NO CHANGE
B. seems to be lifting
C. seem to be lift
D. seem to lift

74. **F.** NO CHANGE
G. had been aiming
H. was aiming
J. aimed

Question 75 asks about the preceding passage as a whole.

75. Suppose the writer's primary purpose had been to highlight a contemporary artist's approach to a historical art form. Would this essay accomplish that purpose?

A. Yes, because it discusses how Montileaux works within and modernizes the tradition of ledger art.
B. Yes, because it focuses on the ways that ledger art has evolved since Montileaux's time.
C. No, because it questions the accuracy of Montileaux's style of ledger art.
D. No, because it indicates that Montileaux radically alters the antique ledger pages.

END OF TEST 1

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

MATHEMATICS TEST

60 Minutes—60 Questions

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

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

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

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

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

DO YOUR FIGURING HERE.

1. On Monday, Elsa put \$40 in her empty lockbox. Each following Monday, Elsa will deposit \$18 to her lockbox. Which of the following expressions gives the number of dollars in Elsa's lockbox after Elsa's deposit w weeks from now?

A. $40 + 18w$
B. $40 - 18w$
C. $40w + 18$
D. $40w - 18$
E. $(40 + 18)w$

2. Raheem made a down payment of \$250.00 at a local store for an HDTV that cost \$880.00 with tax included. He arranged to make 8 equal monthly payments to the store to finish paying for the HDTV. Given that he paid no additional fees, how much was Raheem's monthly payment?

F. \$ 78.75
G. \$ 80.00
H. \$110.00
J. \$140.00
K. \$141.25

3. What is 25% of 50% of 80 ?

A. 5
B. 10
C. 20
D. 40
E. 60

4. In scientific notation, 0.00041 = ?

F. 4.1×10^{-5}
G. 4.1×10^{-4}
H. 4.1×10^{-3}
J. 4.1×10^{3}
K. 4.1×10^{4}

DO YOUR FIGURING HERE.

5. What is the value of $5xy^2$ when $x = -2$ and $y = -4$?

A. −320
B. −160
C. 160
D. 320
E. 1,600

6. What is the value of $|-8| - |7 - 33|$?

F. −34
G. −18
H. 18
J. 34
K. 48

7. Given that $a^3a^k = a^9$ for all real numbers a, what is the value of k ?

A. 2
B. 3
C. 6
D. 12
E. 27

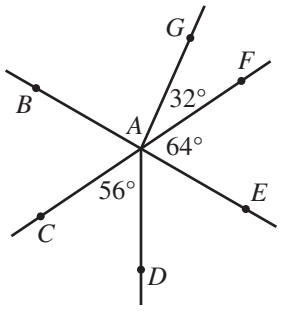
8. What is the least common multiple of 20, 30, and 130 ?

F. 60
G. 78
H. 180
J. 780
K. 78,000

9. If $f(x) = 2x^2 + 6x - 7$, then $f(-3) = ?$

A. −37
B. −7
C. 7
D. 11
E. 29

10. In the figure below, $\overleftrightarrow{BE}$ and $\overleftrightarrow{CF}$ intersect at point A. Points G and D are in the interiors of angles $\angle BAF$ and $\angle CAE$, respectively. Some angle measures are given. What is the measure of $\angle BAG$?



F. 56°
G. 60°
H. 84°
J. 90°
K. 96°

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DO YOUR FIGURING HERE.

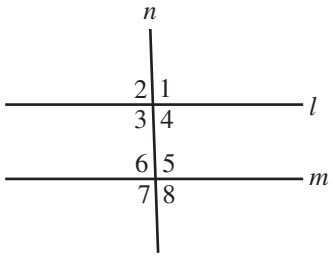
11. Salma attended a concert on Friday. She arrived at the concert hall at 5:46 p.m. and left the concert hall at 11:27 p.m. How long was Salma at the concert hall?

A. 5 hours 19 minutes
B. 5 hours 41 minutes
C. 6 hours 19 minutes
D. 6 hours 21 minutes
E. 6 hours 41 minutes

12. Given that $x \leq 3$ and $x + y \geq 5$, what is the LEAST value that y can have?

F. −8
G. −2
H. 0
J. 2
K. 8

13. In the figure below, parallel lines l and m are intersected by transversal n, forming the numbered angles. Which of the following congruence statements is NOT necessarily true?



A. $\angle 1 \cong \angle 5$
B. $\angle 2 \cong \angle 8$
C. $\angle 3 \cong \angle 5$
D. $\angle 4 \cong \angle 7$
E. $\angle 6 \cong \angle 8$

14. What is the largest possible product for 2 even integers whose sum is 50 ?

F. 96
G. 100
H. 184
J. 400
K. 624

15. The blood types of 150 people are determined for a study. The results show that 62 people have Type O blood, 67 have Type A blood, 15 have Type B blood, and the others have Type AB blood. If 1 person from this study is randomly selected, what is the probability that this person has either Type O or Type AB blood?

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

B. $\frac{11}{25}$

C. $\frac{14}{25}$

D. $\frac{31}{75}$

E. $\frac{34}{75}$

DO YOUR FIGURING HERE.

16. If $x + y = 26$ and $x - y = 14$, then $y = ?$

F. 6
G. 7
H. 12
J. 20
K. 40

17. The chart below shows the possible combinations of numbers that can land faceup when 2 numbered cubes are rolled at the same time. Each combination is equally likely.

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

What is the probability of rolling the numbered cubes so that the sum of the numbers that land faceup is 8 or greater?

A. $\frac{5}{12}$

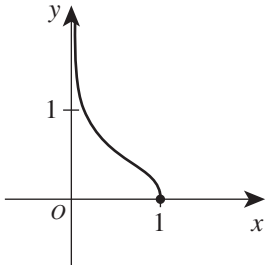
B. $\frac{5}{18}$

C. $\frac{5}{36}$

D. $\frac{13}{18}$

E. 0

18. The graph of the function $y = \sqrt{-\log_{10} x}$ is shown in the standard (x,y) coordinate plane below. The function is defined for values of x strictly between which of the following pairs of numbers?



F. −10 and −1
G. −1 and 0
H. 0 and 1
J. 1 and 10
K. 10 and 100

DO YOUR FIGURING HERE.

19. To increase the mean of 7 numbers by 3, by how much would the sum of the 7 numbers have to increase?

A. 3
B. 7
C. 10
D. 21
E. 42

20. In the standard (x,y) coordinate plane, the line with equation $y + 1 = \frac{3}{4}(2x + 8)$ has a slope of:

F. $\frac{3}{4}$

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

H. 2

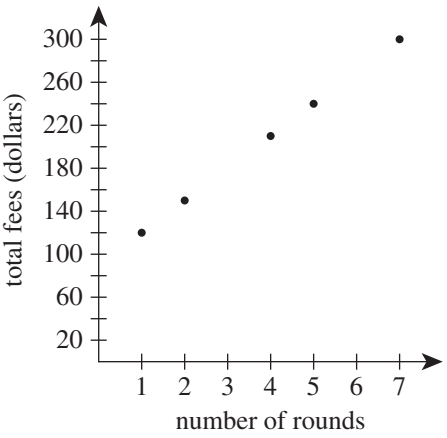
J. 5

K. 6

21. A parallelogram has a perimeter of 88 inches, and 1 of its sides measures 18 inches. If it can be determined, what are the lengths, in inches, of the other 3 sides?

A. 18, 18, 34
B. 18, 17, 17
C. 18, 26, 26
D. 18, 35, 35
E. Cannot be determined from the given information

22. Five friends play golf at a course that charges both an annual membership fee and a fee to play each round. Each point on the scatterplot below represents the number of rounds each person played during a year and the total fees the golf course charged that person.



One of the following values is the fee to play each round. Which one?

F. $ 0.75
G. $ 30.00
H. $ 53.68
J. $ 90.00
K. $300.00

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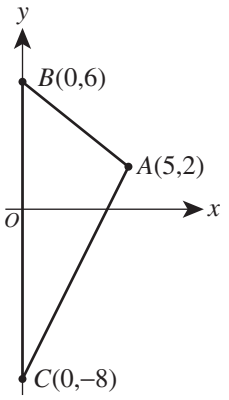
DO YOUR FIGURING HERE.

23. Tomás wants to tile a rectangular floor with square tiles that measure 12 inches on a side. The floor measures 10 feet 6 inches long by 8 feet 6 inches wide. If he is able to cut the tiles without waste, what is the minimum whole number of tiles Tomás needs to completely cover the floor?

A. 80
B. 90
C. 98
D. 99
E. 100

24. In the standard (x,y) coordinate plane below, $\triangle ABC$ is bounded by $\overline{AB}$, $\overline{AC}$, and the y-axis. Which of the following values is closest to the area, in square coordinate units, of $\triangle ABC$?



F. 15.8
G. 31.6
H. 35.0
J. 70.0
K. 79.1

25. In right triangle $\triangle JKL$, the right angle is at K, the length of $\overline{JK}$ is 10 cm, and $\sin L = \frac{5}{11}$. What is the value of $\cos J$?

A. $\frac{5}{11}$
B. $\frac{6}{11}$
C. $\frac{5}{\sqrt{96}}$
D. $\frac{6}{\sqrt{96}}$
E. $\frac{5}{\sqrt{146}}$

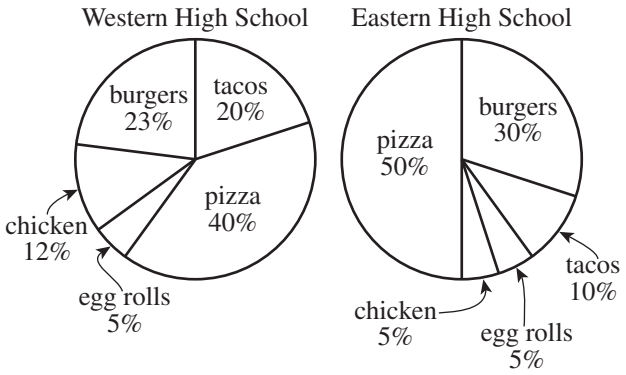
26. John averages 60 miles per hour (mph) the 6 hours he travels from his house to Ling's house. On his return trip, John experiences heavy traffic due to construction zones. He averages 36 mph the first 3 hours of his return trip. What is the average speed, in miles per hour, John must drive for the rest of the return trip for a return trip of 7 hours?

F. 42
G. 48
H. 54
J. 63
K. 66

DO YOUR FIGURING HERE.

Use the following information to answer questions 27–29.

At Western High School and Eastern High School, 200 students and 100 students, respectively, were surveyed to determine their fast-food preferences. Each of the 300 students indicated 1 preference among 5 choices, as summarized in the pie charts below.



(Note: Each pie chart is made up of sectors that are proportional in size to the percent of students they represent.)

27. How many students surveyed at Western High School indicated chicken as their preference?

A. 12
B. 17
C. 24
D. 36
E. 40

28. What is the measure, to the nearest 1°, of the central angle of the sector that represents the number of students at Western High School who indicated pizza as their preference?

F. 40°
G. 80°
H. 108°
J. 120°
K. 144°

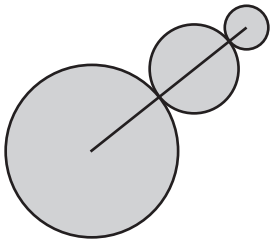
DO YOUR FIGURING HERE.

29. The same survey was taken at Central High School. The percent of students at Eastern High School who indicated chicken as their preference was 1 more than $\frac{1}{2}$ the percent of students at Central High School who indicated chicken as their preference. What percent of students at Central High School indicated chicken as their preference?

A. 3%
B. 4%
C. 8%
D. 9%
E. 12%

---

30. Jermaine will build a metal wall sculpture that is composed of 3 circles of different sizes, shown below. The smallest circle will have a diameter of 8 inches, and the diameters of the 3 circles will be in the ratio of 1:2:4. To reinforce the sculpture, Jermaine will place a straight metal bar from the center of the smallest circle, through the center of the middle circle, to the center of the largest circle. What will be the length, in inches, of the bar?



F. 28
G. 36
H. 56
J. 64
K. 72

31. Juan will flip a fair 2-sided coin and spin a wheel. The coin has 1 heads side and 1 tails side. The wheel has an equal chance of stopping on any one of its 4 sections: red, blue, yellow, and green. What is the probability that the coin lands tails side up and the wheel stops on the green section?

A. $\frac{1}{8}$
B. $\frac{1}{6}$
C. $\frac{1}{3}$
D. $\frac{1}{2}$
E. $\frac{3}{4}$

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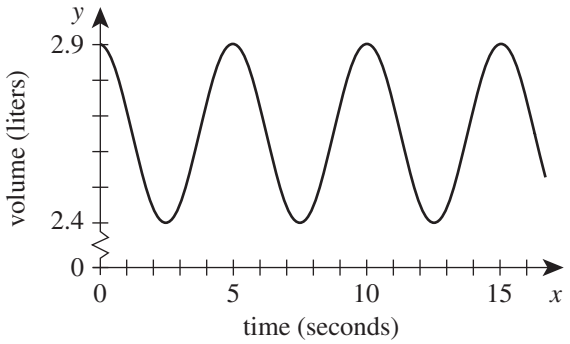
DO YOUR FIGURING HERE.

32. The volume of air, in liters, in the lungs of an average person during normal breathing is a function of time, in seconds. This function is modeled by the sine function graphed in the standard (x,y) coordinate plane below. One of the following values is the period, in seconds, of this function. Which one?



F. 0.5
G. 2.4
H. 2.5
J. 2.9
K. 5.0

33. If $f(x) = 5^x$ and $g(x) = -2$, then $-f(g(x)) = ?$

A. -25

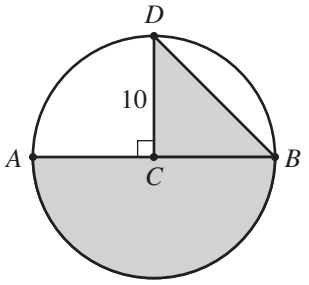
B. $-\sqrt{5}$

C. $-\frac{1}{25}$

D. 2

E. 25

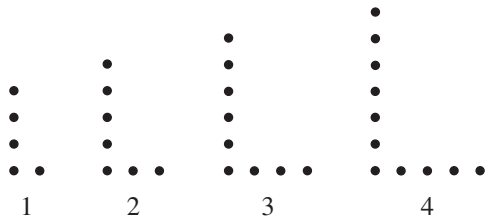
34. In the circle shown below, C is the center, $\overline{AB}$ is a diameter, and $\overline{CD}$ is a radius of length 10 inches that is perpendicular to $\overline{AB}$. Which of the following values is closest to the area, in square inches, of the shaded region (the combined area of the semicircle and $\triangle BCD$) ?



F. 150
G. 186
H. 207
J. 236
K. 264

DO YOUR FIGURING HERE.

35. During one of their routines, the Longsboro High School marching band members line up in a succession of L-shaped formations. The first 4 formations, numbers 1 through 4, are shown below, with each dot representing a band member. The pattern demonstrated by the addition of band members in the first 4 formations continues through each successive L-shaped formation in the routine. Which of the following equations gives the relationship between n, the formation number, and b, the number of band members in that formation?



A. $b = n + 2$
B. $b = n + 4$
C. $b = 2n + 3$
D. $b = 3n + 2$
E. $b = 5n$

36. The Better Cellular Company offers customers 2 monthly plans. Plan A costs \$40.00 per month plus \$0.05 per minute of time used, while Plan B costs \$20.00 per month plus \$0.10 per minute of time used. What is the least whole number of minutes a customer could use in 1 month to make Plan A *less expensive* than Plan B for that month?

F. 50
G. 51
H. 399
J. 400
K. 401

37. Which of the following expressions is equivalent to $\sqrt[4]{81x^{16}}$?

A. $3x^2$
B. $3x^4$
C. $3x^8$
D. $9x^4$
E. $9x^8$

38. A pyramid has a square base with a side length of 6 feet. The volume of the pyramid is 144 cubic feet. What is the height, in feet, of the pyramid?

(Note: The volume of a pyramid with base area B and height h is $\frac{1}{3}Bh$.)

F. 8
G. 12
H. 24
J. 48
K. 72

DO YOUR FIGURING HERE.

39. What is the value of $\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\frac{1}{3}}}}$?

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

B. $\frac{3}{7}$

C. $\frac{7}{11}$

D. $\frac{7}{10}$

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

40. What are all the real solutions to the equation $|1 - 2x| = 3$?

F. $x = -1$ only
G. $x = -1$ and $x = -2$
H. $x = -1$ and $x = 1$
J. $x = -1$ and $x = 2$
K. $x = 1$ and $x = 2$

41. For what value of a would the following system of equations have an infinite number of solutions?

$$2x - 3y = 6$$
$$4x - 6y = 3a$$

A. 2
B. 4
C. 6
D. 12
E. 18

42. In the equation $ax + b = 0$, when a, x, and b are integers and x and b are positive, *a must* be:

F. negative and a factor of b.
G. negative and a multiple of b.
H. positive and a factor of b.
J. positive and a multiple of b.
K. positive and equal to b.

43. Given the complex numbers $2 - i$ and $2 + i$, which of the following expressions is equal to $\sqrt{(2 - i)(2 + i)}$?

A. $\sqrt{3 + 4i}$
B. $\sqrt{5 - 4i}$
C. $\sqrt{5 + 4i}$
D. $\sqrt{3}$
E. $\sqrt{5}$

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44. Which of the following fractions is closest to 0 ?

DO YOUR FIGURING HERE.

F. $-\frac{3}{25}$

G. $-\frac{1}{6}$

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

J. $\frac{1}{8}$

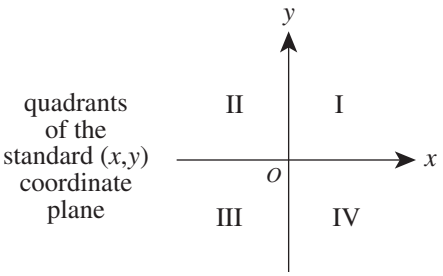
K. $\frac{123}{1{,}000}$

45. A spin of a certain spinner has 5 possible outcomes. The table below shows the probability of spinning each of the 5 outcomes. The probability of spinning Outcome 4 is a and the probability of spinning Outcome 5 is $2a$. What is the value of a ?

Outcome	1	2	3	4	5
Probability	0.20	0.38	0.24	a	$2a$

A. 0.06
B. 0.09
C. 0.12
D. 0.18
E. 0.33

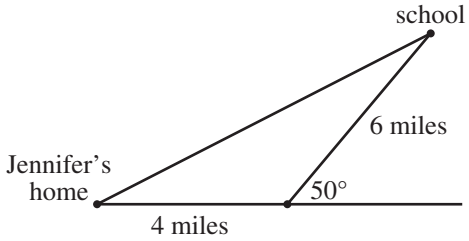
46. The quadrants of the standard (x,y) coordinate plane are shown below. The vertices of $\triangle ABC$ are $A(-3,3)$, $B(-3,1)$, and $C(-1,1)$. The triangle is translated by $x' = x + 5$ and $y' = y - 2$. The image of (x,y) on $\triangle ABC$ is (x',y') on $\triangle A'B'C'$. The vertices of $\triangle A'B'C'$ lie in which quadrant(s)?



F. Quadrant I only
G. Quadrant II only
H. Quadrant III only
J. Quadrants I and IV only
K. Quadrants II and III only

DO YOUR FIGURING HERE.

47. The figure below shows a map of Jennifer's neighborhood.



Which of the following expressions represents the straight-line distance, in miles, from Jennifer's home to school?

(Note: For a triangle with sides of length a, b, and c that are opposite angles $\angle A$, $\angle B$, and $\angle C$, respectively, $\frac{\sin \angle A}{a} = \frac{\sin \angle B}{b} = \frac{\sin \angle C}{c}$ and $c^2 = a^2 + b^2 - 2ab \cos \angle C$.)

A. $\frac{4 \sin(130°)}{\sin(25°)}$

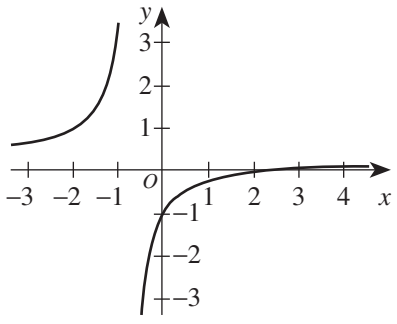
B. $\frac{6 \sin(130°)}{\sin(25°)}$

C. $\sqrt{4^2 + 6^2 - 2(4)(6) \cos(25°)}$

D. $\sqrt{4^2 + 6^2 - 2(4)(6) \cos(50°)}$

E. $\sqrt{4^2 + 6^2 - 2(4)(6) \cos(130°)}$

48. The graph below shows the function $f(x) = \frac{2x - 5}{7x + 5}$ in the standard (x,y) coordinate plane. Which of the following is an equation of the *horizontal* asymptote of $f(x)$?



F. $x = -1$

G. $x = \frac{2}{7}$

H. $y = -1$

J. $y = \frac{2}{7}$

K. $y = \frac{5}{7}$

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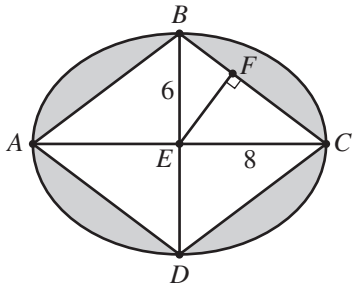
DO YOUR FIGURING HERE.

Use the following information to answer questions 49–51.

In the ellipse shown below, $\overline{AC}$ is the major axis with length 16 feet, $\overline{BD}$ is the minor axis with length 12 feet, and E is the center. Point F lies on side $\overline{BC}$ of the inscribed rhombus $ABCD$.



49. For any ellipse, the area is πab, where a and b are half the lengths of the major and minor axes, respectively. What is the area, in square feet, of the shaded region (the region outside the rhombus and inside the ellipse)?

A. $12\pi - 24$
B. $12\pi - 48$
C. $48\pi - 48$
D. $48\pi - 96$
E. $192\pi - 96$

50. Which of the following expressions gives the measure of $\angle EBC$?

F. $\sin^{-1}\left(\frac{3}{5}\right)$
G. $\sin^{-1}\left(\frac{3}{4}\right)$
H. $\tan^{-1}\left(\frac{3}{4}\right)$
J. $\tan^{-1}\left(\frac{4}{3}\right)$
K. $\cos^{-1}\left(\frac{4}{5}\right)$

51. The *eccentricity*, e, of an ellipse is a measure of the flatness of the ellipse. The eccentricity of a circle is 0. The value of e is given by the ratio $\frac{\sqrt{a^2 - b^2}}{a}$, where a and b are half the lengths of the major and minor axes, respectively. Which of the following intervals contains the value of e for this ellipse?

A. $0.0 < e < 0.2$
B. $0.2 < e < 0.4$
C. $0.4 < e < 0.6$
D. $0.6 < e < 0.8$
E. $0.8 < e < 1.0$

DO YOUR FIGURING HERE.

52. Given the recursive formula below, which of the following equations is a correct explicit formula for the sequence?

$$a_1 = 10$$
$$a_{n+1} = 2a_n$$

F. $a_n = 8 + 2n$
G. $a_n = 9 + n$
H. $a_n = 9 + 2^n$
J. $a_n = 10(2^n)$
K. $a_n = 10(2^{n-1})$

53. A toddler has 2 sets of blocks. The blocks within each set are equal-sized cubes. The blocks within one set are smaller than the blocks within the other set. The edge length of each smaller block is $\frac{1}{2}$ the edge length of each larger block. How many of the smaller blocks must be stacked together to create an arrangement with the same volume as 1 larger block?

A. 8
B. 6
C. 4
D. 3
E. 2

54. What is the determinant of the matrix $\begin{bmatrix} 10 & 8 \\ 20 & 12 \end{bmatrix}$?

F. −40
G. −6
H. 40
J. 104
K. 160

55. A different whole number from 1 through 150 will be painted on each of the 150 parking spaces in a new parking lot. Each number will be painted using a minimum number of digits. For example, for space 15, 2 digits, 1 and 5, will be painted, and for the first 15 spaces, a total of 21 digits will be painted. In total, how many digits will be painted for all 150 parking spaces?

A. 150
B. 287
C. 337
D. 339
E. 342

DO YOUR FIGURING HERE.

56. How many seating arrangements are possible for 5 people to sit in the 5 seats of a car if 1 person sits in each seat and only 3 of the 5 people can sit in the driver's seat?

F. 10
G. 12
H. 24
J. 72
K. 120

57. Let x be an odd integer greater than 1, and let $b = x - 1$. The equation $\log_b a = x$ is true. Which of the following phrases describes every value of a ?

A. Odd only
B. Odd or 0 only
C. 0 only
D. Odd and 0 only
E. Even and nonzero only

58. Quadrilateral $ABCD$ in the standard (x,y) coordinate plane has these 4 vertices: $A(0,6)$, $B(-1,1)$, $C(3,1)$, and $D(3,6)$. Which of the following categories most precisely describes this quadrilateral?

F. A parallelogram
G. A rhombus
H. An isosceles trapezoid
J. A quadrilateral that is not a trapezoid
K. A nonisosceles trapezoid

59. In the polynomial expansion of $(x + y)^5$, what is the coefficient of the x^2y^3 term?

A. 1
B. 4
C. 6
D. 10
E. 15

60. Meg has a bucket of plastic balls. Exactly 20% of these balls are yellow, and the rest are white. Some of the balls have a star on them. Exactly 6% of the balls are yellow and have a star on them. Meg will randomly draw 1 ball from the bucket. If the drawn ball is yellow, what is the probability that it will have a star on it?

F. 0.012
G. 0.030
H. 0.120
J. 0.260
K. 0.300

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.

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READING TEST

35 Minutes—40 Questions

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

Passage I

LITERARY NARRATIVE: This passage is adapted from *Unless: A Novel* by Carol Shields (©2002 by Carol Shields).

From my mother I developed my love of flowers. Their shapes came folded inside tiny seeds, so small that fifty of them filled the bottom of a flat seed packet. They were miraculously encoded from the beginning, little specks of dark matter that we shook into our hands, then sowed into flower beds. They sprouted, then opened out in a studied and careful program of increments. Now, that was astonishing, all those compressed unfoldings and burstings, but no one said so. No one made a fuss when the seeds actually performed: sprouts, leaves, the long rivery stems, and finally the intricacy of blossoms. I liked to tear the silk of the petals between my fingers, rubbing the pollen into my hands. "But that isn't nice, Reta," my mother said. "Why would you want to hurt a beautiful flower?" I didn't believe this, that flowers hurt, but nevertheless I didn't do it again. I was the inept child searching for those moments of calm when I would find adult validation or at least respite from my endless uncertainty.

I once scratched the banister with a spoon. My mother rubbed it with butter, and the scratch went away. She had no idea I had done it, her little girl wouldn't do a thing like that. With great good nature they laughed when I said eggshells were made of plastic, and also when I asked my father if we could buy some icicles, long sculptured fingers of silvery ice that lasted all winter. "Our little Reta," they said, laughing. I was afraid of drowning in their approval. There was nothing hard to hang on to.

I had no siblings, but I closely observed small babies who entered our house, the children of my parents' friends. There they lay, tiny, bundled, smelling like spoiled milk, wound tight in fleece blankets. From the beginning I saw that they possessed a patient evenness of curiosity that reduced and simplified the mysteries thronging our household. They didn't worry as I did about the halo around the head of the baby Jesus, what it was made of, what kept it hovering over his head and traveling along with him wherever he went. They put their small hands on the plastic-ribbed face of the radio in the kitchen and laughed at the vibrations that poured out. I could see that they accepted simple electrical transmission for what it was, whereas I had special knowledge available to me: I knew there were little people living inside the radio's shell, the obliging citizens of a miniature village that clung to a steep dark mountain.

It wasn't neglect that spawned the ignorance I was captive to. Adults were too busy to deliver complicated explanations. In fact, it was partly the busyness of my parents that frightened me, the frantic responsibility that preoccupied them. Their job was to keep us alive. It never occurred to them that I worried about the fact that I could see through my nose when I looked to the left or right, straight through, except for the fleshy blurred outline. And certainly neither of them stopped to express their own bafflement about the universe they inhabited, that they too might be swamped by barely grasped concepts. My slender, long-legged father patrolling the garden, leaning down to inspect an iris; he possessed a gardener's watchfulness and did not appear to reel with wonder at this serenely formal flower, that its cape and collar opened out of a tightly packed bulb, every part of it predestined and perfectly in place. He was a dealer in early Canadian pine furniture and as a sideline worked as a distressor; that is, he took modern limited editions of books and battered their pages and their boards into decent old age, giving them the tact and smell of history.

The moon followed me. When I staggered, seven years old, across the grass in the backyard, my head thrown back, willing myself to be dizzy, I could see how the moon lurched along with my every step, keeping me company as I advanced toward the peony bed. Why, out of all the people in the world, had I been chosen as the moon's companion? What did this mean? Honour, responsibility, blame, which?

I confided to my friend Charlotte this curious business about the moon. But she insisted that, on the contrary, the moon followed her. So back to back, at the end of the lane we paced off steps, she one way, I the other. Immediately I grasped the fact that the moon followed everyone. This insight came mostly as a relief, only slightly tarnished with disappointment.

The fact is, I didn't need to know everything and no one expected it of me in the first place.

1. The point of view from which the passage is narrated is best described as that of:

- **A.** a young child describing what interests her.
- **B.** a young child explaining her disappointments to her parents.
- **C.** an adult remembering her childhood perceptions of the world.
- **D.** an adult contrasting her observations of the world with those of her child.

2. Details in the third paragraph (lines 30–47) serve primarily to develop a contrast between the:

- **F.** dull routines of the babies and the reckless inattention of the narrator.
- **G.** energy of the babies and the calm detachment of the narrator.
- **H.** sweetness of the babies' exploration and the bitterness of the narrator's feelings toward them.
- **J.** contentment that the babies' ignorance permits and the anxiety that the narrator's knowledge produces.

3. It can most reasonably be inferred that the narrator reacted to her father's patrolling of the garden with:

- **A.** admiration; she was impressed by her father's benevolent cultivation of the irises.
- **B.** puzzlement; she noticed that her father did not marvel at the irises' blossoms.
- **C.** excitement; she anticipated the fun of working with her father in the garden.
- **D.** fear; she thought her father might trample the perfectly formed irises.

4. The phrase "studied and careful program of increments" (lines 7–8) most nearly means that the flowers' growth was:

- **F.** understood only by those familiar with gardening.
- **G.** easily disrupted by human interference.
- **H.** miraculously haphazard and surprising.
- **J.** exact and predetermined by nature.

5. Which of the following statements best captures the main idea of lines 17–19?

- **A.** The narrator looked for rare moments when adults in her life were able to alleviate her feelings of inadequacy and confusion.
- **B.** The narrator became increasingly angry with the adults in her life who refused to help answer her questions.
- **C.** The narrator felt increasingly confused by the numerous but conflicting explanations offered by adults.
- **D.** The narrator searched for moments when she felt free from constant adult supervision.

6. The narrator indicates that her mother would have reacted to the news that the narrator scratched the banister with a sense of:

- **F.** anger that her daughter would intentionally disobey her.
- **G.** sympathy for her daughter's need to explore the world.
- **H.** disbelief that her daughter would behave badly.
- **J.** annoyance with her daughter for her carelessness.

7. Lines 28–29 suggest that the narrator found her parents' approval to be:

- **A.** cynical.
- **B.** fulfilling.
- **C.** enlightening.
- **D.** overwhelming.

8. As it is used in line 29, the word *hard* most nearly means:

- **F.** burdensome.
- **G.** tangible.
- **H.** formidable.
- **J.** rugged.

9. The passage suggests that when the narrator's father gave books the "tact and smell of history" (line 69), he was:

- **A.** making modern books appear old.
- **B.** restoring damaged pages of antique books.
- **C.** verifying the age of a limited edition.
- **D.** destroying old books that were no longer useful to him.

10. According to the passage, when the narrator realizes that the moon follows everyone, she feels a little disappointed but primarily:

- **F.** jealous.
- **G.** angry.
- **H.** relieved.
- **J.** surprised.

Passage II

SOCIAL SCIENCE: This passage is adapted from *Extra Virginity: The Sublime and Scandalous World of Olive Oil* by Tom Mueller (©2012 by Tom Mueller).

"If I were a king, I'd eat nothing but fat." Thus a seventeenth-century farmer expressed his longing for triglycerides, both saturated and unsaturated, five centuries before they fell from medical and culinary favor—and before hydrogenation made them dangerous. Fats and oils are a remarkably efficient fuel, not only for lamps and furnaces and the olive's germinating seed, but for people as well. In times of unrelenting manual labor and ever-present cold, when most people's main preoccupation was how to fill their bellies, fatty foods were associated with health and prosperity.

But which fat to choose—saturated or unsaturated? Animal fat or olive oil? By the late Middle Ages in Europe, the battle line between these ancient antagonists more or less followed the modern border between Tuscany to the south and Emilia-Romagna to the north. South of this line, olive oil was the favored condiment for vegetables, soups, and fish both grilled and fried. To the north, in Italy and beyond the Alps, where olive trees didn't thrive because of the cold, a few olive oil aficionados existed among the upper classes, but animal fat held sway among the masses except during Lent and fast days. Northern Europeans had mixed emotions about olive oil. They prized it for its sacred symbolism and medicinal properties, yet disliked its bitterness and bite, so different from the sweet animal fats used to season their native comfort foods. If they ate olive oil at all, they preferred milder oils like those grown on the shores of Lake Garda, but often enough they simply kept the substance well away from their mouths. Hildegard of Bingen, the German abbess, mystic, poet, and polymath, spoke for many northerners when she concluded that olive oil was excellent medicine but miserable food, which "causes nausea when eaten, and ruins other foods when cooked together with them." Or perhaps Hildegard and her sisters were getting bad oil. Thomas Platter, an English traveler of the late sixteenth century, observed that only low-grade olive oil reached northern Europe, pressed from the lees after the good oil had already been extracted.

A new campaign in the enduring culinary war between olive oil and animal fat began in the fifteenth century, with the triumphant arrival of butter. This invasion came about through subtle changes in dietary custom, and a gradual loosening of Rome's grip on food that occurred in the run-up to the Reformation. In certain areas of northern Europe, where no olives grew and residents had little taste for oil, modifications in canon law permitted the consumption of butter during Lent and fast days, opening the door to widespread substitution of butter for olive oil.

French and English cooks began to replace olive oil with this milder-tasting fat, long a part of their indigenous cuisine, and to weed out Mediterranean influences in their cooking. As far south as Sicily, certain gastronomes and gourmands sang the praises of this wondrously sweet new condiment. In his influential cookbook *Libro de Arte Coquinaria*, written about 1450, Maestro Martino, court chef to the patriarch of Aquileia, instructs his readers to prepare *maccaroni siciliani* with fresh butter and spices rather than with oil. A contemporary play has a group of Venetian gentlemen sitting down to plates of *maccaroni* covered with vast quantities of cheese, cinnamon, sugar, and "so much butter that they swam in it." Butter even worked its way into the dreams of the poor, like the family of sharecroppers in Modena who left their fields and moved across the river into Lombardy, "because there, it's said, you get gnocchi with plenty of cheese, spices, and butter." From the fifteenth century down through the nineteenth, the struggle between oil and butter was brought to life in European paintings, literature, and street dramas.

Still, most southern Europeans remained faithful to olive oil, not only because of their ancient devotion to Mediterranean fare but because butter struck many of them as unnatural, even dangerous. Nobles at the court of Mantua packed ample stores of *oleum bonum* for a journey to England, and the cardinal of Aragon, travelling in the Low Countries in 1517, brought along his personal cook and a generous supply of olive oil. If some chefs pushed butter, others championed oil: a new generation of cookbooks appeared in the fifteenth and sixteenth centuries, primarily in southern Italy, which proposed an exciting new multiethnic Mediterranean cuisine oozing with oil.

11. The passage as a whole can best be described as:

- **A.** an argument that olive oil is a better source of nutrition than is butter, as evidenced by the health of Europeans from France to southern Italy.
- **B.** an examination of where, when, and to what degree butter replaced olive oil as a prized ingredient in the European diet.
- **C.** an overview of the role religion has played in determining the diet of Europeans since the seventeenth century.
- **D.** a comparison of olive oil and other types of cooking oils in terms of their culinary merits and health benefits.

12. Which of the following words is used in the passage in a way that is more figurative than literal?

- **F.** Lamps (line 7)
- **G.** Seed (line 8)
- **H.** Mouths (line 31)
- **J.** Door (line 51)

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13. Within the passage, the quotation in line 1 serves which of the following functions?

I. It sets up a discussion of a historical food trend by starting with a related hyperbole.
II. It establishes the passage's tone of sarcasm.
III. It expresses the passage author's attitude toward the misuse of political power.

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

14. In the context of the passage, what is the significance of Hildegard of Bingen?

F. She played a role in changing official church policy toward the consumption of butter.
G. She advanced the popularity of olive oil by writing poems in praise of olives.
H. Her mixed reaction to olive oil was typical of many northern Europeans of her time.
J. Her recipes are typical of those that turned Europeans away from butter.

15. The phrase "this wondrously sweet new condiment" (line 58) refers to:

A. *oleum bonum*.
B. butter.
C. oil pressed from olives grown near Lake Garda.
D. olive oil pressed from the lees.

16. The reference in the passage to Maestro Martino's cookbook primarily serves to support the point that:

F. southern Europeans were slow to accept butter as a desirable ingredient in traditional dishes.
G. Italian chefs more than French chefs considered butter and olive oil to be staples of their cooking.
H. royalty in Europe pressed their chefs into writing cookbooks to promote certain ingredients.
J. in the fifteenth century, butter's popularity was growing where olive oil had been the favored fat.

17. It can most reasonably be inferred from the last paragraph that the nobles who traveled from Mantua to England took olive oil with them primarily to:

A. trade for butter.
B. sell to the local chefs.
C. consume during their stay.
D. offer as a gift to their hosts.

18. The passage refers to which of the following as making fats dangerous?

F. Hydrogenation
G. A gradual loosening of Rome's grip on food
H. Ever-present cold
J. Modifications in canon law

19. The passage indicates that northern Europeans' attitudes toward olive oil were shaped in part by:

A. temperatures that fueled appetites for rich foods.
B. a climate that is not conducive to growing olives.
C. a growing belief that fatty foods are not healthy.
D. royalty who disdained olive oil.

20. According to the passage, one reason southern Europeans preferred olive oil to butter is that they viewed olive oil as:

F. consistently cheaper.
G. easier to store.
H. milder tasting.
J. more natural.

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Passage III

HUMANITIES: Passage A is adapted from the book *A Natural History of the Piano* by Stuart Isacoff (©2011 by Stuart Isacoff). Passage B is adapted from the essay "Oscar Peterson, My Teacher" by Mike Longo (©2011 by Stuart Isacoff).

Passage A by Stuart Isacoff

For Oscar Peterson the piano had long been a trusted companion—sparking early dreams, conferring a place in the history books, and easing his way in a world of racial strife. Now, at eighty-one, he looked worn out. Arriving at the stage of New York's landmark jazz club Birdland, he struggled to move onto the piano bench.

Yet, as soon as the keyboard was within reach, he thrust out his right arm and grabbed a handful of notes; at that signal, the bass player, drummer, and guitarist launched into their first number. And suddenly there was that sound. He still had it—a musical personality as large as life, steeped in tradition yet recognizably, unmistakably all its own.

For dazzling technique, he followed the lessons of the European classical tradition, culled from childhood sessions first with his sister, Daisy, then with local pianist Louis Hooper and the Hungarian teacher Paul de Marky. He was so serious about his lessons as a young boy that he would practice for up to eighteen hours at a time, he said, on days "when my mother didn't drag me off the stool." De Marky was a good model: he had studied in Budapest with Stefan Thomán, who had studied with the great Franz Liszt—a musical titan of his day and the founder of modern piano technique.

De Marky trained Peterson in that great tradition, and assigned the pianist other staples of the repertoire, such as Chopin's treacherously difficult Etudes. And as he taught Peterson, Paul de Marky honed in on Chopin's most important trait. "I don't hear the melody singing," he would tell his student. "The melody is choppy. Make it sing." And so the works of the celebrated classical composers—great improvisers, all—served as his training ground.

Paul de Marky also encouraged Oscar Peterson's immersion in the jazz canon. Peterson remembered, "What I loved about him was that he was not shortsighted. He was a fantastic classical pianist. But I would come to him for a lesson, and he'd be playing jazz records"—greats like Teddy Wilson, Nat "King" Cole, and Duke Ellington. "Their playing served as my rudiments," he reported.

Oscar Peterson's rise to the top of the jazz pantheon was based on a formula that merged the classical European tradition and the homespun American one. But he focused especially on a common denominator he had found in the approach of all the greats: their refusal to settle for anything less than a full command of their resources. "I never tried to sound like a trumpet or a clarinet," he said. "I was taught to respect [this instrument] for what it was: a piano. And it spoke with a certain voice." He had always striven, he explained, to be the kind of musician who could take advantage of the entire keyboard, of everything the instrument was capable of producing.

Passage B by Mike Longo

During the 1960s I had the honor of being Oscar Peterson's private student. He and some colleagues had started a school for contemporary music, and though there had to be around fifty students, after about two or three weeks he took me under his wing. From that time on, I saw him three or four times a week, instead of the usual once. He gave me the key to his studio so I could practice on his piano. That was necessary, because he had me practicing thirteen hours a day.

He transformed my playing. I had already graduated college as a piano major, but no one had ever spoken to me about my physical approach to the instrument. I was playing with my wrist down. He had me raise it, and taught me to play without a lot of arm weight. The technique originated with Liszt; it allows you to strike the keys without ever exerting yourself.

He also taught me the true meaning of piano "style," which has to do with developing a personal sound. Think of all the jazz organists, he said, who each have a tremendous number of "stops" at their disposal, mechanical devices on the instrument that change the quality of the sound. Despite that variety of choice, they all use the same ones, so every jazz organist ends up sounding exactly like Jimmy Smith, the jazz master who popularized the instrument. To have real style, he explained, means to create a sound that is instantly recognizable as yours.

So Oscar Peterson didn't let his students play like him—or like anybody else, for that matter. One day I was using chord voicings [particular spatial arrangements of the tones in a harmony] like those of Bill Evans and he yelled: "You know that's not you!" He had a formula for achieving beautiful results at the piano. He called it "the five T's": touch, time, tone, technique, and taste. Of course, he had them all.

Questions 21–24 ask about Passage A.

21. The author of Passage A characterizes Peterson's musical style as:

- **A.** predictable and clichéd, borrowing from antiquated styles.
- **B.** eccentric and radical, rejecting established techniques.
- **C.** distinctive and eclectic, drawing from multiple traditions.
- **D.** spontaneous and variable, changing from show to show.

22. Beginning with the third paragraph (lines 15–25), the focus of Passage A shifts from a description of one of Peterson's performances to:

F. a discussion of the origins of Peterson's technique.
G. an analysis of how Peterson's playing changed in his later years.
H. an explanation of the European classical tradition.
J. a description of Peterson's style as a piano teacher.

23. The author of Passage A bases the claim that de Marky was a good model for Peterson most directly on the fact that de Marky:

A. was known to practice piano for up to eighteen hours at a time.
B. was known as the founder of modern piano technique.
C. had studied piano technique in many different countries.
D. had been taught piano technique by a student of Liszt.

24. Which of the following statements best captures what Peterson loved about de Marky's habit of playing jazz records?

F. De Marky, realizing classical piano would be displaced by jazz, trained himself in jazz piano techniques.
G. De Marky, in an effort to challenge Peterson, asked him to identify classical techniques in jazz music.
H. De Marky, despite being a dedicated classical pianist, was open-minded enough to enjoy jazz music.
J. De Marky, knowing Peterson wanted to play jazz, purchased records for him to study.

Questions 25–27 ask about Passage B.

25. Passage B can best be described as:

A. an analysis of how the author's current musical career reflects Peterson's influence.
B. a critical review of Peterson for teaching lessons from the European classical tradition.
C. an account of what surprised the author about Peterson's personality.
D. a recollection of what the author learned as Peterson's student.

26. Passage B indicates that, compared to the author's prior piano training, Peterson's training taught the author more about:

F. the different parts of the instrument.
G. the author's physical approach to the instrument.
H. which jazz masters to emulate.
J. the history of classical music.

27. Peterson's example regarding jazz organists, as it is presented in Passage B, indicates that piano players who want to develop a personal sound should avoid:

A. studying solely the music of classical composers.
B. using mechanical devices to alter the instrument's sound.
C. limiting themselves to the styles used by jazz masters.
D. following a formula for beautiful playing.

Questions 28–30 ask about both passages.

28. Both passages suggest that a key component of Peterson's musical talent is his:

F. innovative, self-taught technique.
G. rigorous study of legendary jazz musicians.
H. perseverance in overcoming life's obstacles.
J. attainment of a recognizable personal sound.

29. Both passages most strongly suggest that Peterson viewed the piano as an instrument that:

A. sounds best when accompanied by other instruments.
B. accommodates a range of different musical styles.
C. has a history of merging cultural traditions.
D. can be mastered without learning classical techniques.

30. Of the musical training experiences described in Passage A, which experience does Passage B seem to suggest Peterson considered important to require of his own students?

F. Practicing for many hours a day
G. Taking lessons from a number of teachers
H. Listening to recordings of great jazz musicians
J. Studying the musical traditions of several nations

Passage IV

NATURAL SCIENCE: This passage is adapted from the article "Gene Behind van Gogh's Sunflowers Pinpointed" by Helen Thompson (©2012 by Nature Publishing Group).

A team of plant biologists has identified the gene responsible for the 'double-flower' mutation immortalized by painter Vincent van Gogh in his iconic *Sunflowers* series.

Van Gogh's 1888 series includes one painting in which many of the flowers depicted lack the broad dark centre characteristic of sunflowers and instead comprise mainly golden petals. This was not simply artistic license on van Gogh's part but a faithful reproduction of a mutant variety of sunflower. Researchers at the University of Georgia report that they have pinned down the gene responsible for the mutation, which could shed light on the evolution of floral diversity.

A wild sunflower is not so much a single flower as a composite of tiny florets. The golden ray florets, located at the sunflower's rim, resemble long petals, are bilaterally symmetrical and do not produce pollen. That job belongs to the disc florets, tiny radially symmetrical blossoms that occupy the sunflower's darker centre. In combination, the two types of florets create the impression of a single large flower, and presumably an attractive target for insect pollinators.

Because changes in floral symmetry can affect how a plant interacts with pollinators—and therefore its reproductive fitness—the unusual sunflowers depicted by van Gogh piqued plant biologist John Burke's curiosity.

He says that the diversity of traits seen in many species of flowering plants are thought to be related to the '*CYC*-like' class of genes, named after the gene *CYCLOIDEA*. *CYC*-like genes control DNA transcription and influence floral morphology in *Gerbera* daisies and flowering weeds from the *Senecio* genus—which belong to the same family as sunflowers—but their function in sunflowers has been less understood.

"It's been hypothesized that these genes could be responsible for driving the evolution of floral head diversity," says Burke.

Double-flowered mutants present geneticists with a practical challenge as their relative lack of pollen makes it difficult to generate offspring. To surmount this, the researchers began by crossing a wild-type sunflower with a partial double-flowered mutant and then allowing the offspring to self-pollinate. Among the offspring was a new mutant with 'tubular' flowers, so named because of their resemblance to soda straws. The researchers soon traced the differences between mutant and wild-type sunflowers to insertions of chunks of DNA in the gene *HaCYC2c*. In the double-flowered mutants, there was one insertion; in the tubular flowers, there were two.

Previous studies had shown that *HaCYC2c* is highly expressed in ray flowers. The researchers found that in the double-flowered mutants, the first insertion increased *HaCYC2c* expression in all floral tissues, causing the centre disc flowers to appear more ray-like. In the tubular mutants, the second insertion mutation stops transcription of the gene, preventing proper ray flowers from forming.

"It looks like this gene is a key player in determining ray versus disc morphology in sunflowers," says Burke. "Basically, if you turn the gene on in the wrong place, it'll cause disc flowers to look like ray flowers. Conversely, if you knock the gene out, it causes the ray flowers to become more disc-like."

The researchers constructed a family tree tracking *HaCYC2c* over different sunflower family species. The results suggest that mutations in the gene evolved independently to influence floral shape, confirming earlier studies.

Because sunflowers can reproduce by self-pollination and cross-pollination between individuals, it is possible that the mutations leading to tubular florets represent an adaptation. Ray flowers produce no pollen but attract pollinators, so the mutation could be an advantage in circumstances in which only self-pollination is likely. "When the plants are invading a new area, and there aren't as many pollinators—why put energy into a ray floret when you don't need to attract pollinators?" says Richard Abbott, a biologist.

In contrast, the double-flowered mutation immortalized by van Gogh is unlikely to have been an adaptive feature, as such plants would have difficulty reproducing. "This sort of thing would be selected against under natural conditions," says Mark Chapman, a co-author. "This was presumably a random mutation."

In fact, says Chapman, it is likely that human plant breeders have perpetuated the mutation because of its striking appearance. But although the mutation it carries conveys a disadvantage, it has offered a window into the evolutionary history of the sunflower family.

31. The passage presents a study that examines the genetic differences among which of the following sets of three sunflower varieties?

- **A.** Wild, double-flowered, and tubular
- **B.** Mutant, golden, and composite
- **C.** Wild, daisy-like, and flowering
- **D.** Self-pollinating, cross-pollinating, and *HaCYC2c*

32. The main purpose of the third paragraph (lines 14–22) is to:

- **F.** indicate that wild sunflowers are unattractive to insect pollinators.
- **G.** explain how a wild sunflower's disc florets blossom.
- **H.** describe some of the physical characteristics of a wild sunflower.
- **J.** suggest that wild sunflowers are actually one single large flower.

33. As it is used in line 9, the word *faithful* most nearly means:

- **A.** sacred.
- **B.** resolute.
- **C.** affectionate.
- **D.** accurate.

34. It can reasonably be inferred from the passage that unlike the bilaterally symmetrical blossoms of a wild sunflower, the radially symmetrical blossoms:

- **F.** have golden petals.
- **G.** attract light.
- **H.** have long petals.
- **J.** produce pollen.

35. According to the passage, what role did van Gogh's painting of mutated sunflowers play in the study presented in the passage?

- **A.** The painting revealed that artists often take creative license when representing objects in nature, contradicting Burke's findings that the sunflowers existed.
- **B.** The sunflowers in the painting confirmed Burke's hypothesis that mutant sunflowers were primarily cultivated naturally in the late nineteenth century.
- **C.** The unusual sunflowers depicted in the painting intrigued Burke and prompted him to study the mutation and its existence.
- **D.** The painting demonstrated that van Gogh was familiar with plant biology and early theories about genetic mutations.

36. The passage states that changes in floral symmetry are important because they:

- **F.** lead to the creation of tubular flowers.
- **G.** affect a plant's reproductive fitness.
- **H.** indicate an increase in a flower's pollen.
- **J.** suggest a need for greater floral diversity.

37. According to the passage, what do *Gerbera* daisies, sunflowers, and flowering weeds from the *Senecio* genus have in common?

- **A.** They are from the same family of flowers.
- **B.** They are mutant varieties of their respective species.
- **C.** They are composed of mostly ray florets.
- **D.** They are identical in their DNA makeup.

38. It can reasonably be inferred from the passage that the practical challenge geneticists face when studying double-flowered mutants is that the flowers:

- **F.** are comprised of the same genetic structure with each new generation of mutations.
- **G.** have a genetic structure that is often confused with that of *Gerbera* daisies.
- **H.** lack the gene *HaCYC2c*, complicating the study of floral head diversity for geneticists and plant biologists.
- **J.** have difficulty reproducing, making it challenging for geneticists to identify patterns across generations.

39. As it is used in line 42, the word *crossing* most nearly means:

- **A.** navigating.
- **B.** breeding.
- **C.** marking.
- **D.** bisecting.

40. The passage states that although the mutated sunflowers depicted in van Gogh's painting are at a disadvantage, studying the mutation is important because it:

- **F.** immortalizes van Gogh's iconic series as a true representation of sunflowers.
- **G.** proves that sunflowers are more than just flowering weeds.
- **H.** sheds light on the evolutionary history of the sunflower family.
- **J.** refutes the claim that plant breeders have perpetuated the mutation because of its striking appearance.

END OF TEST 3

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

DO NOT RETURN TO A PREVIOUS TEST.

SCIENCE TEST

35 Minutes—40 Questions

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

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

Passage I

The 4 common *halide ions* are fluoride (F^-), chloride (Cl^-), bromide (Br^-), and iodide (I^-). A halide in solution can be identified by mixing the solution with various test solutions and observing the *precipitates* (solids), if any, that form.

Table 1 shows the results of mixing each of 4 colorless aqueous halide solutions with a colorless aqueous test solution containing calcium (Ca^{2+}), silver (Ag^+), thallium (Tl^+), or lead (Pb^{2+}).

Table 2 shows the results of mixing each of 2 colorless aqueous solutions (A and B) with each test solution. Each of Solutions A and B is a combination of 2 of the halide solutions.

Table 1

Halide in aqueous solution	Appearance of halide solution after mixing with an aqueous test solution of:			
	Ca^{2+}	Ag^+	Tl^+	Pb^{2+}
F^-	shiny white precipitate	NP*	NP*	dull white precipitate
Cl^-	NP*	cloudy white precipitate	dull white precipitate	shiny white precipitate
Br^-	NP*	cloudy yellow precipitate	faint yellow precipitate	shiny white precipitate
I^-	NP*	cloudy yellow precipitate	bright yellow precipitate	bright yellow precipitate

*No precipitate formed.

Table 2

Solution	Appearance of halide solution after mixing with an aqueous test solution of:			
	Ca^{2+}	Ag^+	Tl^+	Pb^{2+}
A	shiny white precipitate	cloudy white precipitate	dull white precipitate	mixture of shiny white and dull white precipitates
B	shiny white precipitate	cloudy yellow precipitate	faint yellow precipitate	mixture of shiny white and dull white precipitates

1. Table 1 shows the results of how many total tests?

A. 4
B. 8
C. 11
D. 16

2. Based on Table 1, mixing the Br^- solution with which of the test solutions listed below results in the formation of a precipitate having a yellow color?

I. The Ag^+ solution
II. The Tl^+ solution
III. The Pb^{2+} solution

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

3. When *sodium iodide* (NaI) is dissolved in water, Na^+ and I^- ions are produced. Based on Table 1, mixing a colorless aqueous solution of NaI with the Ag^+ test solution would most likely result in the formation of:

A. no precipitate.
B. a cloudy yellow precipitate.
C. a cloudy white precipitate.
D. a shiny white precipitate.

4. Suppose that Solution A and Solution B are combined to produce colorless Solution C. Based on Table 2, if Solution C is mixed with the Tl^+ test solution, what will the result be?

F. A shiny white precipitate
G. A dull white precipitate
H. A mixture of shiny white and faint yellow precipitates
J. A mixture of dull white and faint yellow precipitates

5. Based on Tables 1 and 2, which 2 halide ions are NOT present in Solution B ?

A. F^- and Br^-
B. F^- and I^-
C. Cl^- and Br^-
D. Cl^- and I^-

6. When each of the 4 halide solutions is mixed with the Ca^{2+} test solution, only 1 precipitate forms. This precipitate most likely has what chemical formula?

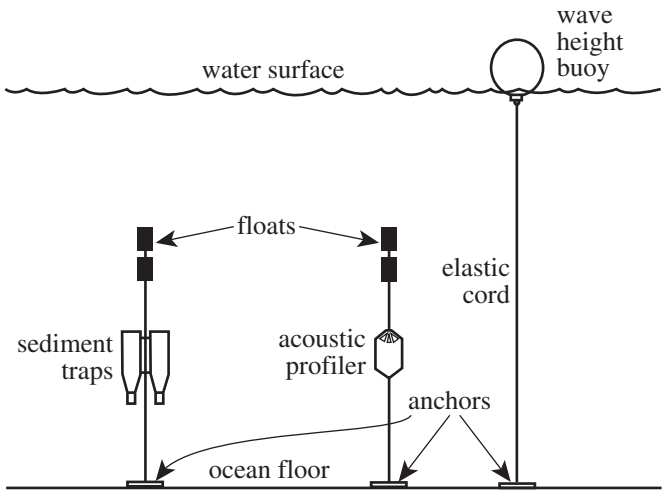
F. CaF
G. Ca_2F
H. CaF_2
J. CaF_3

Passage II

A study performed at a site off the Mediterranean coast examined how an ocean storm during the winter affected wave height, current speed, and the rate of sedimentation.

Study

Before the winter storm season began, 3 types of instruments were anchored to the ocean floor in water 26 m deep (see Figure 1). A *wave height buoy*, which was attached to its anchor with an elastic cord, contained a device that measured its vertical movements in the waves. An *acoustic profiler*, fixed in position 2.5 m above the ocean floor, used sound waves to measure the horizontal speed of the ocean current at that depth. A pair of *sediment traps*, fixed at the same distance above the ocean floor as the acoustic profiler, collected sediment that settled out of the water.



Note: Drawing is not to scale.

Figure 1

From November 4 to November 24, the average wave height, in meters (m), and the average current speed, in centimeters per second (cm/sec), were determined daily (see Figures 2 and 3, respectively). The mass of sediment, in grams (g), deposited per square meter (m^2) of ocean floor per day (the *sedimentation rate*) was also determined daily over those 21 days (see Figure 4). A strong storm affected the site beginning the morning of November 12.

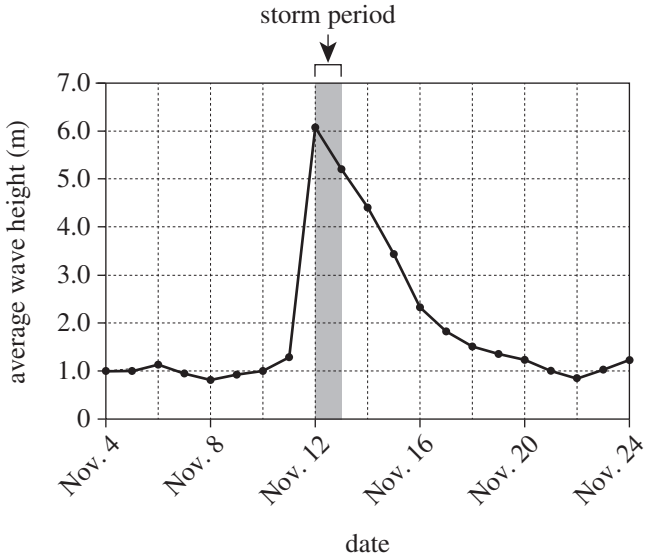


Figure 2

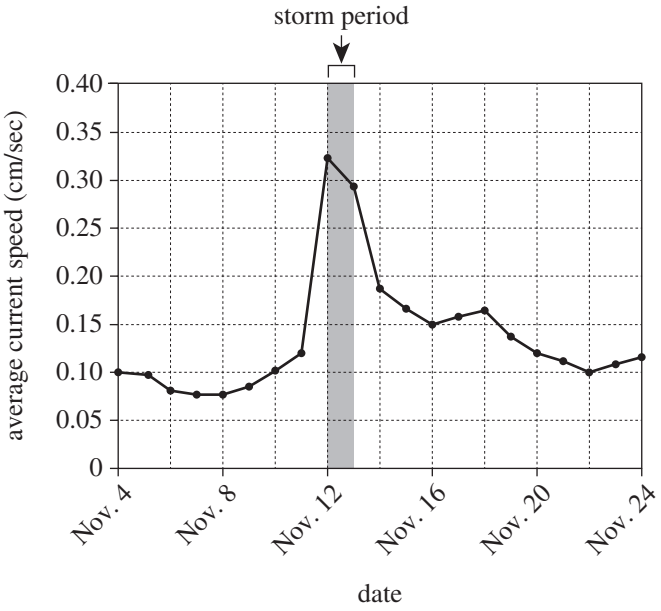


Figure 3

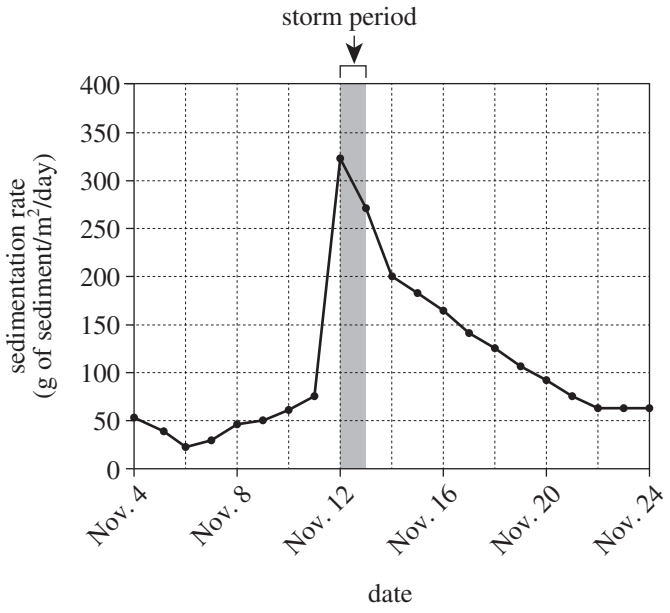


Figure 4

Figures adapted from Antoine Grémare et al., "The Effects of a Strong Winter Storm on Physical and Biological Variables at a Shelf Site in the Mediterranean." ©2003 by Elsevier SAS.

7. Based on Figure 2, were ocean waves *absent* on any of the days from November 4 to November 24 ?

A. Yes; on some of those days, the average wave height was 0 m.
B. Yes; on all of those days, the average wave height was greater than 0 m.
C. No; on some of those days, the average wave height was 0 m.
D. No; on all of those days, the average wave height was greater than 0 m.

8. The sediment traps were positioned how far above the ocean floor?

F. 2.5 m
G. 23.5 m
H. 26.0 m
J. Cannot be determined from the given information

9. Based on Figure 4, the sedimentation rate, averaged over the period from November 4 to November 11, was closest to which of the following?

A. 25 g of sediment/m^2/day
B. 50 g of sediment/m^2/day
C. 75 g of sediment/m^2/day
D. 100 g of sediment/m^2/day

10. Each of the values of current speed plotted in Figure 3 is an average value. Based on the description of the study, is it more likely that each of these values was obtained by averaging measurements of current speed taken at different times of the day or by averaging measurements of current speed taken at different locations in the ocean?

F. Different times of the day, because all measurements of current speed were taken at the same location.
G. Different times of the day, because all measurements of current speed were taken at different locations.
H. Different locations, because all measurements of current speed were taken at the same time of day.
J. Different locations, because all measurements of current speed were taken at different times of the day.

11. Suppose that the storm had lasted for 48 hours. Based on Figure 3, the average current speed on November 14 would most likely have been:

A. less than 0.14 cm/sec.
B. between 0.14 cm/sec and 0.16 cm/sec.
C. between 0.16 cm/sec and 0.18 cm/sec.
D. greater than 0.18 cm/sec.

12. Consider the value of the average wave height on the day before the storm began. After the storm began, approximately how many days did it take for the average wave height to return to that value?

F. 4
G. 8
H. 10
J. 12

13. The acoustic profiler was fixed in position at what *depth* ?

A. 2.5 m
B. 10.5 m
C. 23.5 m
D. 25.5 m

Passage III

Scientists studied how *perceived predation* (hearing the calls and sounds of predators), in the absence of direct predation, affects the production of offspring by female song sparrows (*Melospiza melodia*). *M. melodia* sparrows produce 2 *clutches* (groups) of eggs in a breeding season.

Study

At the beginning of a breeding season, 24 *M. melodia* nests without eggs were located in low-growing shrubs. Direct predation was eliminated by surrounding each shrub with an electric fence to protect the nest from ground predators and by covering each shrub with a net to protect the nest from aerial predators.

The nests were evenly divided into 2 groups: a predator treatment (PT) group and a nonpredator treatment (NPT) group. A speaker that broadcast the calls and sounds of predators of *M. melodia* was set up near each nest in the PT group. A speaker that broadcast the calls and sounds of nonpredators of *M. melodia* was set up near each nest in the NPT group.

Throughout the breeding season, each speaker broadcast the appropriate calls and sounds every few minutes on a 4-day-on, 4-day-off cycle. (The parents and offspring associated with each nest did not hear sounds emitted by speakers other than their own speaker.) The number of eggs and the number of hatchlings produced in each nest were recorded. The number of hatchlings that successfully left each nest (such hatchlings are called *fledglings*) was also recorded. The figure shows, for each group, the average number of offspring (as eggs, as hatchlings, and as fledglings) per nest in each clutch.

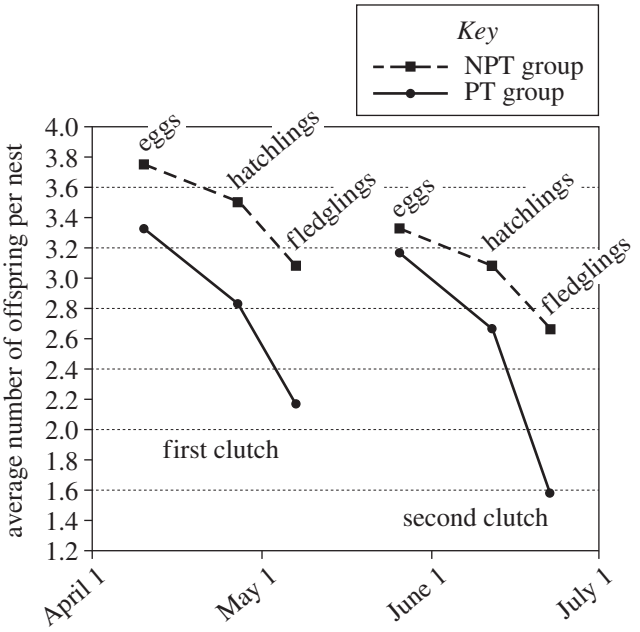


Figure adapted from Liana Y. Zanette et al., "Perceived Predation Risk Reduces the Number of Offspring Songbirds Produce per Year." ©2011 by American Association for the Advancement of Science.

14. Suppose that 1 yr after the sparrows fledged, the scientists wanted to determine how many fledglings from the PT group and how many fledglings from the NPT group had survived. Which of the following procedures, if it had been part of this study, would have enabled the scientists to monitor the fledglings' survival 1 yr later?

F. Feeding the hatchlings in both groups extra food before they fledged
G. Tagging the hatchlings in both groups with identifying markers before they fledged
H. Removing the nets from the shrubs of the PT group before the fledglings left their nests
J. Preventing the hatchlings in the NPT group from leaving their nests by covering the nests with nets having smaller holes

15. A speaker that was set up near a nest in the PT group broadcast the calls and sounds of:

A. only predators of *M. melodia*.
B. only nonpredators of *M. melodia*.
C. both predators of *M. melodia* and nonpredators of *M. melodia*.
D. neither predators of *M. melodia* nor nonpredators of *M. melodia*.

16. The statement "On average, female *M. melodia* sparrows have fewer fledglings when exposed to the calls and sounds of predators than when exposed to the calls and sounds of nonpredators" is consistent with the results of the study for which of the clutches, if either?

F. First clutch only
G. Second clutch only
H. Both the first and second clutches
J. Neither the first nor second clutch

17. The statement "The average number of offspring per nest in the first clutch was less for the PT group than for the NPT group" is consistent with the results of the study for which type(s) of offspring?

A. Eggs only
B. Eggs and hatchlings only
C. Hatchlings and fledglings only
D. Eggs, hatchlings, and fledglings

18. The nets used in the study were most likely chosen because they had holes that were small enough to exclude which of the birds listed below?

I. Male sparrows
II. Female sparrows
III. Aerial predators of sparrows

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

19. To eliminate direct predation on *M. melodia* offspring, the scientists engaged in which 2 of the actions listed below?

I. Installed an electric fence around each shrub
II. Covered each shrub with a net
III. Set up speakers to broadcast the calls and sounds of predators
IV. Set up speakers to broadcast the calls and sounds of nonpredators

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

20. The results of the study provide evidence of which of the following situations involving predators and prey?

F. Predators being affected by prey through nonbodily contact
G. Predators being affected by prey through bodily contact
H. Prey being affected by predators through nonbodily contact
J. Prey being affected by predators through bodily contact

Passage IV

As a banana ripens, the external peel changes color and the chemical composition of the internal pulp changes. Three experiments were performed to study the ripening of bananas.

Experiment 1

On Day 0, 100 bananas were harvested from the same banana plant. All the banana peels were completely green, so the average peel color "completely green" was assigned to the group. Next, the bananas were stored under *ripening conditions* (16°C and 85% relative humidity) over the next 35 days. Every 7 days during that time period, the bananas were inspected and a new average peel color was assigned. The relationship between average peel color and time is shown in Table 1.

Table 1

Day	Average peel color
0	completely green
7	green with yellow streaks
14	yellow with green tips
21	completely yellow
28	yellow with brown spots
35	brown

Experiment 2

On each day that an average peel color was assigned, the following procedures were also performed: First, 3 bananas were randomly selected from the group and peeled. Then, the pulps of the 3 bananas were thoroughly mixed together, and a 100 g sample of the pulp mixture was collected. Next, an 80% solution of ethanol in H_2O (by volume) was mixed with the sample to extract the starch and the sugars from the sample. Then, the mass, in g, of the starch in the sample and the mass, in g, of the sugars in the sample were determined (see Figure 1).

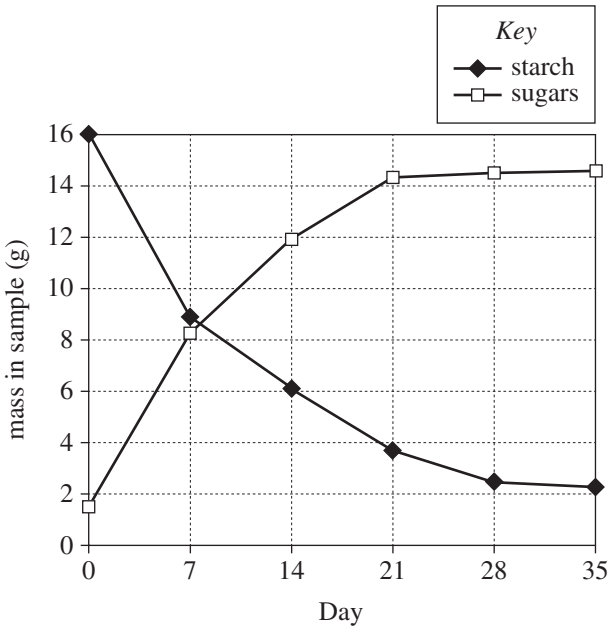


Figure 1

Experiment 3

On each day that the mass of the sugars in a sample was determined, the sugars were further analyzed, and the mass, in g, of each of the 3 sugars—fructose, glucose, and sucrose—in the sample was determined (see Figure 2).

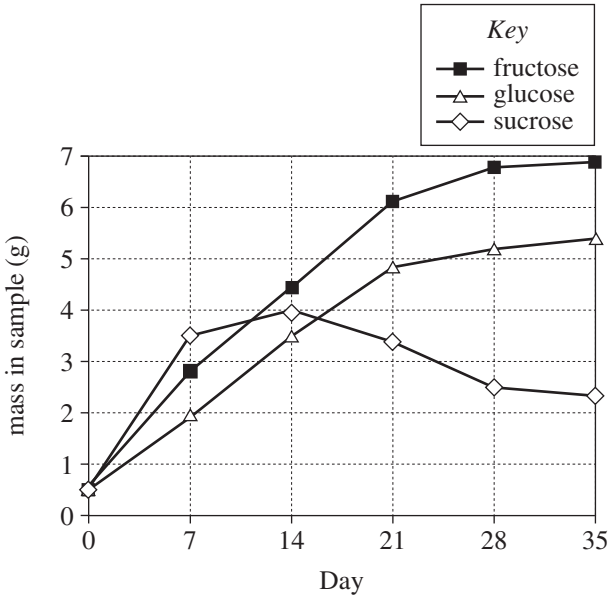


Figure 2

Table and figures adapted from R. C. Adão and M. B. A. Glória, "Bioactive Amines and Carbohydrate Changes During Ripening of 'Prata' Banana (*Musa acuminate x M. balbisiana*)." ©2005 by Elsevier Ltd.

21. According to the results of Experiment 3, from sample to sample over the 35 days of testing, which sugars always increased in mass?

A. Fructose and glucose only
B. Fructose and sucrose only
C. Glucose and sucrose only
D. Fructose, glucose, and sucrose

22. According to the results of Experiments 1 and 2, on the day that the average peel color was completely yellow, the mass of starch in the sample was closest to which of the following?

F. 2 g
G. 4 g
H. 6 g
J. 8 g

23. According to the results of Experiment 3, on which of the following days was the mass of sucrose in the sample lower than the mass of fructose in the sample but higher than the mass of glucose in the sample?

A. Day 7
B. Day 14
C. Day 21
D. Day 28

24. In Experiment 2, why were the bananas that were selected from the group selected randomly rather than nonrandomly?

F. To increase the likelihood that the bananas would be representative of the group
G. To decrease the likelihood that the bananas would be representative of the group
H. To increase the likelihood that the bananas that remained in the group would be those having starch and sugars in their pulps
J. To decrease the likelihood that the bananas that remained in the group would be those having starch and sugars in their pulps

25. Do the results of Experiment 2 indicate that each sample of pulp mixture contained only starch and sugars?

A. Yes, because for any given day of testing, the sum of the mass of starch in the sample and the mass of sugars in the sample was equal to 100 g.
B. Yes, because for any given day of testing, the sum of the mass of starch in the sample and the mass of sugars in the sample was not equal to 100 g.
C. No, because for any given day of testing, the sum of the mass of starch in the sample and the mass of sugars in the sample was equal to 100 g.
D. No, because for any given day of testing, the sum of the mass of starch in the sample and the mass of sugars in the sample was not equal to 100 g.

26. The ethanol solution used in Experiment 2 was prepared by mixing 80 mL of ethanol and 20 mL of H_2O. Which of the following expressions gives the percent by volume of ethanol in this solution?

F. $\left(\frac{\text{80 mL ethanol}}{\text{20 mL } H_2O}\right) \times 100\%$
G. $\left(\frac{\text{20 mL } H_2O}{\text{80 mL ethanol}}\right) \times 100\%$
H. $\left(\frac{\text{20 mL } H_2O}{\text{80 mL ethanol + 20 mL } H_2O}\right) \times 100\%$
J. $\left(\frac{\text{80 mL ethanol}}{\text{80 mL ethanol + 20 mL } H_2O}\right) \times 100\%$

27. The variation in the mass of starch and in the mass of sugars in the banana pulps over the 35 days, as shown in Figure 1, depended on the process of *osmosis*. Which of the following statements about the transfer of water or soluble substances in the bananas is consistent with this information?

A. As water was transferred from peel to pulp, the mass of starch in the pulps decreased and the mass of sugars in the pulps increased.
B. As water was transferred from peel to pulp, the mass of starch in the pulps increased and the mass of sugars in the pulps decreased.
C. As soluble substances were transferred from peel to pulp, the mass of starch in the pulps decreased and the mass of sugars in the pulps increased.
D. As soluble substances were transferred from peel to pulp, the mass of starch in the pulps increased and the mass of sugars in the pulps decreased.

Passage V

Spheres W, X, Y, and Z, initially at rest at the starting line on an inclined plane, will be released one at a time and allowed to roll, without sliding, all the way to the finish line at the bottom of the incline. The masses and radii of Spheres W and X are compared in the following table, as are the masses and radii of Spheres Y and Z.

Spheres	Properties
W and X	Spheres have the same radius. W has the greater mass.
Y and Z	Spheres have the same mass. Y has the greater radius.

A teacher asks 2 students to predict whether Sphere W or Sphere X, if either, will reach the finish line in less time, and whether Sphere Y or Sphere Z, if either, will reach the finish line in less time.

Student 1

Sphere W will reach the finish line in less time than Sphere X. Sphere W weighs more than Sphere X, so the force of gravity exerted on Sphere W is greater than that exerted on Sphere X. Because force = mass × acceleration, Sphere W will have the greater acceleration down the incline and, therefore, the greater average speed.

Sphere Y will reach the finish line in less time than Sphere Z. For 2 spheres having the same mass, as sphere radius increases, sphere density decreases, so the energy required for a sphere to complete a rotation decreases. The mass of Sphere Y is spread over a greater volume than is the mass of Sphere Z, so Sphere Y is less dense than Sphere Z and will have the greater acceleration and the greater average speed.

Student 2

Spheres W and X will reach the finish line in the same amount of time. The acceleration of a sphere due to gravity is independent of the sphere's mass, so the 2 spheres will have the same acceleration and, therefore, the same average speed.

Sphere Z will reach the finish line in less time than Sphere Y. For spheres having the same mass, as sphere radius increases, the energy required for a sphere to complete a rotation increases. This is because as sphere radius increases, the distance traveled by the sphere to complete a rotation increases. Therefore, because Sphere Y has the greater radius, it will have the lesser acceleration and the lesser average speed.

28. Sphere S has a mass of 10 kg, and Sphere T has a mass of 20 kg. The 2 spheres have the same radius. If both spheres are dropped from the same height at the same instant, Student 1 would more likely predict that which sphere will hit the ground first?

(Note: Assume that air resistance is insignificant.)

- **F.** Sphere S, because the force of gravity on Sphere S would be greater than the force of gravity on Sphere T.
- **G.** Sphere S, because the force of gravity on Sphere S would be less than the force of gravity on Sphere T.
- **H.** Sphere T, because the force of gravity on Sphere T would be greater than the force of gravity on Sphere S.
- **J.** Sphere T, because the force of gravity on Sphere T would be less than the force of gravity on Sphere S.

29. Based on the information in the table, which sphere, Sphere Y or Sphere Z, will complete the greater number of rotations while rolling from the starting line to the finish line?

A. Sphere Y, because it has the greater radius.
B. Sphere Y, because it will travel the greater distance down the incline.
C. Sphere Z, because it has the lesser radius.
D. Sphere Z, because it will travel the lesser distance down the incline.

30. According to Student 2's prediction, which sphere, Sphere Y or Sphere Z, will take less time to reach the finish line?

F. Sphere Y, because it will have the greater average speed.
G. Sphere Y, because it has the lesser radius.
H. Sphere Z, because it will have the greater average speed.
J. Sphere Z, because it has the greater radius.

31. Let t_Y and t_Z represent the time it takes Sphere Y and Sphere Z, respectively, to reach the finish line. Which of the following values of t_Y and t_Z are consistent with Student 1's prediction?

	t_Y (sec)	t_Z (sec)
A.	2	3
B.	3	2
C.	2	2
D.	3	3

32. Based on the information in the table, which of Spheres W and X is denser, and which of Spheres Y and Z is denser?

F. Sphere W; Sphere Y
G. Sphere W; Sphere Z
H. Sphere X; Sphere Y
J. Sphere X; Sphere Z

33. Which of the students, if either, would be likely to agree that a sphere's acceleration is related to its average speed down the incline?

A. Student 1 only
B. Student 2 only
C. Both Student 1 and Student 2
D. Neither Student 1 nor Student 2

34. Suppose the spheres were tested on the Moon instead of on Earth. Based on Student 2's prediction, which sphere, Sphere W or Sphere X, if either, would reach the finish line in less time?

F. Sphere W, because on the Moon, the mass of Sphere W would be greater than the mass of Sphere X.
G. Sphere X, because the weight of each sphere would be less on the Moon than on Earth.
H. Neither sphere, because the mass of each sphere would be the same on the Moon as it is on Earth.
J. Neither sphere, because the acceleration of each sphere due to the Moon's gravity would be independent of the sphere's mass.

Passage VI

Microtubules (MTs), which are structural components of cells, continuously elongate and shorten. An MT in *catastrophe* stops elongating and starts to shorten. An MT in *rescue* stops shortening and starts to elongate. When a cell enters mitosis from interphase, these transitions contribute to the rearrangement of the MT structure to form the mitotic spindle.

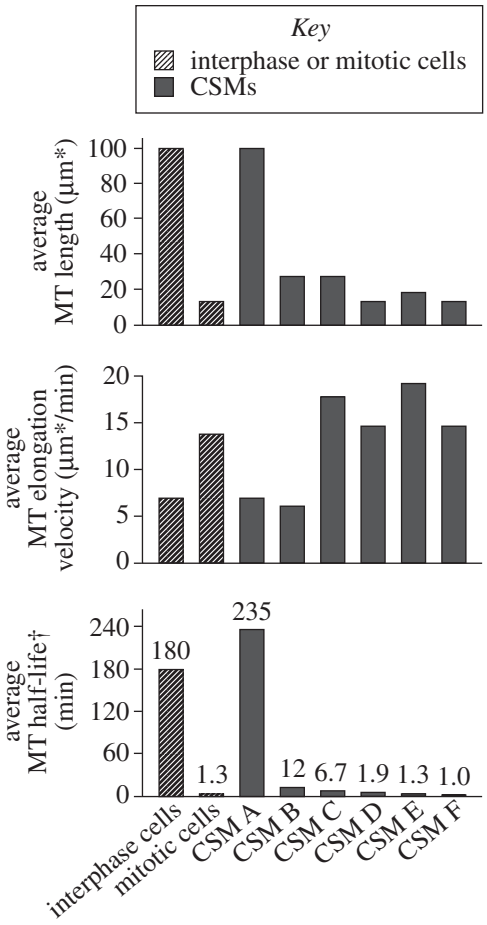
Table 1 shows the values of 3 parameters that were set in 6 computer-simulation models (CSMs A–F) of MT populations. It also shows the known values of the parameters for interphase cells and mitotic cells.

Table 1

Cell type or Model	Number of MTs	Catastrophe frequency* (number/sec)	Rescue frequency† (number/sec)
Interphase	500	0.019	0.044
Mitotic	2,000	unknown	unknown
CSM A	500	0.019	0.044
CSM B	2,000	0.019	0.044
CSM C	500	0.056	0.044
CSM D	2,000	0.056	0.044
CSM E	500	0.019	0.000
CSM F	2,000	0.019	0.000

*number of MTs in catastrophe per second
†number of MTs in rescue per second

Figure 1 compares, for 3 MT characteristics, the average values predicted by the CSMs with the known average values for the 2 cell types.



*$\mu m = 10^{-6}$ m
†the time in which an MT population is reduced by half in number

Figure 1

Table and figure adapted from N. R. Gliksman et al., "How the Transition Frequencies of Microtubule Dynamic Instability (Nucleation, Catastrophe, and Rescue) Regulate Microtubule Dynamics in Interphase and Mitosis: Analysis Using a Monte Carlo Computer Simulation." ©1993 by The American Society for Cell Biology.

35. According to Figure 1, which CSM predicts an average MT half-life that is equal to that of a mitotic cell?

A. CSM B
B. CSM C
C. CSM D
D. CSM E

36. According to Figure 1, the average length of an MT during interphase and the average length of an MT during mitosis, respectively, are closest to which of the following?

	interphase	mitosis
F.	13 μm	100 μm
G.	100 μm	13 μm
H.	100 μm	27 μm
J.	500 μm	2,000 μm

37. According to Table 1, in which CSM were the values of the 3 parameters set to match those of an interphase cell?

A. CSM A
B. CSM B
C. CSM C
D. CSM E

38. The computer simulations determined that CSM D was a good model for MT populations in mitotic cells. Based on the value of the catastrophe frequency and the value of the rescue frequency for CSM D in Table 1, a scientist concluded that in mitotic cells the catastrophe frequency is likely to be higher than the rescue frequency. Is this conclusion valid?

F. Yes; the catastrophe frequency was 0.019 MTs/sec and the rescue frequency was 0.000 MTs/sec for CSM D.
G. Yes; the catastrophe frequency was 0.056 MTs/sec and the rescue frequency was 0.044 MTs/sec for CSM D.
H. No; the catastrophe frequency was 0.000 MTs/sec and the rescue frequency was 0.019 MTs/sec for CSM D.
J. No; the catastrophe frequency was 0.044 MTs/sec and the rescue frequency was 0.056 MTs/sec for CSM D.

39. According to Figure 1, for which of the 3 MT characteristics did CSM B predict a value that was closer to that of interphase cells than to that of mitotic cells?

A. Average MT length only
B. Average MT elongation velocity only
C. Average MT half-life only
D. All 3 of the MT characteristics

40. Based on Table 1 and Figure 1, which of the following changes most likely does NOT occur when the MT structure rearranges to form the mitotic spindle?

F. An increase in the number of MTs
G. A decrease in the average MT length
H. An increase in the average MT elongation velocity
J. An increase in the average MT half-life

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.

Scoring Keys for Form Z08

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

Test 1: English—Scoring Key

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

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

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

Number Correct (Raw Score) for:

Production of Writing (POW) _____ (23)

Knowledge of Language (KLA) _____ (12)

Conventions of Standard English (CSE) _____ (40)

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

Test 2: Mathematics—Scoring Key

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

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

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

***Reporting Categories**

PHM = Preparing for Higher Math
- N = Number & Quantity
- A = Algebra
- F = Functions
- G = Geometry
- S = Statistics & Probability

IES = Integrating Essential Skills

MDL = Modeling

Number Correct (Raw Score) for:

Preparing for Higher Math (PHM) (N + A + F + G + S)	_____ (35)
Integrating Essential Skills (IES)	_____ (25)
Total Number Correct for Mathematics Test (PHM + IES)	_____ (60)
Modeling (MDL) (Not included in total number correct for mathematics test raw score)	_____ (17)

Test 3: Reading—Scoring Key

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

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

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

Number Correct (Raw Score) for:

Key Ideas & Details (KID) _____ (24)

Craft & Structure (CS) _____ (12)

Integration of Knowledge & Ideas (IKI) _____ (4)

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

Test 4: Science—Scoring Key

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

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

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

Number Correct (Raw Score) for:

Interpretation of Data (IOD) _____ (16)

Scientific Investigation (SIN) _____ (9)

Evaluation of Models, Inferences & Experimental Results (EMI) _____ (15)

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

ACT Resource Links

ACT Online Practice Tests: https://www.crackab.com/act/

※ **ACT English Practice Tests:**

https://www.crackab.com/act/english/

※ **ACT Math Practice Tests:**

https://www.crackab.com/act/math/

※ **ACT Reading Practice Tests:**

https://www.crackab.com/act/reading/

※ **ACT Science Practice Tests:**

https://www.crackab.com/act/science/

ACT Grammar: **https://www.crackab.com/act/grammar/**

ACT Real Past Papers Download:

https://www.crackab.com/act-downloads/

Digital SAT & New SAT Practice Tests:

https://www.cracksat.net

Real SAT Tests Download:

http://www.cracksat.net/sat-downloads/

AP Exams Practice Tests:

https://www.crackap.com

https://www.apstudy.net

Explanation of Procedures Used to Obtain Scale Scores from Raw Scores

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

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

ACT Test Z08	**Your Scale Score**
English	_____
Mathematics	_____
Reading	_____
Science	_____
Sum of scores	_____
Composite score (sum ÷ 4)	_____

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

Scale Score	Raw Scores				Scale Score
	Test 1 English	Test 2 Mathematics	Test 3 Reading	Test 4 Science	
36	74-75	59-60	40	40	**36**
35	72-73	56-58	39	39	**35**
34	71	54-55	38	—	**34**
33	70	53	37	38	**33**
32	69	52	—	37	**32**
31	68	51	36	—	**31**
30	67	49-50	35	36	**30**
29	65-66	47-48	34	35	**29**
28	64	44-46	33	34	**28**
27	62-63	41-43	32	33	**27**
26	60-61	38-40	31	32	**26**
25	57-59	35-37	30	30-31	**25**
24	53-56	32-34	28-29	28-29	**24**
23	50-52	30-31	26-27	26-27	**23**
22	47-49	29	24-25	24-25	**22**
21	44-46	27-28	23	22-23	**21**
20	41-43	26	22	21	**20**
19	38-40	24-25	20-21	19-20	**19**
18	36-37	22-23	19	18	**18**
17	34-35	18-21	17-18	16-17	**17**
16	32-33	15-17	16	15	**16**
15	29-31	12-14	15	13-14	**15**
14	26-28	10-11	13-14	12	**14**
13	25	8-9	12	11	**13**
12	22-24	7	10-11	9-10	**12**
11	19-21	5-6	9	8	**11**
10	16-18	4	8	7	**10**
9	14-15	—	7	6	**9**
8	12-13	3	6	5	**8**
7	10-11	—	5	4	**7**
6	8-9	2	4	3	**6**
5	6-7	—	3	—	**5**
4	5	1	—	2	**4**
3	3-4	—	2	1	**3**
2	2	—	1	—	**2**
1	0-1	0	0	0	**1**

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