Form D03

(December 2020)

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

Changing the Face of Journalism

"The nation and its news media are going in opposite directions, and the public is paying the price," in 2013, Dori Maynard wrote this. (1) She was following up on her point that although people of color make (2) up nearly 40 percent of the US population, while (3) only about 12 percent of full-time daily news journalists are people of color. Her who's (4) an award-winning African American journalist, Maynard became a Nieman fellow at Harvard University in 1993. (5)

For much of her journalism career, she was involved with the Maynard Institute, a journalism-education institute in Oakland, California. (The institute was founded in 1977 by her father, Robert C. Maynard,

1. **A.** NO CHANGE
   B. in 2013, that statement was written by Dori Maynard.
   C. this is something Dori Maynard wrote in 2013.
   D. Dori Maynard wrote in 2013.

2. **F.** NO CHANGE
   G. does make
   H. is making
   J. makes

3. **A.** NO CHANGE
   B. and
   C. but
   D. DELETE the underlined portion.

4. **F.** NO CHANGE
   G. Herself
   H. Hers
   J. Her

5. Given that all the choices are accurate, which one most clearly introduces the focus of the essay?
   A. NO CHANGE
   B. advocated diversity within newsrooms for the sake of fairer representation of all communities.
   C. reported news across the United States, from California to Michigan to Massachusetts.
   D. was a member of the Society of Professional Journalists.

former editor of the *Oakland Tribune*.) Conversely, (6) the organization is dedicated to recruiting and training people of color to become journalists. By the time Dori Maynard became president of the institute in 2001, she was already passionately committed to this mission.

6. **F.** NO CHANGE
G. Among other objectives,
H. Besides that objective,
J. In comparison,

Diversity among journalists in the United States must increase, Maynard believed, if (7) the industry is going to meet its' (8) ethical obligation to provide a wide audience credible and accurate news. She argued that a reporter's cultural background inevitably influences his or her perspective on current events. More diversity in newsrooms will naturally lead to more complete, nuanced, (9) and sensitive news coverage of all communities, specifically communities of color expressly. (10) This, in turn, will better our society as a whole; we'll gain a richer understanding of each other's lives, she explained.

7. **A.** NO CHANGE
B. as soon as
C. whereas
D. until

8. **F.** NO CHANGE
G. their
H. its
J. it's

9. **A.** NO CHANGE
B. with a level of nuance,
C. a nuanced feel,
D. having nuance,

10. **F.** NO CHANGE
G. in terms of news coverage.
H. in particular.
J. DELETE the underlined portion and end the sentence with a period.

Under Dori Maynard's leadership, the Maynard Institute trained hundreds of minority reporters. The institute also has helped them get hired and heard. Many former trainees now reports (11) for influential newspapers such as (12) the *New York Times* and the *Washington Post*. Dori Maynard (13) helped show the journalism industry that presenting the culturally

11. **A.** NO CHANGE
B. works as a reporter
C. is reporting
D. report

12. **F.** NO CHANGE
G. newspapers, for example:
H. newspapers for example:
J. newspapers: such as

13. **A.** NO CHANGE
B. Appointed president of the Maynard Institute in 2001, Dori Maynard
C. Having been leader of the Maynard Institute, Dori Maynard
D. Dori Maynard, an award-winning journalist,

diverse voices of the United States through inclusive news stories written by people of color is possible. [14]

14. The writer wants to conclude the essay with a strong, emphatic statement that asserts the far-reaching significance of Dori Maynard's work with the Maynard Institute. Which choice best accomplishes that goal?

F. NO CHANGE
G. is vital for social justice.
H. will likely be noticed.
J. makes sense.

Question 15 asks about the preceding passage as a whole.

15. Suppose the writer's primary purpose had been to present highlights of Dori Maynard's work as a journalist reporting daily news. Would this essay accomplish that purpose?

A. Yes, because it suggests that fair representation of diversity was always one of Maynard's priorities as a journalist.
B. Yes, because it provides details about Maynard's most influential daily news stories.
C. No, because it concentrates instead on Maynard's efforts to bring diversity to the journalism industry.
D. No, because it focuses instead on why journalism is important to the Maynard family.

PASSAGE II

To Sew on Savile Row

Bespoke tailors create men's suits exactly to a customer's specifications, aiming for refined elegance and technical flawlessness. Regardless, a [16] focus on bespoke tailoring has made Savile Row a small, street in London, [17] the world's most distinguished location for menswear for over two hundred years. In 2008, Savile Row Academy, located within the bespoke suit shop called Maurice Sedwell, at 19 Savile Row, was established to celebrate [18] this time-honored craft.

16. **F.** NO CHANGE
G. Similarly, a
H. Besides, a
J. A

17. **A.** NO CHANGE
B. Row, a small street in London,
C. Row, a small street in London
D. Row a small street in London

18. Which choice provides the clearest foundation for the suggestion made later in the essay that the tradition of bespoke tailoring on Savile Row has diminished?

F. NO CHANGE
G. show off
H. preserve
J. embody

Customers are fitted on the main floor of the shop. In the well-lit basement, students of various ages and backgrounds master the dozens of skills needed to make (19) a classic three-piece bespoke suit. Traditionally, a bespoke suit is created beginning from start to completion (20) by one tailor, who rarely uses a sewing machine. The students' primary tools, therefore, are tailor's chalk, shears, needles, and a thimble. During the two-year professional training program, students learn to take measurements, draft patterns; cut cloth; hand sew coats, (21) vests, and trousers; create pockets; and stitch finishing details. Creating one suit requires well over a hundred hours of concentrated work, even for an expert. [22]

[1] From the size of the buttons on the coat to the angle of the pleats on the trousers and (23) nearly every feature of a traditional bespoke suit is (24) chosen by the customer. [2] Still, Andrew Ramroop, owner of the Sedwell shop and founder of the Academy, encourages his students, (25) to develop their own style within those constraints.

19. **A.** NO CHANGE
B. skills, needed to make
C. skills needed, to make
D. skills needed to make,

20. **F.** NO CHANGE
G. by a single artisan from the first to the final steps
H. by a trained individual from beginning to end
J. from start to finish

21. **A.** NO CHANGE
B. measurements; draft patterns; cut cloth; hand sew coats,
C. measurements; draft patterns; cut cloth; hand sew coats;
D. measurements draft patterns; cut cloth; hand sew coats,

22. If the writer were to delete the preceding sentence, the essay would primarily lose a:
F. statement suggesting that expert tailors require even more time to create a bespoke suit than do novice tailors.
G. detail that emphasizes the time and attention required for a tailor to create a bespoke suit.
H. description that illustrates exactly why a bespoke suit must be created slowly.
J. comment implying that most tailors aim to create a bespoke suit in under a hundred hours.

23. **A.** NO CHANGE
B. trousers, in that
C. trousers,
D. trousers;

24. **F.** NO CHANGE
G. have been
H. were
J. are

25. **A.** NO CHANGE
B. Academy, encourages his students
C. Academy encourages his students,
D. Academy encourages his students

[3] Ramroop is known for his inventive use of color, especially contrast stitching in pockets. [4] Adhering to the traditions of the craft is a must, he explains, but your signature style (26) is what will bring your customers back. [27]

While mass-manufactured suits have become standard in many suit shops on Savile Row; however, several (28) Academy graduates have found jobs pleasantly working (29) in the shops on the street that remain committed to classic design and unmatchable craftsmanship. Many others have taken their shears and needles to fine tailoring houses around the world. (30)

26. **F.** NO CHANGE
G. approach to tailoring (such as a fondness for contrast stitching in pockets, as I have previously mentioned)
H. expression, your individual approach that customers will visit you again to experience,
J. manner that is unique to you alone

27. For the sake of the logic and cohesion of this paragraph, Sentence 2 should be placed:
A. where it is now.
B. before Sentence 1.
C. after Sentence 3.
D. after Sentence 4.

28. **F.** NO CHANGE
G. Row, several
H. Row. Several
J. Row; several

29. Given that all the choices are accurate, which one most strongly reiterates a defining characteristic of the craft of bespoke tailoring as the craft is presented in the essay as a whole?
A. NO CHANGE
B. hand stitching
C. producing clothes
D. sewing

30. **F.** NO CHANGE
G. that aren't on Savile Row but rather are on other streets, elsewhere.
H. located all over the globe, but not on Savile Row.
J. DELETE the underlined portion and end the sentence with a period.

PASSAGE III

Uncovering the World's Largest Cave

[1]

Deep below the mountains of central Vietnam lies what could be described as: another world. (31)

31. **A.** NO CHANGE
B. as—
C. as
D. as,

Located in Phong Nha-Ke Bang National Park, the enormous (32) Hang Son Doong ("Mountain River Cave") is believed to be the largest cave in the world. [33] Son Doong is part of a system of 150 caves that snake beneath the ground throughout the region. At (34) roughly five miles long, 300 feet wide, and 660 feet tall, (35) Son Doong is large enough to hold an entire city block of forty-story buildings.

[2]

Even more impressive than the cave's size, perhaps, such as (36) what grows within it. [A] Portions of Son Doong contain what many envision when they think of caves, which (37) dark chambers ornamented with gigantic calcite formations and populated by colorless creatures that are very unique looking. (38) Other parts of the cave, however, are dramatically different, (39) verdant ferns, palm trees, bamboo, liana vines, and stinging nettles flourish here as well.

32. **F.** NO CHANGE
G. decidedly prodigiously proportioned
H. massive and immense
J. gigantically huge

33. At this point, the writer is considering adding the following accurate sentence to the essay:

> Phong Nha-Ke Bang National Park was named a UNESCO World Heritage Site in 2003.

Should the writer add this sentence here?

A. Yes, because the paragraph focuses mainly on the history of discoveries in Phong Nha-Ke Bang National Park.
B. Yes, because the essay emphasizes the need for worldwide recognition of national parks.
C. No, because it does not explain how a park is designated a UNESCO World Heritage Site.
D. No, because it would interrupt the description of Hang Son Doong's size and location.

34. **F.** NO CHANGE
G. This marvel is
H. The cave is
J. It's

35. Which choice best maintains the stylistic pattern established in the sentence?

A. NO CHANGE
B. a height of 660 feet,
C. 660 feet in height,
D. tall at 660 feet,

36. **F.** NO CHANGE
G. it's
H. is
J. DELETE the underlined portion.

37. **A.** NO CHANGE
B. caves:
C. caves;
D. caves

38. Which choice adds the most specific information to the sentence's description of the organisms inside Son Doong?

F. NO CHANGE
G. animals that can be found in various sections of the cave.
H. things often found in sunless environments.
J. fish, millipedes, and wood lice.

39. **A.** NO CHANGE
B. different, for instance,
C. different;
D. different and

In fact, researchers have found that the dense subterranean jungle of Son Doong essentially have mirrored (40) the variety of plants and animals in the forest directly aboveground.

[3]

While the (41) abundance of vegetation in Son Doong is possible because of the way the cave formed. Between two and five million years ago, the Rao Thuong River chiseled through the limestone under the range now known as the Annamite Mountains, (42) near Vietnam's border with Laos. At the top of the cave, colossal "skylights," measuring up to 300 feet across, that (43) formed when weak portions of the cave's ceiling collapsed. [B] The gaps allow sunlight to pass through and nourish the life below. [C]

[4]

Exploring Son Doong is a once-in-a-lifetime experience, but it isn't easy. Simply hiking there from the nearest village takes more than a day. [D] Inside the cave, formidable obstacles, such as a 200-foot-high wall covered in mud, make (44) traversing it a major challenge. Still, year after year, Son Doong draws people from around the globe who want to experience what was once a hidden underground world.

40. **F.** NO CHANGE
G. tend to mirror
H. mirrors
J. mirror

41. **A.** NO CHANGE
B. Whether the
C. Though the
D. The

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

F. explains the differences between national parks in Vietnam and in Laos.
G. suggests that Son Doong extends beyond the border of Vietnam and into Laos.
H. provides additional information about Son Doong's location within Vietnam.
J. gives a visual description of the Annamite Mountains.

43. **A.** NO CHANGE
B. those that
C. which
D. DELETE the underlined portion.

44. **F.** NO CHANGE
G. is likely to make
H. tends to make
J. makes

Question 45 asks about the preceding passage as a whole.

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

> Aboveground, thick stands of bamboo and other vegetation make approaching the cave's entrance extremely difficult.

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

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

PASSAGE IV

The Best Map of the World in the World

[A] More fictional than factual, most maps made in medieval Europe combined a smattering of accurate information with a slew of inaccurate information, guesses, and outright inventions. [B] In 1139, however, when King Roger II of Sicily wanted a new map of the known world, since he desired (46) accuracy foremost. [C] To that end, he engaged Moroccan-born scholar Muhammad al-Idrisi. [D] Al-Idrisi adopted a systematic approach to the project, combining comparative analysis, eyewitness accounts, and scientific measurements. [47]

Al-Idrisi had been educated in Córdoba, Spain. (48) He also scrutinized accounts written by long-distance travelers. By comparing sources, al-Idrisi could judge their accuracy. If multiple sources agreed on things—the (49) route of a river, for instance—it was likely true.

If sources disagreed, likewise, (50) al-Idrisi sought the truth, he dispatched (51) a research expedition to the area in question.

46. **F.** NO CHANGE
G. in which he desired
H. he desired
J. desiring

47. The writer is considering adding the following sentence to this paragraph:

> Generally, people accepted such maps as accurate, not realizing how flawed they were.

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

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

48. Given that all the choices are true, which one most effectively introduces this paragraph?

F. NO CHANGE
G. was just one of many illustrious and cosmopolitan scholars in King Roger's court.
H. started work on the map when he was forty years old.
J. studied as many existing maps as he could.

49. **A.** NO CHANGE
B. something—
C. those—
D. them—

50. **F.** NO CHANGE
G. on the other hand,
H. regardless,
J. otherwise,

51. **A.** NO CHANGE
B. truth and he dispatched
C. truth by dispatching
D. truth, dispatched

Al-Idrisi brought a similarly logical approach for the positioning to (52) locations on his map. Most mapmakers at the time arranged (53) cities, mountains, and other features, on their maps (54) quite haphazardly. But al-Idrisi, informed by the work of the best Arab and Greek scientists, lay out the sites (55) on his map using astronomical coordinates.

After fifteen years of the daily grind, (56) al-Idrisi completed his project. The final products included: (57) a two-meter-wide silver disk engraved with a world map, an atlas containing seventy detailed regional maps, and a lengthy descriptive text. The maps were of a quality and accuracy unparalleled at the time. They noted the source of the Nile River—in Africa's equatorial highlands—(58) and used a sophisticated method of depicting (59) the earth's round shape on a flat map. Unfortunately, the maps never circulated widely. Moreover, the text wasn't translated from Arabic for hundreds of years. It would be the twentieth century before al-Idrisi's work received the appreciation it deserved.

52. **F.** NO CHANGE
G. by the positioning on
H. to the positioning of
J. in the positioning at

53. **A.** NO CHANGE
B. collected
C. devised
D. posed

54. **F.** NO CHANGE
G. (other features on their maps)
H. other features on their maps,
J. other features on their maps

55. **A.** NO CHANGE
B. lay out the sights
C. laid out the sites
D. laid out the cites

56. **F.** NO CHANGE
G. ongoing expenditure of mental effort,
H. plugging away,
J. labor,

57. **A.** NO CHANGE
B. products, which included
C. products, including
D. products included

58. The writer wants to emphasize that the inclusion of the source of the Nile River on al-Idrisi's maps represented a notable achievement. Which choice most effectively accomplishes this goal?

F. NO CHANGE
G. regarded as the longest river in the world—
H. near what's now known as Lake Victoria—
J. a first for a Europe-centered map—

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

A. method for the depiction of
B. method in order to depict
C. method, it depicted
D. method to depict

Question 60 asks about the preceding passage as a whole.

60. Suppose the writer's primary purpose had been to explore the degree of influence al-Idrisi's maps and methods had on other mapmakers. Would this essay accomplish that purpose?

F. Yes, because the essay explains that the accuracy of al-Idrisi's maps established a foundation for other mapmakers to build upon.
G. Yes, because the essay pinpoints which aspects of al-Idrisi's work were most frequently imitated by other mapmakers.
H. No, because the essay instead focuses on how al-Idrisi created his maps and why they were superior to other maps.
J. No, because the essay instead mainly shows how al-Idrisi's education and travels helped him create his maps.

PASSAGE V

More than a Silver Lining

[1]

Iridescent clouds—in which patches, bands, or waves of color appears—are arresting phenomena. (61)

61. A. NO CHANGE
B. appear—are
C. appears—is
D. appear—is

Aptly nicknamed "rainbow clouds," flaunting displays (62) that range (63) from pastel suffusions to vivid, fiery streaks. But the conditions that iridescence requires are far more allusive than (64) those that produce rainbows, making iridescent clouds comparatively rare.

62. F. NO CHANGE
G. clouds" and flaunting
H. clouds," they flaunt
J. clouds" with

63. A. NO CHANGE
B. differ
C. rank
D. trek

64. F. NO CHANGE
G. allusive then
H. elusive then
J. elusive than

[2]

[A] Think of every cloud as a vast collection of wet or icy particles. For iridescence to occur, many of these particles must be roughly uniform in size and shape. [B] They must also be minute: smaller than most cloud particles. Finally, a portion of the cloud (typically along the edges) must be nearly transparent. Together, these traits cause sunlight passing through the cloud to diffract consistently.

[3]

Its consistency that allows people to see individual colors. [C] Visible sunlight is actually multiple wavelengths of light, each with its own color. Sunlight usually appears as "white" light because all the wavelengths are traveling at the same angle, and the eye can't discern them individually. But when sunlight collides with a cloud particle, the component wavelengths are deflected at different angles, an event known as diffraction. [D] When the diffraction is consistent (when all the red light waves deflect at one angle, the blues at another, and so on), the eye can detect individual colors.

65. Which choice most specifically indicates how minute the particles are?

A. NO CHANGE
B. they are tinier than you can even imagine.
C. about 1/100th the width of a human hair.
D. unbelievably minute, in fact.

66. **F.** NO CHANGE
G. cloud (typically, along the edges),
H. cloud, (typically along the edges)
J. cloud (typically along the edges),

67. **A.** NO CHANGE
B. It's this
C. It is its'
D. Its this

68. **F.** NO CHANGE
G. light and each with
H. light; each with
J. light, each has

69. **A.** NO CHANGE
B. wavelengths, which are traveling
C. wavelengths, which travel
D. wavelengths that travel

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

F. angles, which is an event
G. angles—an event
H. angles, which is
J. angles, this is

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

A. an explanation for why red and blue light waves deflect at different angles.
B. an example that helps clarify what happens when diffraction is consistent.
C. an indication that only blue and red light waves are visible in iridescent clouds.
D. details that specify why iridescent clouds are rare.

[4]

Diffraction happens in all clouds, but most cloud particles are too large and irregular to diffract sunlight consistently. One particle might deflect red waves at the same angle an adjacent particle deflects green. Or, in really close-knit[72] clouds, each light wave is likely to collide with a series of particles, deflecting at a different angle every time. In both cases, the different light waves cross paths, and the cloud appears white.

[5]

In iridescent clouds, for example,[73] deflection angles don't conflict. As sunlight passes through the cloud, patches, bands, or waves of color become visible.[74]

72. Which choice most closely maintains the tone established in the essay?

F. NO CHANGE
G. more crammed
H. jam-packed
J. denser

73. **A.** NO CHANGE
B. consequently,
C. furthermore,
D. however,

74. Given that all of the choices are accurate, which one best concludes the essay by reiterating both the reason for iridescence in clouds and its visual effect?

F. NO CHANGE
G. every particle deflects distinct light waves at consistent angles, and breathtaking colors emerge.
H. iridescence will be nearly impossible unless light waves can avoid colliding with multiple particles.
J. this rare phenomenon can be enjoyed.

Question 75 asks about the preceding passage as a whole.

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

> Iridescence happens only in clouds that have three specific traits.

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

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

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. Which of the following expressions is equivalent to the expression below?

$$-7(5a - b) + 3(-8b + a)$$

A. $-38a - 31b$
B. $-34a - 25b$
C. $-34a - 17b$
D. $-32a - 25b$
E. $-32a - 17b$

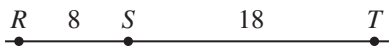
2. For Bill's birthday party, his parents will pay \$35 for the cake plus \$15 per person for catering expenses. They will spend *at most* a total of \$300 for his party. The greatest integer in the solution set of one of the following inequalities gives the maximum number of people, p, who can attend the party. Which one?

F. $p + 50 \geq 300$
G. $p(15p + 35) \geq 300$
H. $(35 + 15)p \leq 300$
J. $15p \leq 300$
K. $15p + 35 \leq 300$

3. The number 312.8 is 34% of x. What is the value of x rounded to the nearest whole number?

A. 9
B. 11
C. 106
D. 920
E. 10,635

4. For $\overleftrightarrow{RT}$ shown below, point S is on $\overline{RT}$, the length of $\overline{RS}$ is 8 cm, and the length of $\overline{ST}$ is 18 cm. What is the distance, in centimeters, between T and the midpoint of $\overline{RS}$?



F. 13
G. 17
H. 18
J. 22
K. 26

DO YOUR FIGURING HERE.

5. A certain committee is composed of 9 juniors and 11 seniors. Two different members of the committee will be randomly selected for 2 different leadership roles. Given that the 1st member who will be selected is a senior, what is the probability that the 2nd member who will be selected is a junior?

A. $\frac{9}{19}$

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

C. $\frac{10}{19}$

D. $\frac{10}{20}$

E. $\frac{11}{20}$

6. What is the least common multiple of 60, 70, and 90 ?

F. 60
G. 220
H. 630
J. 1,260
K. 378,000

7. The Newton High School girls' softball team currently has a record of 8 wins, 5 losses, and 0 ties. What is the *least* number of its remaining 10 games the team must win to finish the season winning *more than* 50% of all the team's games?

A. 3
B. 4
C. 5
D. 6
E. 7

8. For what value of x is $2(x - 12) + x = 24$ true?

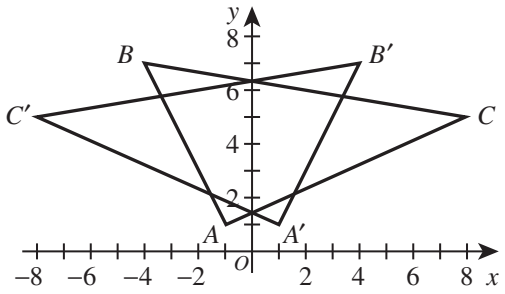
F. 0
G. 4
H. 12
J. 16
K. 24

9. The principal of Lowe High School (LHS) authorized a study to estimate the percent of the LHS student population that will attend a 4-year college after graduation. LHS students in honors courses were asked about their postgraduation plans, and their responses were recorded. Students in other courses were NOT included in the study. Which of the following phrases best describes the principal's study?

A. Randomized census
B. Randomized experiment
C. Nonrandomized experiment
D. Randomized sample survey
E. Nonrandomized sample survey

DO YOUR FIGURING HERE.

10. Triangles $\triangle ABC$ and $\triangle A'B'C'$ are graphed in the standard (x,y) coordinate plane below.



Triangle $\triangle A'B'C'$ is the image of $\triangle ABC$ under one of the following transformations. Which one?

F. 90° clockwise rotation about the origin
G. 90° counterclockwise rotation about the origin
H. Horizontal translation
J. Reflection across the x-axis
K. Reflection across the y-axis

11. Banu will build a fence around a rectangular 30-foot-by-25-foot play area. Given that fencing costs \$4.05 per foot, how much will the fencing cost for Banu to completely surround the play area?

A. \$445.50
B. \$344.25
C. \$324.00
D. \$268.00
E. \$222.75

12. The diagonal of a rectangular flat television screen is 26.0 inches. The width of the screen is 22.7 inches, and the height of the screen is 10.0 inches less than the width of the screen. Which of the following is closest to the area, in square inches, of the television screen?

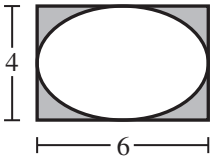
F. 144
G. 165
H. 288
J. 330
K. 590

13. For all $a \neq 0$, $\frac{a^8}{a^4}$ is equivalent to:

A. 1
B. a^2
C. a^4
D. a^{12}
E. a^{32}

DO YOUR FIGURING HERE.

14. An ellipse with a major axis of length 6 inches and a minor axis of length 4 inches is inscribed in a rectangle, as shown below. The region inside the rectangle but outside the ellipse is shaded. What is the area, in square inches, of the shaded region?



(Note: The area, A, of any ellipse can be found by the formula $A = \pi ab$ where a is $\frac{1}{2}$ the length of the major axis and b is $\frac{1}{2}$ the length of the minor axis.)

F. $24 - 24\pi$
G. $24 - 12\pi$
H. $24 - 6\pi$
J. 6π
K. $24 + 6\pi$

15. Given $2x - \sqrt{3} = 6$, what is the value of x ?

A. $3 - \frac{\sqrt{3}}{2}$

B. $3 - \sqrt{3}$

C. $3 + \frac{\sqrt{3}}{2}$

D. $3 + \sqrt{3}$

E. $4 + \sqrt{3}$

16. What is the largest possible product for 2 even integers whose sum is 18 ?

F. 11
G. 19
H. 77
J. 80
K. 81

17. Juanita walked from her home to the bakery, first walking 0.3 miles due east and then 0.4 miles due north. What is the straight-line distance, in miles, from the bakery to Juanita's home?

A. 0.1
B. 0.2
C. 0.3
D. 0.5
E. 0.7

DO YOUR FIGURING HERE.

18. $\begin{bmatrix} 10 & -13 \\ -8 & 11 \end{bmatrix} - \begin{bmatrix} -9 & -17 \\ -8 & 14 \end{bmatrix} = ?$

F. $\begin{bmatrix} -3 & 26 \\ 3 & -6 \end{bmatrix}$

G. $\begin{bmatrix} 1 & -30 \\ -16 & -3 \end{bmatrix}$

H. $\begin{bmatrix} 1 & -30 \\ -16 & 25 \end{bmatrix}$

J. $\begin{bmatrix} 2 & -2 \\ 17 & 3 \end{bmatrix}$

K. $\begin{bmatrix} 19 & 4 \\ 0 & -3 \end{bmatrix}$

19. The line with equation $2x + 5y = 9$ is graphed in the standard (x,y) coordinate plane. What is the slope of the line?

A. $-\frac{5}{2}$

B. $-\frac{2}{5}$

C. $\frac{2}{5}$

D. $\frac{5}{2}$

E. 2

20. Yolanda is calculating the weekly payroll for her small business. One employee earns \$7.20 per hour and has worked 4 days this week: $9\frac{1}{4}$ hours the first day, 8 hours the second day, $6\frac{3}{4}$ hours the third day, and $7\frac{1}{2}$ hours the fourth day. Which of the following is the employee's pay for this week, before any deductions are made?

F. \$226.80
G. \$225.00
H. \$219.60
J. \$131.40
K. \$ 38.70

21. What is the (x,y) solution, if one exists, to the system of equations $y = 2x + 6$ and $6x + 12 = 3y$?

A. (−3,0)
B. (−2,0)
C. (0,4)
D. (0,6)
E. There is no solution to this system.

DO YOUR FIGURING HERE.

22. Sets A, B, and C are defined below.

$A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
$B = \{2, 4, 6, 8\}$
$C = \{4, 8\}$

A number will be randomly selected from A. What is the probability that the selected number will be an element of C *and* an element of B ?

F. $\frac{1}{9}$

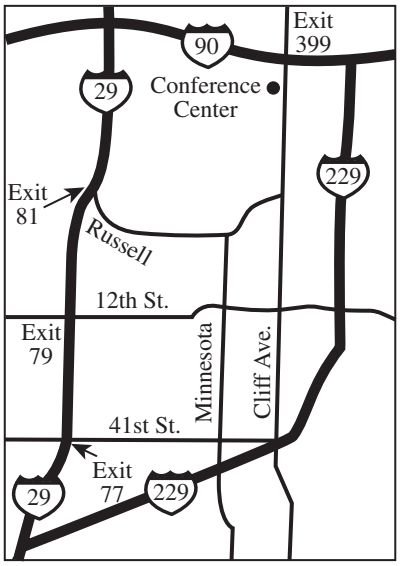
G. $\frac{2}{9}$

H. $\frac{4}{9}$

J. $\frac{6}{9}$

K. 1

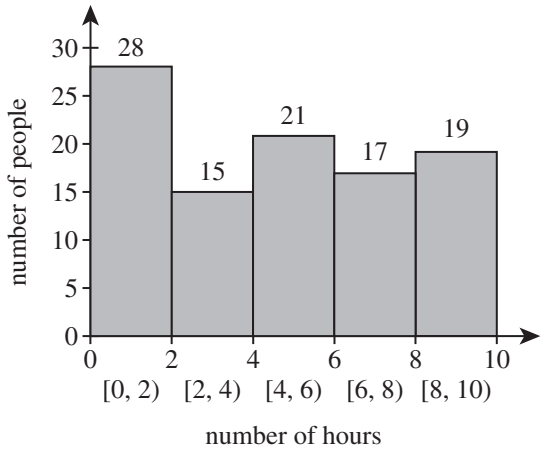
23. Maranda is going to a leadership conference and was given the map below to guide her to the Conference Center. The map has no scale, but she knows that the distance between Exits 77 and 79 on Interstate 29 is 2 miles. On the map, this distance is $\frac{3}{4}$ of an inch. She plans to exit Interstate 29 at Exit 77, travel on 41st Street to Cliff Avenue, and then proceed on Cliff Avenue to the Conference Center. The distance on the map from Exit 77 to the Conference Center over this route is $3\frac{3}{8}$ inches. What is this distance, in miles?



A. 4
B. 5
C. 9
D. 12
E. 18

DO YOUR FIGURING HERE.

24. The histogram below shows the results of a survey of 100 people. Each person identified the number of hours per week that they watch TV. How many people surveyed watch TV at least 4 hours per week?



F. 57
G. 38
H. 28
J. 21
K. 19

25. Each side of a square is 4 cm long. One vertex of the square is at (6,2) on a square coordinate grid marked in centimeter units. Which of the following points on the grid could be another vertex of the square?

A. (10, 2)
B. (7, 3)
C. (2, 5)
D. (1,–5)
E. (–4, 2)

26. An outlier is added to the data set below. Which of the following pairs of statistics has no change in value as a result of the addition of the outlier?

{60, 63, 66, 70, 72, 72, 73, 73, 73, 75}

F. Mean and median
G. Mean and mode
H. Mean and range
J. Median and mode
K. Median and range

27. Given that $\angle R$ is the included angle between the 2 congruent sides of the isosceles triangle $\triangle RST$, and the measure of $\angle R$ is 50°, what is the measure of $\angle S$?

A. 20°
B. 50°
C. 65°
D. 80°
E. 130°

DO YOUR FIGURING HERE.

28. In the standard (x,y) coordinate plane, what is the distance, in coordinate units, from $A\left(5\frac{1}{3},-3\right)$ to $B\left(-1\frac{5}{9},-3\right)$?

F. $\frac{8}{9}$

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

H. $3\frac{7}{9}$

J. $6\frac{8}{9}$

K. $12\frac{8}{9}$

29. Hikers' World Foods sells raisin-nut mix in bulk to stores. The dollar amount *per pound*, $P(x)$, for a store to purchase x pounds of raisin-nut mix from Hikers' World is given by the function below.

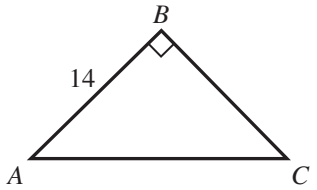
$$P(x) = 3.50 + 0.90^x$$

To the nearest \$0.01, which of the following dollar values is equal to the total price for a store to purchase 100 pounds of raisin-nut mix in a single order from Hikers' World?

A. \$350.00
B. \$359.00
C. \$440.00
D. \$616.00
E. \$903.50

30. In right triangle $\triangle ABC$ shown below, $\sin C = \frac{5}{7}$ and the length of $\overline{AB}$ is 14 inches. What is the length, in inches, of $\overline{AC}$?

F. $\sqrt{24}$
G. $\sqrt{74}$
H. 10
J. 19.6
K. 24



31. The 1st term of a geometric sequence is 27, and the 4th term is 64. In terms of n, what is the nth term of the sequence?

A. $27\left(\frac{3}{4}\right)^{n-1}$

B. $27\left(\frac{3}{4}\right)^{n}$

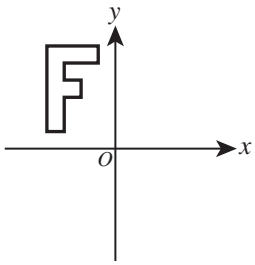
C. $27\left(\frac{4}{3}\right)^{n-1}$

D. $27\left(\frac{4}{3}\right)^{n}$

E. $27\left(\frac{4}{3}\right)n$

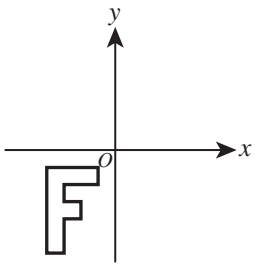
DO YOUR FIGURING HERE.

32. A series of transformations are applied to the graph in the standard (x,y) coordinate plane below. The graph below is reflected across the x-axis. The new graph is reflected across the y-axis. This new graph is rotated 90° clockwise (↻) about the origin.

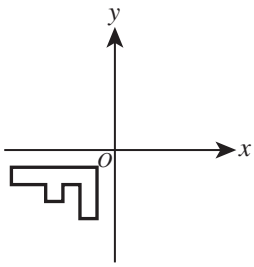


The resulting graph is one of the following graphs. Which one?

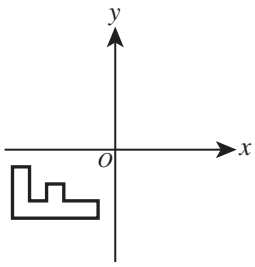
F.



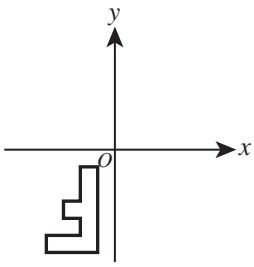
J.



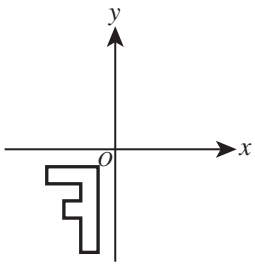
G.



K.



H.



33. What is the least positive number that has a remainder of 3 when divided by 6 and a remainder of 6 when divided by 9 ?

A. 15
B. 18
C. 24
D. 42
E. 72

DO YOUR FIGURING HERE.

34. What rational number is exactly halfway between $\frac{2}{8}$ and $\frac{6}{14}$ on the real number line?

F. $\frac{2}{11}$

G. $\frac{19}{14}$

H. $\frac{19}{28}$

J. $\frac{5}{56}$

K. $\frac{19}{56}$

35. On a certain day in Katie's yard, the average rate of change in temperature per hour between 1 p.m. and 11 p.m. was −2°F per hour. The temperature in Katie's yard at 11 p.m. that day was 42°F. Which of the following was the temperature in Katie's yard at 1 p.m. that day?

A. 14°F
B. 22°F
C. 62°F
D. 64°F
E. 84°F

36. Given that i is the imaginary unit, which of the following complex numbers is equal to $(7 + 6i)^2$?

F. 13
G. 85
H. $13 + 84i$
J. $14 + 12i$
K. $85 + 84i$

37. Two motorcycles, starting at the same point at the same time, travel away from each other at a 90° angle. One travels at 40 miles per hour and the other at 60 miles per hour. If they continue traveling at these constant rates, after about how many hours will they be 200 miles apart?

A. 1.4
B. 2.8
C. 3.2
D. 7.7
E. 8.7

DO YOUR FIGURING HERE.

Use the following information to answer questions 38–40.

A website about birds made the 4 claims below about American robins.

1. The population of American robins in 2015 was 320 million.

2. The wingspans of all American robins can be fit to a normal distribution model that has a mean of 36.00 cm and a standard deviation of 2.50 cm.

3. The maximum reported flight speed for an American robin is 3,168 feet per minute.

4. A certain conservation organization will only consider American robins *threatened* if the total number of American robins declines by at least 30% over a 10-year period.

38. Suppose the population of American robins increased each year from 2005 to 2015. The conservation organization will consider American robins threatened provided that their population in 2025 is no greater than what number?

F. 960,000
G. 9,600,000
H. 22,400,000
J. 96,000,000
K. 224,000,000

39. The population of American robins in 2015 is equal to 3.2×10^k for some integer k. What is the value of k ?

A. −8
B. −7
C. 2
D. 7
E. 8

40. A certain robin flew for 15 seconds at the maximum reported flight speed cited by the website. Which of the following values is closest to the number of *meters* the robin flew during that time?

(Note: 1 meter ≈ 3.3 feet)

F. 64
G. 240
H. 697
J. 792
K. 960

DO YOUR FIGURING HERE.

41. Let x be a real number. Which of the following statements is true for all possible values of x ?

A. $-x < x$
B. $-x < |x|$
C. $x = |x|$
D. $|x| = |-x|$
E. $-|x| = |-x|$

42. In the standard (x,y) coordinate plane, the 3 distinct points $A(3,5)$, $B(6,8)$, and C are collinear, and B is equidistant from A and C. What are the coordinates of C ?

F. (4,7)
G. (9,11)
H. (1.5,1.5)
J. (4.5,6.5)
K. (7.5,10.5)

43. If $90° < \theta < 180°$ and $\sin\theta = \frac{8}{17}$, then $\cos\theta = ?$

A. $\frac{8}{15}$

B. $\frac{17}{8}$

C. $-\frac{17}{8}$

D. $-\frac{15}{17}$

E. $-\frac{17}{15}$

44. The mean of 10 numbers entered into a computer statistics program was 75.0. One number was incorrectly entered as 73 instead of 78. When the 73 is replaced by 78, by how much will the mean increase?

F. 0.1
G. 0.5
H. 1.5
J. 3.0
K. 5.0

45. At Mort's Sporting Goods Store, the sale price of a pair of athletic shoes is 30% off the regular price of the shoes. The sale price of the shoes is \$84.00. What is the regular price of the shoes?

A. \$ 54.00
B. \$ 64.62
C. \$109.20
D. \$114.00
E. \$120.00

DO YOUR FIGURING HERE.

Use the following information to answer questions 46–48.

Data from a random sample of 335 car owners in a certain city are listed below. The table indicates the number of owners in 3 age brackets (16–25, 26–45, 46–60) who own cars from 3 car companies (A, B, C) in this city. Each owner in the sample owns only 1 car.

Age (in years)	Car companies			
	A	B	C	Total
16–25	16	24	40	80
26–45	54	48	53	155
46–60	65	23	12	100
Total	135	95	105	335

46. Two car owners from this sample will be chosen at random. Given that no owner is chosen twice, which of the following expressions gives the probability that both owners chosen will be from the same age bracket?

F. $\frac{80(79)}{335(334)} + \frac{155(154)}{335(334)} + \frac{100(99)}{335(334)}$

G. $\frac{135(134)}{335(334)} + \frac{95(94)}{335(334)} + \frac{105(104)}{335(334)}$

H. $\frac{80}{335} + \frac{155}{335} + \frac{100}{335}$

J. $\frac{80}{335}\left(\frac{155}{334}\right)\left(\frac{100}{333}\right)$

K. $\frac{1}{3}\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)$

47. For those in the sample who are 26 to 45 years old, which of the following values is closest to the average number of car owners per company?

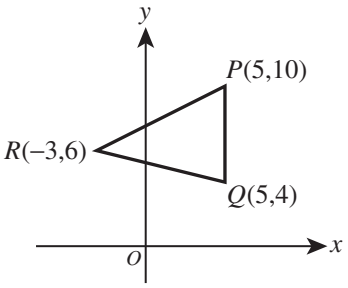
A. 37
B. 45
C. 52
D. 112
E. 155

48. A circle graph will be drawn with 3 sectors each representing the proportion of owners from Company A, B, and C who are 16 to 25 years old. What is the measure of the central angle for the Company A sector of the graph?

F. 5°
G. 17°
H. 20°
J. 43°
K. 72°

DO YOUR FIGURING HERE.

49. The vertices of $\triangle PQR$ are given in the standard (x,y) coordinate plane below. What is the area, in square coordinate units, of $\triangle PQR$?



A. 24
B. 25
C. 30
D. 48
E. 50

50. The table below gives values of the functions f and g at different values of x. What is $f(g(1))$?

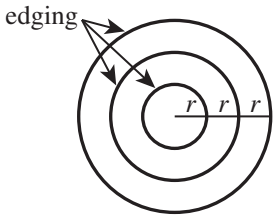
x	1	2	3
$f(x)$	3	−6	2
$g(x)$	2	7	1

F. −6
G. 1
H. 2
J. 3
K. 7

51. Joe, Carmen, and Dave each receive an allowance. The ratio of Joe's allowance to Dave's allowance is 3:2, and the ratio of Dave's allowance to Carmen's allowance is 3:4. What is the ratio of Joe's allowance to Carmen's allowance?

A. 1:2
B. 1:6
C. 2:5
D. 3:4
E. 9:8

52. The figure below shows a flower bed consisting of 3 regions each bordered by garden edging. The edging forms 3 concentric circles with the distance between successive borders equal to the radius, r meters, of the smallest circle. The length of edging needed for the border of the smallest region is 10 meters. What is the total length, in meters, of edging needed for the borders of all 3 regions?



F. 30
G. 60
H. 90
J. 110
K. 140

53. If $\ln x = 2$, then $x = ?$

A. 1
B. $\frac{2}{e}$
C. $2e$
D. e
E. e^2

DO YOUR FIGURING HERE.

54. The first 4 elements of a pattern are shown below. Each element is composed of small squares that are 18 inches wide and 18 inches long. Each element is a square with both dimensions 18 inches less than the dimensions of the next element. What is the perimeter, in *feet*, of the 5th element?

F. 6
G. 7.5
H. 20
J. 25
K. 30

55. For all positive x, which of the following is equal to $2 + \frac{3x}{x+2} - \frac{6}{2x+4}$?

A. $\frac{5x+1}{x+2}$

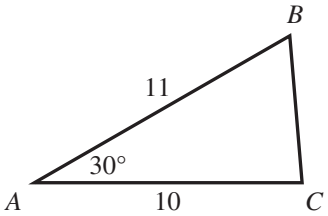
B. $\frac{6x-6}{2x+4}$

C. $\frac{7x+2}{2x+4}$

D. $\frac{3x-4}{3x+6}$

E. $\frac{3x-4}{3x+7}$

56. In $\triangle ABC$ shown below, the given side lengths are in meters. Which of the following expressions gives the area, in square meters, of $\triangle ABC$?



F. $\frac{1}{2}(11)(10)$

G. $\sqrt{10^2 + 11^2}$

H. $\frac{1}{2}(11)(10)(\cos 30°)$

J. $\frac{1}{2}(11)(10)(\sin 30°)$

K. $\sqrt{10^2 + 11^2 - 2(10)(11)(\cos 30°)}$

57. The simple interest for 1 year for an investment was \$372. If the interest rate had been 1% higher for this investment, the simple interest for 1 year would have been \$434. How much money was invested?

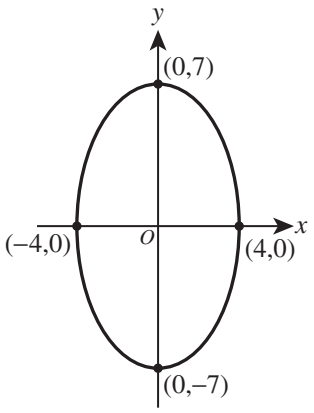
A. \$ 62
B. \$ 520
C. \$ 620
D. \$5,200
E. \$6,200

DO YOUR FIGURING HERE.

58. For what values of b does the equation $x^2 + bx + 1 = 0$ have no real solutions?

F. All $b < 0$
G. All $b < 1$
H. All $b < 2$
J. $0 < b < 4$
K. $-2 < b < 2$

59. In the standard (x,y) coordinate plane below, the endpoints of the major and minor axes of the ellipse are labeled. Which of the following equations determines the ellipse?



A. $\frac{x^2}{4} + \frac{y^2}{7} = 1$

B. $\frac{x^2}{8} + \frac{y^2}{14} = 1$

C. $\frac{x^2}{16} + \frac{y^2}{49} = 1$

D. $(x - 4)^2 + (y - 7)^2 = 1$

E. $(x + 4)^2 + (y + 7)^2 = 1$

60. One root of the quadratic polynomial $ax^2 + 13x - 6$ is equal to -3. Which of the following binomials is a factor of $ax^2 + 13x - 6$?

F. $x - \frac{2}{5}$

G. $x + \frac{2}{5}$

H. $x - 3$

J. $x - 5$

K. $x + 5$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.

READING TEST

35 Minutes—40 Questions

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

Passage I

LITERARY NARRATIVE: This passage is from the essay "In-Betweens" by Diana Abu-Jaber.

The narrator moves to Jordan with her Jordanian father, American mother, and two younger sisters.

One night after my sisters and I are in bed and the baby cats have ceased their crying, my parents come to our room, whispering and nudging each other, their smiles sly, as if they shared a private joke. They shake us out of sleep and say, "C'mon, we're going to do something!"

We yawn, slide out of the warm caves of our beds; our parents are gesturing us out the front door, their laughter lowered and mesmerizing. Then we are running across the stone courtyard—my sisters and I barefooted in cotton pajamas, the stones waxy beneath our feet. The neighbors and the street are all asleep, the buildings shut up, rose-tinted under a brassy, round moon. In one corner of the courtyard, tilted under the staircase to the upper floors, is the scooter, its red gleam muted now, private and soft. For a moment I think of my grandmother back in New Jersey, who wears a lipstick in the same fluid tones: red shot through with an undercurrent of blue. I look back at it as my parents open the car.

We drive through parts of the city that I've never seen before, where the lights glow like melted butter and the girls on the sidewalks are wearing brimmed hats and high heels. Men smile and turn to watch our car passing: I watch back, hands pressed to the window. Then we race beyond the glowing streets—they dwindle to a star—and the road ahead of us is long and dusty blue and smells like a warm, blue must, like the heat of a sheep's back.

When we finally get out of the car, there's a gravel lot, an expanse of folding chairs, patios, sparkly restaurants wedged in a long crescent along a flat blackness like gleaming enamel. Dad holds his hand out toward the gleam. "And what did I promise you kids?" he asks, though I recall no promises related to anything like this. "It's the Dead Sea!"

We've come, as usual, with no preparation, so my parents let us run into the water in our underpants—like the Jordanian kids around us. The salt water is satiny, so soft and dense it seems to bend beneath our arms. My father, who is generally afraid of the water, comes out and shows us how you can sit in the sea. He lazes back in it, and my sister tows him around by his hair while he makes boat sounds.

One of the restaurants on the lip of the water has a string of red lights that drop their reflections in the moonlit water; they make me think of the lonely red scooter. After a while, I straggle out of the water, yanking up my soggy underpants with their sprung elastic waistband. Mom is stretched out on a canvas chaise longue, holding a drink with a little parasol on the side. She wraps me shivering into a beach towel and makes room for me beside her on the lounge.

I blink out of my towel cave at this new place around us, then touch my mother's ribs through her cotton shirt. "Mom, how long do you have to be best friends with someone if you're best friends?"

She flitters at my bangs; they're drying stiff with salt. "Well, honey, I don't think there's any rules about that. I guess you can be best friends with someone your whole life if you're lucky."

"Are you and Dad best friends?"

It's hard to make out her expression under the cherry lights. She seems to be thinking about it, staring out to where Dad is still drifting around, piping and tooting like a tugboat.

"You have to do whatever your best friend says, right?"

Now I can see her face—amused and wary. "Why do you say that?"

"Dad said to come to Jordan, right?"

There is even less sound now than before, if that is possible, just a slip of waves on the shore, a sighing wash like the sound of someone saying *hush, hush,* or the rustle of the palm fronds arching over the sand. "Your father . . . needed us to come here, he needed to see—what it felt like."

"What does it feel like?" I ask quietly, not quite knowing what I'm asking, just following the path of the questions.

"I don't think—" she starts, then stops. My father is climbing out of the dark wash of the sea. "I don't think it feels the way he remembers it."

I put my hands on her waist—something that feels a little like a spark of alarm bounces through me. "Does he know that? That it doesn't feel the same?"

She looks over her shoulder, my father's shadow falling toward us in a long, cool slip as he walks beneath the neon lights. "He's still finding out."

The medicinal waters of the Dead Sea roll behind us, and the wild, heavy scent of honey, rocks, and thyme tempers the air. People come to dip themselves in these waters, to be cured of everything from skin ailments to spiritual wasting. I breathe it in deeply and sense a sort of dawning sweetness—of loss and nostalgia.

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1. The point of view from which the passage is told is best described as that of a first person narrator who:

A. relates the actions of several characters but reveals only her own inner thoughts.
B. focuses on interpreting the behavior of one of her sisters.
C. both relates the actions of and shares the inner thoughts of her mother, father, and sisters.
D. retells a story that has been told to her by someone else.

2. Which of the following statements best captures a main theme of the passage?

F. It isn't hard to understand what makes someone a best friend.
G. A dramatic life change can be both exciting and difficult.
H. Trips that are taken spontaneously are the most enjoyable trips.
J. Older siblings can help younger siblings understand a new situation.

3. It can most reasonably be inferred that which of the following objects referred to in the passage has a special but unexplained significance to the narrator?

A. The canvas chaise longue
B. The cotton pajamas
C. The brassy, round moon
D. The red scooter

4. The narrator's question "Mom, how long do you have to be best friends with someone if you're best friends?" (lines 56–57) leads the two into a discussion about the:

F. dynamics of the relationship between the narrator's mother and father.
G. narrator's new best friend and how long their friendship might last.
H. characteristics of the narrator's relationship with one of her sisters, who is her best friend.
J. narrator's belief that a person should have several close friends, not just one best friend.

5. The narrator's parents' mood during the action portrayed in lines 1–9 can best be described as:

A. boastful and aggravated.
B. solemn and mystified.
C. mischievous and enthusiastic.
D. confused and stern.

6. The main function of the third paragraph (lines 21–29) is to:

F. present the narrator's thoughts about the dusty streets she has traveled on several times before.
G. describe the narrator's fascination with the street lights that glow hazily and brightly.
H. illustrate the narrator's visual impression of the family's journey through the city and out of it.
J. make clear the narrator's admiration for the clothing the girls on the sidewalks wear.

7. In the passage, the phrase "a flat blackness like gleaming enamel" (lines 32–33) is used to describe which of the following places or areas?

A. A long, crescent-shaped stretch of developed land near the Dead Sea
B. The polished walkway along the Dead Sea
C. A gravel lot near the Dead Sea
D. The Dead Sea itself

8. The narrator feels something like "a spark of alarm" (line 85) when she puts her hands on her mother's waist primarily because the narrator has just:

F. sensed her mother's concern that the narrator's sisters are unable to talk openly about the family's move.
G. realized her father might be in a situation that's difficult for him and troubling to her mother.
H. begun to understand that her mother never had a best friend as a child.
J. learned that her mother isn't pleased with her questions.

9. It can most reasonably be inferred from the passage that, with regard to the narrator's father's feelings about having returned to Jordan, the narrator's mother believes she is:

A. more aware of his feelings than he himself is yet.
B. more surprised by his feelings than the girls are.
C. less worried about his feelings than the girls are.
D. less aware of his feelings than he himself is yet.

10. According to the passage, it's uncommon for the narrator's family to be:

F. away from the narrator's father's parents.
G. traveling by car instead of by train.
H. taking a long vacation together.
J. prepared for an outing.

Passage II

SOCIAL SCIENCE: This passage is from the article "The Awful Reign of the Red Delicious" by Sarah Yager.

In the 1870s, Jesse Hiatt, an Iowa farmer, discovered a mutant seedling in his orchard of Yellow Bellflower apple trees. He chopped it down, but the next season, it sprang back through the dirt. He chopped it down again. It sprang back again. "If thee must grow," he told the intrepid sprout, "thee may."

A decade later, Hiatt's tree bore its first fruit. The apples were elongated globes with red-and-gold striped skin, crisp flesh, and a five-pointed calyx. In 1893, when Stark Brothers' Nursery of Louisiana, Missouri, held a contest to find a replacement for the Ben Davis—then the most widely planted apple in the country, strapping and good-looking but bland—Hiatt submitted his new variety, which he called the Hawkeye. "My, that's delicious," Clarence Stark, the company's president, reportedly said after his first bite.

But not for the first time in apple lore, one sweet taste precipitated a fall. Stark Brothers' soon secured the rights to the Hawkeye, changed its name to the Stark Delicious (only after the branding of the Golden Delicious, in 1914, did it become the Red Delicious), and began an ambitious marketing campaign. Over the next two decades, the nursery spent $750,000 to promote the new apple, dispatching traveling salesmen to farms across the country and exhibiting the Delicious at the 1904 World's Fair. After the completion of the Great Northern Railway, Clarence Stark sent trainloads of seedlings to newly established orchards in the Columbia River Valley, their leaves trembling as the engines rumbled West.

With its hardy rootstocks and juicy, curvaceous fruit, the Red Delicious quickly became a favorite of growers and consumers from coast to coast—and as its commercial success grew, so did its distance from Hiatt's Hawkeye. In 1923, a New Jersey orchardist wrote to the Starks to report that one limb of a tree he had purchased from the nursery was producing crimson apples while those on the other limbs remained green. A chance genetic mutation that made the apples redden earlier had also given them a deeper, more uniform color, and customers were lining up for a taste. Paul Stark, one of Clarence's sons, travelled up from Missouri and laid down $6,000 for the limb. News of the deal spread, and soon *The Gettysburg Times* reported that more than 500 horticulturalists from 30 states had gathered at the orchard to discuss the "freak bud" that produced "the marvel apple of the age." Their meeting marked the beginning of an era of fruit improvement, as growers began to seek out and cultivate similar mutations.

By the 1940s, the Red Delicious had become the country's most popular apple, with the broad shoulders and lipstick shine of a Golden Age Hollywood star. The cosmetic changes were a boon for industrial agriculturalists: Apples that turned rosy before they were fully ripe could be picked earlier and stored longer, and skins with more red pigment tended to be thicker, which extended shelf life and hid bruises. But as genes for beauty were favored over those for taste, the skins grew tough and bitter around mushy, sugar-soaked flesh. Still, by the 1980s, the Red Delicious made up 75 percent of the crop produced in Washington. By the time selective breeding had taken its toll, according to apple expert Tom Burford, a few big nurseries controlled the market, planting decisions were made from the remove of boardrooms, and consumers didn't have many varieties to choose from. The Red Delicious became "the largest compost-maker in the country," he said, as shoppers routinely bought the apples and threw them away.

Then in the 1990s, new varieties that American growers had originally developed for overseas markets began to edge into the domestic market. Shoppers had been "eating with their eyes and not their mouths," Burford said. And now their taste buds had been awakened. A sudden shift in consumer preferences, paired with growing competition from orchards in China, took the industry by surprise. Between 1997 and 2000, U.S. apple growers lost nearly $800 million in surplus crop. They had "made the apples redder and redder, and prettier and prettier, and they just about bred themselves out of existence," a marketing director for one Northwestern fruit company told *The New York Times*.

Since then, Red Delicious production has declined by 40 percent. While the apple is still by far the most common in the U.S.—growers produced 54 million bushels of Red Delicious in 2011, compared to just 33 million bushels of its closest competitor, the Gala—the industry is adjusting to a changing market.

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11. The main purpose of the passage is to:

A. explore the apple varieties that were the ancestors of the Red Delicious.
B. relate the history of the Red Delicious.
C. consider contemporary opinions of the Red Delicious.
D. explain how experts improved the Red Delicious.

12. Which of the following statements best represents the passage's central claim about the Red Delicious?

F. Though genetic changes helped the Red Delicious achieve popularity, they eventually contributed to its decreasing popularity.
G. Due to the ease of fostering genetic changes in the Red Delicious, it became the apple of choice for growers.
H. Despite intense competition, the superior taste of the Red Delicious led to its domination of the market.
J. Because the Red Delicious increased the size of the apple market, the development of new apple varieties intensified.

13. Which of the following events referred to in the passage occurred first chronologically?

A. Stark Brothers' Nursery paid $6,000 for one limb in a New Jersey orchard.
B. Stark Brothers' Nursery held a contest to find a new apple variety.
C. The Red Delicious accounted for 75 percent of Washington's apple crop.
D. The Red Delicious was featured at the World's Fair.

14. Based on the passage, the phrase "selective breeding had taken its toll" (line 63) most specifically refers to:

F. the financial cost of the genetic development of the Red Delicious.
G. Burford's opinion that the Red Delicious was hurting overall sales of apples.
H. the market share lost by the Red Delicious to new apple varieties.
J. the deterioration of the taste and texture of the Red Delicious.

15. Which of the following statements best summarizes the sixth paragraph (lines 70–82)?

A. In the 1990s, consumer preference for Red Delicious continued to increase, leading to an $800 million surplus for US apple growers.
B. In the 1990s, consumer preference for fruit other than apples caused US and Chinese apple growers to lose money.
C. In the 1990s, consumer preference for new apple varieties and increased competition from overseas led to financial losses for US apple growers.
D. In the 1990s, consumer preference for redder apples and the planting of too many Red Delicious trees led to financial losses for US apple growers.

16. In the first paragraph, the seedling in Hiatt's orchard is portrayed as:

F. persistent.
G. scruffy.
H. hostile.
J. ordinary.

17. As it is used in line 18, the word *secured* most nearly means:

A. fastened.
B. acquired.
C. guaranteed.
D. fortified.

18. According to the passage, which of the following methods did the Stark Brothers' Nursery use to bring the Stark Delicious to the attention of apple growers?

F. Tasting contests
G. Competitive pricing
H. Newspaper advertising
J. Traveling salesmen

19. The passage claims that which of the following features helps extend the shelf life of apples?

A. Thick skin
B. Shiny skin
C. Firm flesh
D. Sweet flesh

20. In the context of the passage, the information between the dashes in lines 85–87 mainly serves to:

F. show that Red Delicious production stabilized in 2011.
G. contrast the decline in Red Delicious production with the increase in Gala production.
H. specify the size of the US apple harvest.
J. illustrate the continued domination of the market by the Red Delicious.

Passage III

HUMANITIES: This passage is from the article "Photography Changes the Movies We Choose to See" by Preminda Jacob.

For nearly five decades, huge photo-realistic billboards of film stars towered over the streets of Chennai, a major hub of the vibrant and prolific Indian film industry. Expertly hand-painted on canvas banners and plywood cutouts, these eye-catching advertisements extracted dreamlike images of wealth, beauty, and revenge from films screened in darkened and air-conditioned theaters and displayed them in the sunlit glare of urban thoroughfares.

The selection of these photographic stills, plucked from films and enlarged to architectural proportions (one hundred feet in length for banners and forty feet in height for cutouts) was calculated to excite the public and nourish a "spectatorial consciousness," what Roland Barthes, a French cultural critic who often wrote about photography, described as the experiential quality of still photographic images. Barthes recalled being transfixed by still images from movies, but then losing all memory of them while viewing the film they came from. Our perception of a moving cinematic image, he explained, is always determined by the frames that both precede and follow it. In contrast, a single and isolated film still that stands alone can be viewed indefinitely and more carefully.

While the artists who crafted Chennai's cinematic billboards were probably unaware of Barthes' theories, interviews I conducted with them reminded me how aware they were of distinctions between still and moving images. I recall one anecdote in particular. Mr. Vedachellam—a billboard artist and entrepreneur—explained to me that his film-industry clientele routinely attempted to circumvent censorship by protesting to the authorities that the provocative still photographs featured on billboards were simply taken from film footage already cleared by the censors. The police commissioner's canny rejoinder to the publicity agents' appeals, Mr. Vedachellam recalled, was to remind them that these questionable stills appeared on the cinema screen for only a few seconds so viewers would soon forget them, or may not even have quite "seen" them at all. Freezing and enlarging such images, he argued, was a different matter altogether. And displaying them prominently on major thoroughfares would likely result in costly traffic jams and additional accidents. The police routinely censored these images by pasting pieces of white paper over offending portions of the billboards.

In his work, Barthes made another, different point about distinctions between photographic and painted images. A photograph, he claimed, is indexical—it has a direct and detailed correspondence to the subject, whereas in a drawn or painted image, each mark or brushstroke potentially takes on more symbolic value. So, what happens when the conventions of three media coalesce? A photograph of Mr. Vedachellam at work records a complex nexus of photography, painting, and the cinema. Each medium mimics some of the characteristics of the two others. Vedachellam's painting style is photorealistic; he copies a photograph that is, itself, a composite of film stills. And these film stills reflect the influence of the melodramatic look of nineteenth-century European tableaux painting on the sets, costumes, and lighting of the first full-length feature films produced both in Hollywood and in India.

The hybridization of these media dates back to the work of India's earliest photographers. From the 1850s to the present, local entrepreneurs operating photo studios have employed painters to enhance portrait photographs of their clients with drama and desirable accoutrements that were absent in the original photographs. The theatricality of Indian studio photographs, and the fantasies they fulfill, has in turn influenced the idealized ways celebrities are represented in the hand-painted cinema advertisements. Like their counterparts in the world of studio photography, banner artists also painted directly onto a photograph in the process of creating studies for their spectacular enlargements. Using black-and-white poster paints, they first painstakingly outlined every detail in the photograph. Next, a photographic negative of the outlined image was projected onto the canvas or plywood surface and a tracing was made. At every stage in the process artists grasped a film still in one hand while wielding a paintbrush with the other hand.

This method of transferring photographic stills onto canvas encouraged artists to further manipulate and idealize images of their celebrity subjects.

From the article "Photography Changes the Movies We Choose to See" by Preminda Jacob (©2012 by Preminda Jacob). Used with permission.

21. The main purpose of the passage is to:

- **A.** argue that the Indian film industry relies heavily on billboard advertising to increase ticket sales.
- **B.** compare the histories of the Indian and Hollywood film industries as seen through billboard advertisements.
- **C.** demonstrate the effect that Chennai's cinematic billboards have had on movie theaters and the local economy.
- **D.** explore the way Chennai's cinematic billboards represent the melding of film, photography, and painting.

22. In the passage, Chennai's cinematic billboards are most nearly characterized as:

- **F.** imposing and provocative.
- **G.** solemn and forbidding.
- **H.** minimalist yet cheerful.
- **J.** subtle yet informative.

23. The main point of the second paragraph (lines 10–24) is that Barthes theorized that:

A. a film still expanded to architectural proportions is more effective than a small still.
B. careful viewing of film stills is essential to understanding full-length films.
C. the experience of viewing a moving image is different from the experience of viewing a film still.
D. a film still is easier to remember when viewed in the context of the entire movie.

24. According to the passage, in India, the act of enhancing photographic images with paint was first practiced by:

F. portrait painters working in the 1880s.
G. poster artists working in the 1950s.
H. assistants working for photojournalists in the 1960s.
J. painters working for studio photographers in the 1850s.

25. According to the passage, before a billboard artist traced a photographic image onto a canvas, he or she would first:

A. make multiple copies of the photograph as backups.
B. convert any black-and-white photographs to color.
C. cut away unneeded portions of the photograph.
D. outline every detail in the photograph with poster paints.

26. In the passage, lines 4–9 primarily serve to:

F. show that advertisers take different approaches to daytime and nighttime advertising.
G. establish the appearance, function, and appeal of Chennai's cinematic billboards.
H. argue that the glare of sunlight is detrimental to the appreciation of advertising images.
J. explain why Chennai's cinematic billboards tended to emphasize certain images.

27. As it is used in line 13, the word *calculated* most nearly means:

A. intended.
B. estimated.
C. counted.
D. judged.

28. As he is presented in the passage, Barthes claimed that compared to a photograph, a drawn or painted image is potentially more:

F. difficult for many viewers to appreciate.
G. useful for conveying the artist's feelings.
H. likely to be considered an art object.
J. likely to have symbolic value.

29. In the context of discussing the artistic elements at work in Chennai's billboards, the passage author most likely uses the term "complex nexus" (line 56) to suggest:

A. a complicated history.
B. an enduring mystery.
C. a sophisticated connection.
D. a challenging problem.

30. Based on details in the fifth paragraph (lines 65–84), it can reasonably be inferred that one reason billboard artists enhanced or manipulated images from films was to:

F. justify the cost of theater tickets.
G. fulfill viewers' fantasies.
H. protest film censorship.
J. support the local art scene.

Passage IV

NATURAL SCIENCE: Passage A is from the book *Animal Wise: The Thoughts and Emotions of Our Fellow Creatures* by Virginia Morell. Passage B is from the essay "Big Love: The Emotional Lives of Elephants" by Carl Safina.

Passage A by Virginia Morell

One of the more striking discoveries in neuroscience in recent years is the finding that elephants, whales, great apes, and humans all possess a peculiar kind of brain cell. These neurons were first discovered in human brains in the nineteenth century and were named von Economo cells after the Romanian anatomist Constantin von Economo, who identified them. At first, these spindle-shaped neurons were touted as the cells that "make us human," because they're connected to our feelings of empathy, love, emotional suffering, and sociality. Then, in 1999, two other researchers, Patrick Hof and John Allman, spotted von Economo cells in the brains of all the great apes; others recently found them in monkeys. Allman has searched without luck for the cells in more than a hundred other species, from sloths to platypuses. So it was big news when, in 2007, he discovered spindle cells in the brains of whales, dolphins, and elephants. But it was a puzzling discovery, too. Why should such a disparate group of animals have these specialized cells?

From an evolutionary point of view, it's not surprising that primates and humans have von Economo cells, since we are in the same lineage. But primates and humans haven't shared an ancestor with whales or elephants since about the beginning of the mammalian lineage, some sixty million years ago. It seems that cetaceans and elephants evolved their spindle cells independently. What factors would produce such emotionally specialized brain cells?

Allman thinks part of the answer lies in the size of the animals' brains—most species that have spindle cells also have notably large brains—and in the location of the cells. Von Economo cells are always found in two regions of the cortex associated with emotionally charged, visceral judgments, such as deciding whether a fellow animal is suffering. And part of the answer lies in the size of the spindle cells. They are unusually large, enabling them to act like high-speed circuits, fast-tracking information to and from other parts of the brain, while bypassing unnecessary connections. These are the kind of cells, Allman argues, that would be especially useful to an animal living in a complex society—a society in which making accurate, intuitive decisions about another's actions (or facial or vocal expressions) is crucial for your family's and your survival.

Passage B by Carl Safina

Anthropomorphism is the attribution of human motivation, characteristics, or behavior to animals, inanimate objects, or natural phenomena.

In establishing the study of animal behavior as a science, it had originally been helpful to make *anthropomorphism* a word that raised a red flag. But as lesser intellects followed the Nobel Prize–winning pioneers, *anthropomorphism* became a pirate flag. If the word was hoisted, an attack was imminent. You wouldn't get your work published. And in the academic realm of publish or perish, jobs were at stake. Even the most informed, insightful, logical inferences about other animals' motivations, emotions, and awareness could wreck your professional prospects.

But what *is* a "human" emotion? When someone says you can't attribute human emotions to animals, they forget the key leveling detail: humans *are* animals. Human sensations *are* animal sensations. Inherited sensations, using inherited nervous systems.

All of the emotions we know of just happen to be emotions that humans feel. So, simply deciding that other animals can't have any emotions that humans feel is a cheap way to get a monopoly on all of the world's feelings and motivation. People who've systematically watched or known animals realize the absurdity of this. But many others still don't. "The dilemma remains," wrote author Caitrin Nicol recently, "how to get an accurate understanding of the animals' nature and (if appropriate) emotions, without imposing on them assumptions born of a distinctly human understanding of the world."

But tell me, what "distinctly human understanding" hampers our understanding of other animals' emotions? Is it our sense of pleasure, pain, hunger, frustration, self-preservation, defense, parental protection? We never seem to doubt that an animal acting hungry feels hungry. What reason is there to disbelieve that an elephant who seems happy is happy? We can't really claim scientific objectivity when we recognize hunger and thirst when animals are eating and drinking, exhaustion when they tire, but deny them joy and happiness as they're playing with their children and their families. Yet the science of animal behavior has long operated with that bias—and that's unscientific. In science, the simplest interpretation of evidence is often the best.

Passage A: Excerpt(s) from ANIMAL WISE: THE THOUGHTS AND EMOTIONS OF OUR FELLOW CREATURES by Virginia Morell, copyright © 2013 by Virginia Morell. Used by permission of Crown Books, an imprint of the Crown Publishing Group, a division of Penguin Random House LLC. All rights reserved.

Passage B: ©2015 by Carl Safina. Used by permission of Carl Safina in care of the Jean V. Naggar Literary Agency, Inc. (permissions@jvnla.com)

Questions 31–34 ask about Passage A.

31. Passage A most strongly suggests that in the nineteenth century, anatomists generally believed:

A. our feelings of empathy, love, and sociality weren't part of what makes us human.
B. von Economo cells existed only in the human brain.
C. the spindle-shaped neurons that von Economo identified shouldn't be named for him.
D. it was crucial to search for von Economo cells in a variety of animals.

32. It can most reasonably be inferred from Passage A that Allman's search for von Economo cells in which of the following animals occurred last chronologically?

F. Sloths
G. Dolphins
H. Platypuses
J. Great apes

33. The main point of the second paragraph of Passage A (lines 21–29) is that:

A. at the beginning of the mammalian lineage, primates and humans shared ancestors with whales and elephants.
B. primates and humans are in the same lineage.
C. some animals seem to have been able to develop von Economo cells independently from primates and humans.
D. von Economo cells can be described as "emotionally specialized brain cells."

34. According to Passage A, Allman believes a clear correlation exists between a species having spindle cells and that species having:

F. a close genetic link to whales.
G. several types of neurons.
H. a very large brain.
J. a cortex.

Questions 35–37 ask about Passage B.

35. Based on Passage B, how does the passage author feel about the trend in the academic study of animal behavior that is described in lines 49–57?

A. He strongly disapproves.
B. He is ambivalent.
C. He reluctantly approves.
D. He enthusiastically approves.

36. Based on the last paragraph of Passage B, which of the following statements would be the clearest example of "the simplest interpretation of evidence" (line 88)?

F. Parental protection is the most advanced and humanlike emotion that animals can feel.
G. When animals seem frustrated in a frustrating context, the animals are feeling frustration.
H. An animal that seems hungry might not necessarily be hungry.
J. Humans' own emotions interfere with the ability to assess emotion in animals.

37. The author of Passage B criticizes the conclusion that if humans feel a particular emotion, then animals:

A. won't be able to recognize that emotion in humans.
B. will want to learn how to have that emotion.
C. can't have that emotion.
D. must have that emotion.

Questions 38–40 ask about both passages.

38. Which of the following statements best captures a key difference in the way the passages explore the link between human and animal emotions?

F. Passage A focuses on neuroscience, whereas Passage B focuses on the observation of behavior.
G. Passage A focuses on nineteenth-century research, whereas Passage B focuses on current research.
H. Passage A focuses on survival drives, whereas Passage B focuses on familial bonds.
J. Passage A focuses on anecdotal evidence, whereas Passage B focuses on one extensive study.

39. Which of the following statements best captures one difference in the purposes of Passage A and Passage B?

A. Passage A aims to bluntly correct readers' assumptions, while Passage B aims to confirm readers' assumptions.
B. Passage A aims to urge readers to action, while Passage B aims to encourage readers to stop acting carelessly.
C. Passage A aims to present two opposing viewpoints for readers to evaluate, while Passage B aims to entertain readers.
D. Passage A aims to inform readers about a recent finding, while Passage B aims to challenge readers with a bold argument.

40. The passages provide the clearest evidence that which of the following people performs work that is grounded in hands-on scientific research?

F. The author of Passage A
G. The author of Passage B
H. Allman, as he is presented in Passage A
J. Nicol, as she is presented in Passage B

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

Scientists conducted a study to examine the *caching* (storing food) and feeding behaviors of gray squirrels.

Prior to the study, acorns were collected from a park and sorted into types, first according to the species of tree they grew on—red oak, pin oak, or white oak—and then according to whether the acorn was undamaged, *infested* (contained insect larvae), or *shelled* (shell removed). Each acorn was stored at 2°C until the day it was to be used.

Study

The study was conducted over 75 consecutive autumn days. Beginning at the same time each morning, 225 acorns were placed, one at a time, at a given location in the park where the acorns had been collected. Each of the 9 acorn types was presented an equal number of times, and the order in which the acorns were presented was random. All the acorns were picked up by squirrels within 1 minute. Table 1 shows, for each acorn type, the percent of acorns that were cached, eaten, or *rejected* (dropped after being picked up) by the squirrels.

Table 1

Acorn type	Percent of acorns: cached	eaten	rejected
Undamaged red oak	52	44	4
Infested red oak	40	56	4
Shelled red oak	32	60	8
Undamaged pin oak	24	64	12
Infested pin oak	24	68	8
Shelled pin oak	20	64	16
Undamaged white oak	12	88	0
Infested white oak	24	76	0
Shelled white oak	20	76	4

In addition, for each red oak acorn that was not rejected, the average distance (including both horizontal and vertical) the squirrel traveled before caching or eating the acorn was determined (see Table 2).

Table 2

Acorn type	Average distance traveled (m) before: caching	eating
Undamaged red oak	11.4	22.2
Infested red oak	12.5	20.2
Shelled red oak	10.4	15.0

Adapted from M. A. Steele et al., "Caching and Feeding Decisions by *Sciurus carolinensis*: Responses to Weevil-Infested Acorns." ©1996 by American Society of Mammalogists.

1. The study was most likely designed to answer which of the following questions about squirrel behavior?

A. Does the presence of insect larvae in acorns increase the amount of protein consumed by squirrels?
B. Are squirrels more likely to reject acorns that are infested or acorns that are shelled?
C. Does the percent of acorns cached by squirrels vary from season to season?
D. Are squirrels more likely to travel a greater distance during the morning or during the afternoon?

2. Which of the following factors was held constant during the study?

F. Percent of acorns that were cached
G. Time of day scientists began placing acorns at the park
H. Order in which the acorn types were presented
J. Distance a squirrel traveled before eating acorns

3. Which of the following statements about pin oak acorns is consistent with the results of the study?

A. Shelled pin oak acorns were eaten more frequently than infested pin oak acorns.
B. Shelled pin oak acorns were rejected less frequently than undamaged pin oak acorns.
C. Undamaged pin oak acorns and infested pin oak acorns were cached 24% of the time.
D. Undamaged pin oak acorns were cached 64% of the time, and infested pin oak acorns were cached 68% of the time.

4. According to Table 2, before eating shelled red oak acorns, the squirrels traveled an average distance of:

F. 10.4 m.
G. 11.4 m.
H. 12.5 m.
J. 15.0 m.

5. Which of the following statements comparing the distances squirrels traveled before eating infested acorns to the distances they traveled before caching infested acorns is supported by the results in Table 2 ? On average, the distance traveled before:

A. eating was farther than the distance traveled before caching for infested red oak acorns.
B. caching was farther than the distance traveled before eating for infested red oak acorns.
C. eating was farther than the distance traveled before caching for infested white oak acorns.
D. caching was farther than the distance traveled before eating for infested white oak acorns.

6. Assume that the more *perishable* (likely to decay) a given type of acorn, the more likely a squirrel is to eat that acorn rather than cache it. Consider the results in Table 1 for the shelled red oak acorns, infested pin oak acorns, and undamaged white oak acorns. Based on these results, what is the order of these 3 acorn types, from most perishable to least perishable?

F. Shelled red oak, infested pin oak, undamaged white oak
G. Shelled red oak, undamaged white oak, infested pin oak
H. Undamaged white oak, shelled red oak, infested pin oak
J. Undamaged white oak, infested pin oak, shelled red oak

7. Of the 1,875 undamaged pin oak acorns tested in the study, the number of those acorns that were cached by squirrels was closest to which of the following?

A. 225
B. 475
C. 675
D. 1,200

Passage II

In the periodic table, a column of elements is called a *group*. For each of 5 elements in Group 2A and for each of 5 elements in Group 3A, Table 1 gives the *atomic mass* (average mass of 1 atom in atomic mass units, amu) and 3 other properties at a temperature of 298 K:

- density,
- *specific heat* (amount of heat required to raise the temperature of 1 g of a substance by 1 K),
- *thermal conductivity* (ability to conduct heat; the greater the thermal conductivity, the more effectively the substance conducts heat).

Table 1

Group in periodic table	Element (symbol)	Atomic mass (amu)	Density at 298 K (g/cm^3*)	Specific heat at 298 K [J/(g·K)†]	Thermal conductivity at 298 K [W/(m·K)‡]
2A	Beryllium (Be)	9.012	1.85	1.83	200
	Magnesium (Mg)	24.31	1.74	1.02	156
	Calcium (Ca)	40.08	1.54	0.647	200
	Strontium (Sr)	87.62	2.64	0.306	35.3
	Barium (Ba)	137.3	3.62	0.204	18.4
3A	Boron (B)	10.81	2.34	1.03	27.4
	Aluminum (Al)	26.98	2.70	0.897	237
	Gallium (Ga)	69.72	5.91	0.373	40.6
	Indium (In)	114.8	7.31	0.233	81.6
	Thallium (Tl)	204.4	11.8	0.129	46.1

*grams per cubic centimeter
†joules per gram per kelvin
‡watts per meter per kelvin

Figure 1 shows, for Al and for Mg, how the thermal conductivity varies between 1 K and 100 K.

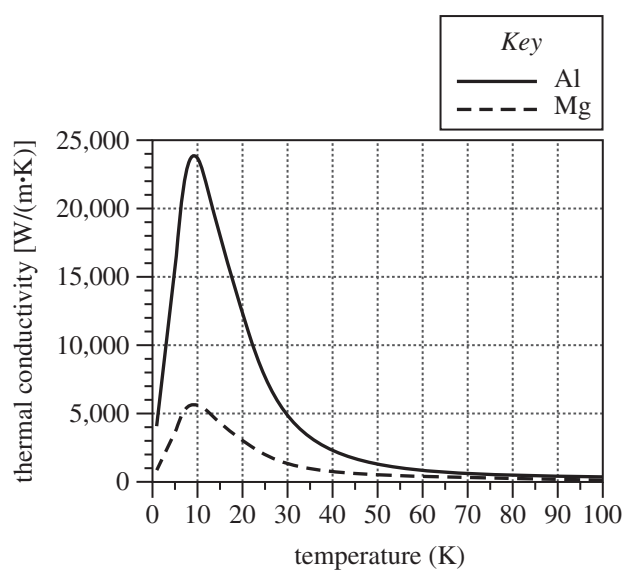


Figure 1

8. Based on Table 1, among the Group 2A elements, as atomic mass increases, the specific heat:

F. increases only.
G. decreases only.
H. increases and then decreases.
J. decreases and then increases.

9. According to Table 1, at 298 K, the specific heat of indium is closest in value to the specific heat of which of the following elements?

A. Ba
B. Ca
C. Sr
D. Tl

10. Based on the definition of thermal conductivity and on Table 1, does strontium or thallium conduct heat more effectively at 298 K ?

F. Strontium; the thermal conductivity of strontium is greater than that of thallium.
G. Strontium; the thermal conductivity of strontium is less than that of thallium.
H. Thallium; the thermal conductivity of thallium is greater than that of strontium.
J. Thallium; the thermal conductivity of thallium is less than that of strontium.

11. Neither Table 1 nor Figure 1 gives the thermal conductivity of magnesium at which of the following temperatures?

A. 50 K
B. 98 K
C. 200 K
D. 298 K

12. Based on Figure 1, at which of the following temperatures is the thermal conductivity of Al closest in value to the thermal conductivity of Mg ?

F. 10 K
G. 30 K
H. 50 K
J. 80 K

13. What is the meaning of the value for the density of indium given in Table 1 ?

A. Each cm^3 of indium has a mass of 7.31 g.
B. Each cm^3 of indium has a volume of 7.31 g.
C. Each g of indium has a volume of 7.31 cm^3.
D. Each g of indium has a mass of 7.31 cm^3.

Passage III

When viewed from above, the path of a launched object is expected to be a straight line. However, because Earth rotates, the *Coriolis effect* causes the object to be deflected, either to the right of the expected path in the Northern Hemisphere, or to the left of the expected path in the Southern Hemisphere. The *magnitude of deflection* (MOD) is a distance that serves as a measure of the Coriolis effect (see Figure 1). The MOD is the same when measured at the same latitude (for example, 30°) in either hemisphere.

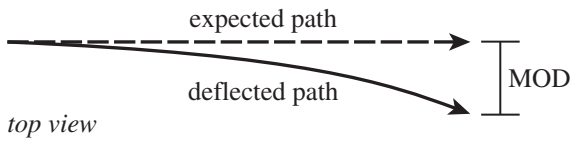


Figure 1

Students conducted 3 experiments to study the Coriolis effect.

Experiment 1

The students performed 5 trials, each at a different latitude. In each trial, they launched a ball due east at a speed of 25 m/s over a distance of 100 m. They then measured the ball's MOD, in cm (see Table 1).

Table 1

Latitude (°N)	MOD (cm)
15	0.75
30	1.46
45	2.06
60	2.53
75	2.82

Experiment 2

The students performed 5 trials, each at 45°N latitude. In each trial, they launched a ball due east at a different speed over a distance of 100 m. They then measured the ball's MOD (see Table 2).

Table 2

Speed (m/s)	MOD (cm)
15	3.44
20	2.58
30	1.72
35	1.47
40	1.29

Experiment 3

The students performed 5 trials, each at a different latitude. In each trial, they repeatedly launched 2 identical disks, each 4 cm in diameter, directly toward one another at identical speeds across a 200 m long frictionless horizontal plane. The speed was adjusted for each launch until the students had determined the *minimum* launch speed required for the disks to just avoid colliding (see Figure 2). Table 3 shows their results.

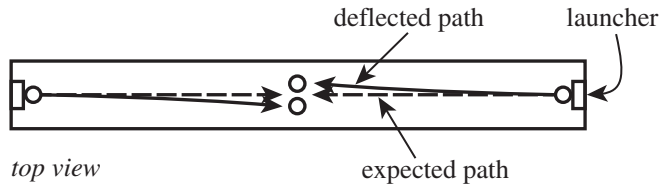


Figure 2

Table 3

Latitude (°N)	Minimum speed (m/s)
15	9.44
30	18.23
45	25.78
60	31.58
75	35.22

14. Suppose that in Experiment 2, the students had launched the ball at a speed of 33 m/s. The ball's MOD at this speed would most likely have been:

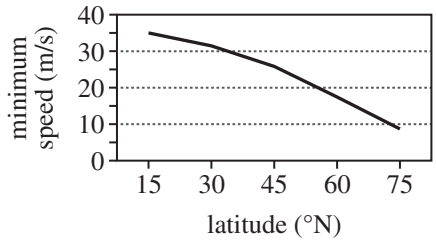
F. smaller than 1.29 cm.
G. between 1.29 cm and 1.47 cm.
H. between 1.47 cm and 1.72 cm.
J. larger than 1.72 cm.

15. According to the results of Experiment 1, as latitude increased, the MOD due to the Coriolis effect:

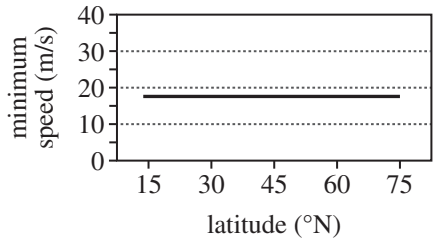
A. decreased only.
B. increased only.
C. decreased and then increased.
D. increased and then decreased.

16. Based on the results of Experiment 3, which of the following graphs best shows the relationship between latitude and minimum speed required to avoid a collision?

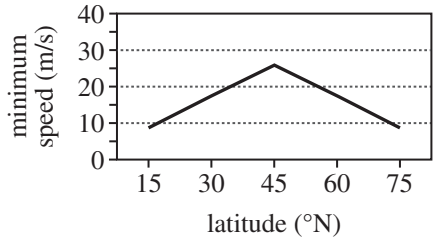
F.



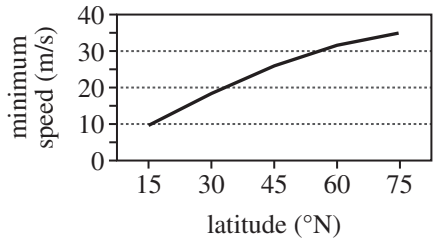
G.



H.



J.



17. The students made certain to use the same ball in both Experiment 1 and Experiment 2. The students most likely did this to ensure that the ball's MOD would be:

A. unaffected by variations in object shape or mass.
B. unaffected by variations in launch speed or latitude.
C. the same for each trial.
D. different for each trial.

18. Based on the results of Experiment 2, by how many *millimeters* did the ball's MOD decrease when the launch speed was increased from 15 m/s to 20 m/s ?

F. 2.5 mm
G. 3.4 mm
H. 5.2 mm
J. 8.6 mm

19. Suppose that in Experiment 1, a trial had been performed in which a ball had been launched at a speed of 25 m/s at 45° *South* latitude. This trial would most likely have resulted in the ball deflecting to the:

A. right of its expected path with an MOD of 2.06 cm.
B. right of its expected path with an MOD of 25.78 cm.
C. left of its expected path with an MOD of 2.06 cm.
D. left of its expected path with an MOD of 25.78 cm.

20. Which of the following statements best summarizes the procedures of Experiment 3 ? The students:

F. repeatedly adjusted the disks' launch speed until the resulting MOD for each disk was slightly larger than 2 cm.
G. repeatedly adjusted the latitude at which the disks were launched until the resulting MOD for each disk was slightly larger than 2 cm.
H. repeatedly adjusted the disks' launch speed until the resulting MOD for each disk was slightly larger than 200 cm.
J. repeatedly adjusted the latitude at which the disks were launched until the resulting MOD for each disk was slightly larger than 200 cm.

Passage IV

In human blood, calcium (Ca^{2+}) concentration is regulated by vitamin D_3. First, vitamin D_3 is converted to *calcidiol* (CD) in the liver. An elevated concentration of CD inhibits further conversion of vitamin D_3. Next, CD is converted to *calcitriol* (CT) in the kidneys in a reaction that requires *parathyroid hormone* (PTH). An elevated concentration of CT increases Ca^{2+} concentration, which in turn inhibits further release of PTH. See Figure 1.

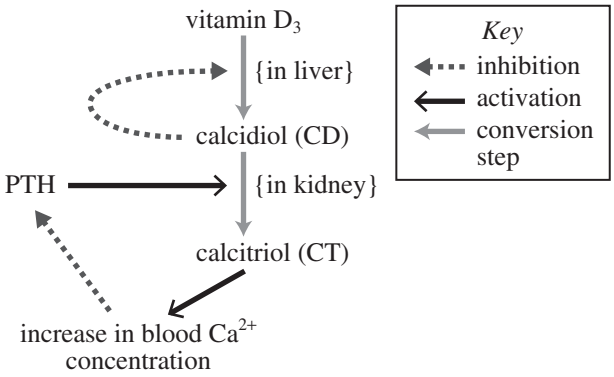
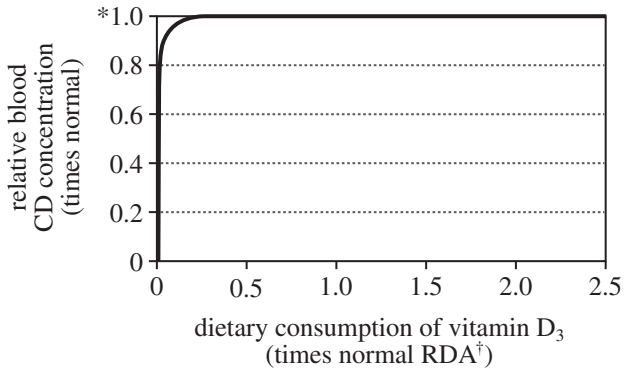


Figure 1

Figures 2 and 3, respectively, show how dietary consumption of vitamin D_3 affects relative blood CD concentration and how blood Ca^{2+} concentration affects relative blood CT concentration.

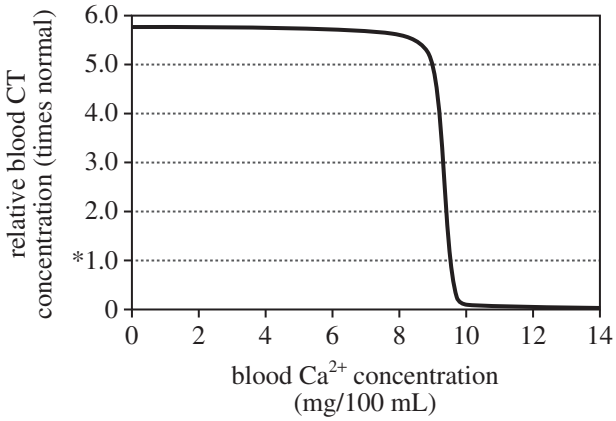


*1.0 represents the normal blood calcidiol concentration

†recommended daily allowance

Note: Assumes minimal exposure to sunlight.

Figure 2



*1.0 represents the normal blood calcitriol concentration

Figure 3

Figures adapted from Hall, John E., *Guyton and Hall Textbook of Medical Physiology*, 12th ed. ©2011 by Saunders Elsevier.

21. According to Figure 2, if an individual increased dietary consumption of vitamin D_3 from 1.0 times the normal RDA to 2.0 times the normal RDA, would the individual's relative blood CD concentration increase?

A. No; according to Figure 2 the relative blood CD concentration would decrease.
B. No; according to Figure 2 the relative blood CD concentration would remain the same.
C. Yes; according to Figure 2 the relative blood CD concentration would increase from 0.5 times normal to 1.0 times normal.
D. Yes; according to Figure 2 the relative blood CD concentration would increase from 1.0 times normal to 2.0 times normal.

22. According to Figure 3, the relative blood CT concentration is between 5 times normal and 6 times normal within which of the following blood Ca^{2+} concentration ranges?

F. 8 mg/100 mL to 9 mg/100 mL
G. 10 mg/100 mL to 11 mg/100 mL
H. 11 mg/100 mL to 12 mg/100 mL
J. 13 mg/100 mL to 14 mg/100 mL

23. According to Figure 1, what activates the conversion of CD to CT?

A. Ca^{2+}
B. CT
C. Vitamin D_3
D. PTH

24. According to Figure 3, when an individual's blood CT concentration is at a normal value, the individual's blood Ca^{2+} concentration is closest to which of the following values?

F. 0.5 mg/100 mL
G. 4.5 mg/100 mL
H. 9.5 mg/100 mL
J. 11.5 mg/100 mL

25. According to Figure 2, the greatest variation in relative blood CD concentration occurs when the dietary consumption of vitamin D_3 is within which of the following ranges?

A. 0 times the normal RDA to 0.25 times the normal RDA
B. 0.25 times the normal RDA to 0.5 times the normal RDA
C. 0.75 times the normal RDA to 1.0 times the normal RDA
D. 1.0 times the normal RDA to 1.25 times the normal RDA

26. According to the given information, the inhibition of the conversion of vitamin D_3 to CD is caused by:

F. a low concentration of CT.
G. a low concentration of CD.
H. an elevated concentration of CT.
J. an elevated concentration of CD.

Passage V

The *Atwood machine* shown in Figure 1 was used as part of 2 studies on objects moving with constant acceleration.

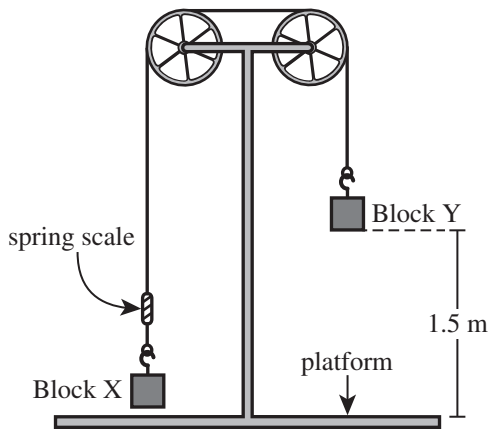


Figure 1

Study 1

In each of 10 trials, the following procedure was performed:

1. A string was passed over 2 pulleys. The string had a ring on each end and a *spring scale* (a device that can measure forces) near one end.

2. Block X, having a mass m_X, was hooked onto the left ring. Block Y, having a mass m_Y, was hooked onto the right ring.

3. Block X was pulled down and held in place so that Block Y was 1.5 m above the platform.

4. With all objects starting at rest, Block X was released, and both F (the force on the string) and t (the time required for Block Y to fall to the platform) were measured.

(Note: All objects other than the 2 blocks had negligible mass. The string was not stretchable.)

Table 1 shows the results, with F in newtons (N) and t in seconds (s).

Table 1

Trial	m_X (kg)	m_Y (kg)	F (N)	t (s)
1	0.2	0.2	1.96	—
2	0.2	0.4	2.61	0.96
3	0.2	0.6	2.94	0.78
4	0.2	0.8	3.14	0.71
5	0.4	0.4	3.92	—
6	0.4	0.6	4.70	1.24
7	0.4	0.8	5.23	0.96
8	0.6	0.6	5.88	—
9	0.6	0.8	6.72	1.46
10	0.8	0.8	7.84	—

Note: A dash indicates that Block Y did not fall.

Study 2

The acceleration, a, of Block Y in each trial of Study 1 was then calculated using the available t data. Table 2 shows the results, with a in meters per second squared (m/s^2).

Table 2

Trial	a (m/s^2)
1	0
2	3.27
3	4.90
4	5.88
5	0
6	1.96
7	3.27
8	0
9	1.40
10	0

27. The *speed* (in m/s) of Block Y can be obtained using the equation:

speed = (acceleration) × (time)

The speed of Block Y at the time it struck the platform in Trial 2 is correctly represented by which of the following expressions?

A. $(3.27\ \text{m/s}^2) \times (0.78\ \text{s})$
B. $(3.27\ \text{m/s}^2) \times (0.96\ \text{s})$
C. $(4.90\ \text{m/s}^2) \times (0.78\ \text{s})$
D. $(4.90\ \text{m/s}^2) \times (0.96\ \text{s})$

28. Which of the following statements is consistent with the available information about the design or procedures of the studies?

F. More trials were performed in Study 2 than were performed in Study 1.
G. In each trial, the mass of Block X was less than or equal to the mass of Block Y.
H. The results of Study 2 were unrelated to the results of Study 1.
J. There was only 1 trial that involved testing blocks of equal mass.

29. Suppose that in Study 1, a trial had been performed in which Block Y was pulled down and then released when Block X was 1.5 m above the platform. Further suppose that in this trial, m_X was 0.8 kg and m_Y was 0.6 kg. The force on the string in this trial would most likely have been closest to which of the following?

A. 3 N
B. 5 N
C. 7 N
D. 9 N

30. Suppose that in Step 3, Block X had been pulled down and held in place so that Block Y was 100 *centimeters* (NOT meters) above the platform. Would the values of t recorded in Study 1 more likely have been greater than or less than those shown in Table 1 ?

F. Greater, because Block Y would have fallen a longer distance.
G. Greater, because Block Y would have fallen a shorter distance.
H. Less, because Block Y would have fallen a longer distance.
J. Less, because Block Y would have fallen a shorter distance.

31. Based on the results of the studies, for a given value of m_X, as m_Y was increased, which of the variables F, t, and a also increased?

A. F and a only
B. F and t only
C. t and a only
D. F, t, and a

32. Based on the description of Study 1, was m_Y a dependent variable or an independent variable?

F. Dependent, because in each trial, its value was intentionally set to one of several chosen values.
G. Dependent, because in each trial, its value was obtained as the result of taking a measurement.
H. Independent, because in each trial, its value was intentionally set to one of several chosen values.
J. Independent, because in each trial, its value was obtained as the result of taking a measurement.

33. Consider any trial in which the block masses were NOT equal. In this trial, once Block X had been released, the gravitational potential energy of Block Y immediately began to:

A. increase, because Block Y began to gain height.
B. increase, because Block Y began to lose height.
C. decrease, because Block Y began to gain height.
D. decrease, because Block Y began to lose height.

Passage VI

Demonstration

A science teacher poured 400 mL of water into a beaker and heated the beaker with a Bunsen burner. After a few minutes, bubbles began to form in the water and float to the surface. Four students were asked to explain how the bubbles were formed and also to describe the composition of the bubbles.

Student 1

The chemical formula of water is H_2O. As H_2O is heated, the chemical bonds between the hydrogen (H) and oxygen (O) atoms break, leaving individual H and O atoms. The H atoms dissolve in the remaining water, while the O atoms combine to form oxygen molecules (O_2). The breakdown of water and the formation of O_2 can be summarized by the following balanced chemical equations:

$$H_2O \rightarrow 2H + O$$
$$O + O \rightarrow O_2$$

Because O_2 is a gas, it forms bubbles in the water, and the bubbles contain O_2 only.

Student 2

Student 1 is correct about how the chemical bonds in H_2O break down and how O_2 molecules are formed. However, the H atoms do not dissolve in the remaining water; rather, they combine to form hydrogen molecules (H_2), as shown in the following equation:

$$H + H \rightarrow H_2$$

Because both O_2 and H_2 are gases, bubbles are formed in the water, and the bubbles contain a mixture of O_2 and H_2 only.

Student 3

The chemical bonds in water do not break when water is heated. Instead, water molecules form new chemical bonds—called *hydrogen bonds*—with other water molecules. As more and more hydrogen bonds form, a thin circular sheet of hydrogen-bonded water molecules is formed. When this sheet comes in contact with the surface of the water, air pressure pushes down on the center of the sheet, causing it to bow in the middle and close up on itself, forming a spherical bubble (see Figure 1). The bubbles contain air (a mixture of gases) only.

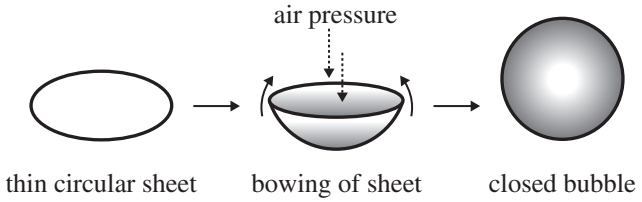


Figure 1

Student 4

As the water is heated, chemical bonds are neither broken nor formed. Instead, the water molecules absorb the heat energy, and this energy is converted into kinetic energy. Once the kinetic energy reaches a certain threshold, the water begins to change from the liquid phase to the gas phase, forming bubbles that contain water vapor only.

34. Based on the description of the demonstration, were the bubbles that formed more dense than the surrounding water, or less dense than the surrounding water?

F. More dense; the bubbles sank to the bottom after formation.
G. More dense; the bubbles floated to the surface of the beaker after formation.
H. Less dense; the bubbles sank to the bottom after formation.
J. Less dense; the bubbles floated to the surface after formation.

35. During the demonstration, bubbles were observed to form well below the water's surface. This information directly *contradicts* the explanation given by which student?

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

36. Which students stated or implied that the bubbles contain gas molecules?

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

37. According to Students 1, 2, and 3, the process of bubble formation (in water) involves which of the following changes?

A. Chemical bonds are formed.
B. Chemical bonds are broken.
C. Kinetic energy of the water molecules is increased.
D. Kinetic energy of the water molecules is decreased.

38. Suppose that after the students gave their responses, the teacher filled a balloon with a mixture of H_2 and O_2. Further suppose that she held a lit candle to the balloon and then the balloon exploded. Based on this information, which of Student 2 and Student 4, if either, would be more likely to claim that an explosion would have occurred during the original demonstration if the teacher had held a lit candle above the surface of the water being heated?

F. Student 2 only
G. Student 4 only
H. Both Student 2 and Student 4
J. Neither Student 2 nor Student 4

39. Which student's explanation is the most scientifically accurate?

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

40. Which of the following balanced chemical equations best summarizes Student 2's explanation?

F. $2H_2O \rightarrow 2H_2 + O_2$
G. $2H_2 + O_2 \rightarrow 2H_2O$
H. $H_2O_2 \rightarrow H_2 + O_2$
J. $H_2 + O_2 \rightarrow H_2O_2$

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.

Scoring Keys for Form D03

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

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

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

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

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)	_____ (23)

Test 3: Reading—Scoring Key

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

	Key	Reporting Category* KID	CS	IKI
21.	D		___	
22.	F	___		
23.	C	___		
24.	J	___		
25.	D	___		
26.	G		___	
27.	A		___	
28.	J			___
29.	C		___	
30.	G	___		
31.	B	___		
32.	G	___		
33.	C	___		
34.	H	___		
35.	A		___	
36.	G	___		
37.	C	___		
38.	F			___
39.	D			___
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)	_____ (23)
Craft & Structure (CS)	_____ (11)
Integration of Knowledge & Ideas (IKI)	_____ (6)
Total Number Correct for Reading Test (KID + CS + IKI)	_____ (40)

Test 4: Science—Scoring Key

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

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

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

Number Correct (Raw Score) for:

Interpretation of Data (IOD)	_____ (18)
Scientific Investigation (SIN)	_____ (11)
Evaluation of Models, Inferences & Experimental Results (EMI)	_____ (11)
Total Number Correct for Science Test (IOD + SIN + EMI)	_____ (40)

Explanation of Procedures Used to Obtain Scale Scores from Raw Scores

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

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

ACT Test D03	**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	75	59-60	40	40	**36**
35	72-74	57-58	39	39	**35**
34	71	55-56	38	38	**34**
33	70	54	37	37	**33**
32	69	53	36	36	**32**
31	68	52	35	35	**31**
30	67	50-51	34	—	**30**
29	66	48-49	—	34	**29**
28	65	46-47	33	33	**28**
27	64	43-45	32	32	**27**
26	62-63	40-42	31	31	**26**
25	59-61	38-39	30	29-30	**25**
24	57-58	35-37	29	27-28	**24**
23	54-56	33-34	27-28	25-26	**23**
22	51-53	32	26	23-24	**22**
21	47-50	30-31	24-25	22	**21**
20	44-46	29	23	20-21	**20**
19	42-43	27-28	22	19	**19**
18	40-41	24-26	21	17-18	**18**
17	38-39	21-23	20	16	**17**
16	35-37	17-20	18-19	14-15	**16**
15	32-34	14-16	17	13	**15**
14	29-31	11-13	15-16	12	**14**
13	27-28	8-10	14	10-11	**13**
12	24-26	7	12-13	9	**12**
11	22-23	6	10-11	8	**11**
10	18-21	5	9	7	**10**
9	15-17	4	8	6	**9**
8	13-14	3	7	5	**8**
7	11-12	—	6	4	**7**
6	9-10	2	5	3	**6**
5	7-8	—	4	2	**5**
4	5-6	1	3	—	**4**
3	4	—	2	1	**3**
2	2-3	—	1	—	**2**
1	0-1	0	0	0	**1**

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