

Questions 1–10 are based on the following passage.

This passage is adapted from Oscar Hijuelos, *The Fourteen Sisters of Emilio Montez O'Brien*. ©1993 by Oscar Hijuelos. Mariela Montez and her husband Nelson O'Brien live in a small town in Pennsylvania with their fifteen children.

When it came to music, Mariela would hear a ragtime piece out the saloon doors, the "Cubanola Glide," and never know that it was about Cuba, as it sounded like so many other rinky-dinky piano rags of that time, and in the days when Nelson had the house wired for electricity and purchased, like half of the country, their very own Atwater Kent superheterodyne crystal-radio set, she might cruise the stations and come across a performance of the Havana Symphony conducted by the composer Ernesto Lecuona, his splendid melodies borne on a spectrally guided wavelength, the music fading in and out, the voice of an announcer commenting from radio station CMCQ in Havana in a storm of staticky convolutions and atmospheric pops, as if spirits, capricious and loud, were gushing, whistling, and shuddering like the winds—the voice announcing the words "*de la Habana, Cuba*," sounding as if it were coming from far away, as far away as the planet Mars.

But that was all, for the most part, of Cuba for many years. She tried to keep the notion of it alive in her daughters, especially the oldest, describing to her with true sweetness the substance of her family's life there before the war in 1895 had disrupted it, a serene petit-bourgeois life, her father Emilio

Montez—after whom her only son, Emilio Montez O'Brien, would be named—being a farmer and merchant of adequate means. He owned two farms and a stable in the city of Santiago, the farms razed to the ground during the war. Her stories of her life in that household before the war sometimes lingered in the minds of the sisters, so that at night, when thinking about their mother and her past life, the life she had lived before any of them was born, they would feel certain changes taking place in the household. Even though they were living just off a road called Abelmyer, some few miles outside of a small Pennsylvania town, the notion of Cuba, like their own femininity, exerted a powerful pull. Sometimes at night they would think about their mother's Cuba and they would have the sensation that the rooms of the house had been turned into a rain forest, that orchids were budding out of the walls, that lianas were hanging off the ceiling beams, that one could hear in the distance the ocean and smell the sea foam—all coming on waves of unconscious speculation, thoughts buzzing in the halls and floating through the doors and from mind to mind of each sleeping sister, arms wrapped about one another, the sisters flinching and breathing loudly—a sigh in the middle of the night—Cuba in the air, the atmosphere of a house in the tropics, sunlight glaring through the windows though it was the dead of darkness.

There was also, at the same time, the Irish influence of their father Nelson, which certain of the sisters, most particularly the younger ones, more closely identified with. It was a more understandable

60 mystery, as they had very few ideas what Ireland was like. Though their father was not a talkative man, at least the nature of his language, English—they knew nothing of the Gaelic tongue—did not mystify them the way the Spanish spoken by the older sisters with 65 their mother did, falling upon their ears like the nearly Babylonian chitchat of songbirds. The name O'Brien had been their main legacy, that and fair complexions and the freckles that burst over their faces in the spring and the blue eyes and the feeling 70 that far away, in a distant land—not Cuba, however—there were others like themselves. It was a world far beyond, about which they knew nothing, the principles of its history, as with Cuba, reduced to a few names from schoolbooks, the most prominent 75 being that of Parnell, and the lore of the place remembered by the shamrock and notes out of the books which would say things like "And it is said that if one kisses the Blarney Stone, then that person will be blessed by luck." And they had those few 80 visual clues as to what their father had left behind in Ireland—no photographs save for one, of a beautiful young woman, life brimming within her, kept on the wall in a gold-leaf oval frame, their Aunt Kate, Nelson's sister, they'd been told, with whom their 85 father had first traveled to America in 1896, and then there was that print, of a lovely house in an emerald meadow in the early-morning mist, the print captioned, "A house, Shannon, Ireland," which the daughters had presented their Poppy for Christmas 90 one year, 1922.

1

In lines 12–20 ("the music . . . Mars"), the narrator's account of the radio broadcast mainly serves to

- A) establish that Mariela believes her family will never return to Cuba.
- B) suggest that Mariela feels isolated from the country of her childhood.
- C) underscore Mariela's fascination with radio technology.
- D) imply that Mariela rarely thinks about Cuba anymore.

2

It can most reasonably be inferred from the passage that when Mariela discusses her youth with her daughters, she is selective in the way that she

- A) minimizes difficulties faced by her family.
- B) explains controversial events in Cuba's history.
- C) portrays her father's professional accomplishments.
- D) encourages them to learn from her past mistakes.

3

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 21–22 ("But that . . . years")
- B) Lines 22–29 ("She tried . . . means")
- C) Lines 29–31 ("He owned . . . war")
- D) Lines 37–40 ("Even . . . pull")

4

As used in line 24, "substance" most nearly means

- A) object.
- B) effect.
- C) essence.
- D) burden.

5

The description of the effect of Mariela's stories on her daughters (lines 31–37) marks a shift in the passage from

- A) the perspective of the older daughters to that of their younger sisters.
- B) the daughters' perspective during childhood to their views as adults.
- C) Mariela's perspective to that of her parents.
- D) Mariela's perspective to that of her daughters.

6

Which choice best supports the idea that over time Mariela increasingly communicated with some of her children in the language of their surrounding community?

- A) Lines 41-47 ("Sometimes . . . foam")
- B) Lines 47-55 ("all . . . darkness")
- C) Lines 59-61 ("It was . . . like")
- D) Lines 61-66 ("Though . . . songbirds")

7

The narrator's use of the words "buzzing" (line 48) and "glaring" (line 54) to describe the sisters' impressions primarily serves to

- A) heighten a general feeling of apprehension.
- B) convey the vividness of certain imaginary conditions.
- C) contrast with the barrenness of life in Pennsylvania.
- D) suggest the improbable nature of Mariela's stories.

8

It can most reasonably be inferred from the passage that Nelson chooses not to discuss his life in Ireland with his daughters mainly because he

- A) prefers to confide in Mariela.
- B) compares his daughters unfavorably with Kate.
- C) refrains from extended conversations in general.
- D) resents intrusive questions about his past.

9

The narrator presents the "shamrock" (line 76) and the "Blarney Stone" (line 78) as examples of

- A) Irish superstitions that Americans have adopted.
- B) traditions in Ireland that the younger sisters find amusing.
- C) symbols of Ireland that are familiar to the younger sisters.
- D) Irish mythology known to readers throughout the world.

10

The passage indicates that unlike the print of the house in Shannon, Ireland, the photograph of Aunt Kate is

- A) a treasured memento from Nelson's past.
- B) an image portraying life in Ireland.
- C) of little interest to the younger sisters.
- D) a symbol of Nelson's desire to return to Ireland.

Questions 11-20 are based on the following passages.

Passage 1 is adapted from Thomas Carlyle, "Signs of the Times." Originally published in 1829. Passage 2 is adapted from Oscar Wilde, "Art and the Handicraftsman." Originally published in 1908, from manuscripts written in the 1880s. Carlyle was a British essayist, and Wilde was an Irish author.

Passage 1

Were we required to characterise this age of ours by any single epithet, we should be tempted to call it, not an Heroical, Devotional, Philosophical, or Moral *Line* Age, but, above all others, the Mechanical Age. It is 5 the Age of Machinery, in every outward and inward sense of that word; the age which, with its whole undivided might, forwards, teaches and practises the great art of adapting means to ends. Nothing is now done directly, or by hand; all is by rule and calculated contrivance. For the simplest operation, some helps and accompaniments, some cunning abbreviating process is in readiness. Our old modes of exertion are 10 all discredited, and thrown aside. On every hand, the living artisan is driven from his workshop, to make room for a speedier, inanimate one. The shuttle drops from the fingers of the weaver, and falls into iron fingers that ply it faster. The sailor furls his sail, and lays down his oar; and bids a strong, unwearied servant, on vaporous wings, bear him through the 15 waters. . . . We remove mountains, and make seas our smooth highways; nothing can resist us. We war with rude Nature; and, by our restless engines, come off always victorious, and loaded with spoils.

What wonderful accessions have thus been made, 20 and are still making, to the physical power of mankind; how much better fed, clothed, lodged and, in all outward respects, accommodated men now are, or might be, by a given quantity of labour, is a grateful reflection which forces itself on every one.

What changes, too, this addition of power is 25 introducing into the Social System; how wealth has more and more increased, and at the same time gathered itself more and more into masses, strangely altering the old relations, and increasing the distance 30 between the rich and the poor, will be a question for Political Economists, and a much more complex and important one than any they have yet engaged with.

... These things, which we state lightly enough here, are yet of deep import, and indicate a mighty 35 change in our whole manner of existence. For the same habit regulates not our modes of action alone,

but our modes of thought and feeling. Men are grown mechanical in head and in heart, as well as in hand. They have lost faith in individual endeavour, 40 and in natural force, of any kind.

Passage 2

Do not think that the commercial spirit which is the basis of your life and cities here is opposed to art. Who built the beautiful cities of the world but commercial men and commercial men only? Genoa 50 built by its traders, Florence by its bankers, and Venice, most lovely of all, by its noble and honest merchants. . . .

Do you think, for instance, that we object to machinery? I tell you we reverence it; we reverence it 55 when it does its proper work, when it relieves man from ignoble and soulless labour, not when it seeks to do that which is valuable only when wrought by the hands and hearts of men. Let us have no machine-made ornament at all; it is all bad and 60 worthless and ugly. And let us not mistake the means of civilisation for the end of civilisation; steam-engine, telephone and the like, are all wonderful, but remember that their value depends entirely on the noble uses we make of them, on the noble spirit in 65 which we employ them, not on the things themselves.

It is, no doubt, a great advantage to talk to a man at the Antipodes through a telephone; its advantage depends entirely on the value of what the two men 70 have to say to one another. If one merely shrieks slander through a tube and the other whispers folly into a wire, do not think that anybody is very much benefited by the invention.

The train that whirrs an ordinary Englishman 75 through Italy at the rate of forty miles an hour and finally sends him home without any memory of that lovely country but that he was cheated by a courier at Rome, or that he got a bad dinner at Verona, does not do him or civilisation much good. But that 80 swift legion of fiery-footed engines that bore to the burning ruins of Chicago¹ the loving help and generous treasure of the world was as noble and as beautiful as any golden troop of angels that ever fed the hungry and clothed the naked in the antique

85 times. As beautiful, yes; all machinery may be beautiful when it is undecorated even. Do not seek to decorate it. We cannot but think all good machinery is graceful, also, the line of strength and the line of beauty being one.

¹ The Great Chicago Fire in 1871 destroyed a large portion of the city.

11

In the context of Passage 1, Carlyle's use of the phrase "not an Heroical, Devotional, Philosophical, or Moral Age" (lines 3-4) is primarily meant to convey the idea that the Mechanical Age

- A) is more impressive than previous historical periods.
- B) has several different labels that can be accurately applied to it.
- C) is less noble in character than previous ages.
- D) is characterized by practicality.

12

In Passage 1, Carlyle implies that the use of machines has

- A) replaced individual efforts with systematized processes.
- B) contributed to improvements in long-standing educational and medical institutions.
- C) caused people to emigrate in search of gainful employment.
- D) led to a deterioration in the quality of manufactured products.

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 8-12 ("Nothing . . . readiness")
- B) Lines 24-29 ("What . . . every one")
- C) Lines 38-40 ("These . . . existence")
- D) Lines 40-42 ("For . . . feeling")

14

As used in line 11, "cunning" most nearly means

- A) clever.
- B) deceitful.
- C) manipulative.
- D) unexpected.

15

According to Carlyle in Passage 1, the Mechanical Age has led to changes in society that include

- A) a shift in philosophical and religious principles.
- B) greater economic disparity between the wealthy and the poor.
- C) a preoccupation with acquiring material possessions.
- D) widespread hostility toward artisans who continue to make products by hand.

16

In Passage 2, lines 46-52 ("Do not . . . merchants") most strongly suggest that Wilde's perspective is that of someone who

- A) believes that major trading centers in Europe owe their prosperity to innovative financiers.
- B) attempts to restore to honor the reputations of certain discredited merchants.
- C) seeks to correct a misapprehension about the compatibility of art and business.
- D) defends businessmen accused of failing to support civic art and great architecture.

17

In the last paragraph of Passage 2, what is the main effect of the references to a "swift legion of fiery-footed engines" (line 80) and a "golden troop of angels" (line 83)?

- A) To highlight the qualities of industriousness and kindness that characterize the way people should behave during a tragedy
- B) To suggest that the beauty and grace of earlier times is not compatible with modern business
- C) To draw attention to the increasing pace of events in modern life
- D) To make a favorable comparison between a charitable act facilitated by modern technology and charitable acts performed long ago

18

Which statement best describes the relationship between the passages?

- A) Passage 1 describes a civilization in decline, while Passage 2 repudiates this view.
- B) Passage 1 scorns the influence of a new technology, while Passage 2 is cautiously optimistic about this influence.
- C) Passage 1 questions new ideas that erode traditions, while Passage 2 explains their necessity.
- D) Passage 1 raises concerns about the rise of mechanization, while Passage 2 embraces it as long as certain criteria are met.

19

Based on Passage 2, how would Wilde most likely respond to Carlyle's concern expressed in lines 12-20 of Passage 1 ("Our . . . waters")?

- A) By suggesting that economic success is more important to society than are the concerns of individual workers
- B) By asserting that technology connects the world far more effectively than individual artisans ever could
- C) By pointing out that much of the work that technology eliminates is difficult and monotonous
- D) By arguing that the market already has safeguards in place that will make it less likely that workers will be negatively affected

20

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 46-49 ("Do not . . . only")
- B) Lines 54-58 ("I tell . . . men")
- C) Lines 67-70 ("It is . . . another")
- D) Lines 70-73 ("If one . . . invention")

Questions 21–31 are based on the following passage and supplementary material.

This passage is adapted from Laurel Hamers, "Eggshell Nanostructure Protects a Chick and Helps It Hatch." ©2018 by Society for Science & the Public.

A chicken eggshell has a tricky job: It must protect a developing chick, but then ultimately let the chick break free. The secret to its success lies in its complex nanostructure—and how that structure changes as the egg incubates.

Chicken eggshells are about 95 percent calcium carbonate by mass. But they also contain hundreds of different kinds of proteins that influence how that calcium carbonate crystallizes. The interaction between the mineral crystals and the proteins yields an eggshell that's initially crack-resistant, while making nanoscale adjustments over time that ultimately let a chick peck its way out, researchers report online in *Science Advances*.

Researchers used a beam of ions to cut thin cross sections in chicken eggshells. They then analyzed the shells with electron microscopy and other high-resolution imaging techniques. The team found that proteins disrupt the crystallization of calcium carbonate, so that what seems at low resolution to be neatly aligned crystals is actually a more fragmented jumble. This misalignment can make materials more resilient: Instead of spreading unimpeded, a crack must zig and zag through scrambled crystals.

Lab tests back up that finding: The researchers added a key shell-building protein called osteopontin to calcium carbonate to yield crystals like those seen in the eggshells. The presence of that protein makes calcium carbonate crystals form in a nanostructured pattern, rather than smooth and even crystal, study coauthor Marc McKee, a biomineralization researcher at McGill University in Montreal, and colleagues found.

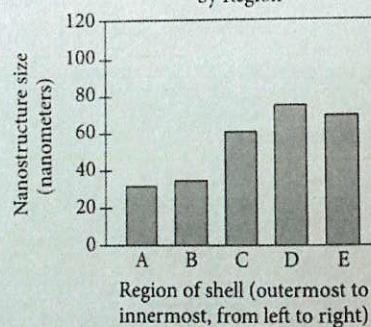
The team also found structural variation on a minute scale throughout the eggshell, though it's only about a third of a millimeter thick. Inner layers have less osteopontin, leading to bigger nanostructures. That may make the inner shell less resilient than the outer shell, which makes sense, McKee says. The outer shell needs to be hard enough to protect the chick, while the inner shell nourishes the developing chick.

Over time, the inner layers of the shell dissolve through a chemical reaction, releasing calcium to build a chick's developing bones. The eggshell undergoes structural changes to facilitate that process, McKee and his colleagues found.

The researchers compared fertilized eggs incubated for 15 days to nonfertilized eggs. Over time, the nanostructures toward the inner shell became smaller in fertilized eggs, but remained the same in the nonfertilized eggs. The change gives the inside of the eggshell a bumpier texture, and by extension, more surface area. That provides more space for that shell-dissolving chemical reaction to take place, the researchers propose. The reaction also thins the shell overall, making it easier for a chick to break through from the inside when it's time to hatch.

Advances in imaging technology are helping scientists find new details like this even in objects as familiar as a chicken eggshell, says Lara Estroff, a materials scientist at Cornell University who wasn't part of the research. In connecting the eggshell's functionality with its fine-grain structure, the new study could provide inspiration for designing new kinds of materials with specific properties.

Atomic Force Microscopy (AFM)
Analysis of the Nanostructure
of Chicken Eggshell (*G. gallus*)
by Region



Adapted from Dimitra Athanasiadou et al., "Nanostructure, Osteopontin, and Mechanical Properties of Calcitic Avian Eggshell." ©2018 by Dimitra Athanasiadou et al.

21

The main purpose of the passage is to

- A) discuss research that focuses on the structure of eggshells.
- B) promote the use of nanostructure technology in new materials.
- C) investigate the role of nanostructures in different natural environments.
- D) explore ways to make eggshells more resistant to cracking.

22

As used in line 1, "tricky" most nearly means

- A) unrealistic.
- B) deceptive.
- C) unstable.
- D) difficult.

23

Which choice best summarizes the information in the third paragraph (lines 15–24)?

- A) The researchers examined the layers of an eggshell and determined that the calcium carbonate crystals are not uniformly arranged.
- B) The researchers proposed an experiment to identify the components of the various layers of an eggshell.
- C) The researchers carried out an experiment to find out what percentage of an eggshell is composed of calcium carbonate.
- D) The researchers concluded that the presence of neatly aligned calcium carbonate crystals prevents an eggshell from cracking before incubation is complete.

24

Based on the passage, which assumption did the researchers make in designing the study?

- A) Using high-resolution imaging techniques would enable them to determine which proteins are most abundant in chicken eggshells.
- B) Examining thin cross sections of chicken eggshells would reveal what percentage of the shell is composed of calcium carbonate.
- C) Combining a particular protein with calcium carbonate would simulate an important effect produced by the proteins found in chicken eggshells.
- D) Adjusting the protein levels in chicken eggshells would allow them to enhance crack resistance in eggshells.

25

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 15–16 ("Researchers . . . eggshells")
- B) Lines 16–18 ("They . . . techniques")
- C) Lines 18–22 ("The team . . . jumble")
- D) Lines 25–28 ("The researchers . . . eggshells")

26

Which choice regarding resistance to cracking can most reasonably be inferred from the passage?

- A) Shells with relatively high levels of proteins tend to be less resistant to cracking than shells with lower levels are.
- B) Shells with relatively large nanostructures tend to be less resistant to cracking than shells with smaller nanostructures are.
- C) Shells with more neatly aligned calcium carbonate crystals tend to be more resistant to cracking than shells with less neatly aligned calcium carbonate crystals are.
- D) Shells with bumpier surface textures tend to be more resistant to cracking than shells with smoother surface textures are.

27

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 9–14 (“The interaction . . . Advances”)
- B) Lines 22–24 (“This . . . crystals”)
- C) Lines 34–36 (“The team . . . thick”)
- D) Lines 36–40 (“Inner . . . says”)

28

As used in line 60, “advances” most nearly means

- A) improvements.
- B) approaches.
- C) motions.
- D) allowances.

29

The last paragraph mainly serves to

- A) provide a summary of the findings described in the passage.
- B) propose a follow-up study about the nanostructures of eggshells.
- C) offer an alternative explanation for how nanostructures form in eggshells.
- D) suggest a practical application for the research discussed in the passage.

30

According to the graph, which two regions of a chicken eggshell are closest in nanostructure size?

- A) Regions A and B
- B) Regions A and C
- C) Regions A and D
- D) Regions A and E

31

Based on the passage, which region of shell depicted in the graph is likely to have the highest level of osteopontin?

- A) Region A
- B) Region C
- C) Region D
- D) Region E

Questions 32–42 are based on the following passage and supplementary material.

This passage is adapted from Marco A. Palma, “Research on How Self-Control Works Could Help You Stick with New Year’s Resolutions.” ©2018 by The Conversation US, Inc.

For decades, studies of self-control in short-term decision-making have led to two clear, but seemingly contradictory, results.

Line 5 One model suggested that self-control is a finite resource that can get used up if you lean on it too heavily, like a battery that loses its charge over time. Each little demonstration of self-control throughout the day ends up exhausting the limited reserves.

The alternative model suggested that exercising 10 self-control can help you build up the skill like a snowball that gets bigger as it builds momentum rolling downhill.

Part of the problem has been how hard it is to conduct behavioral research. Traditional methods 15 assume that test subjects fully understand the questions they’re asked and give honest answers. Unfortunately, researchers had no practical way of knowing whether this was the case, or whether they actually measured what they intended to.

20 But here at the nation’s largest biometrics lab, my Texas A&M colleagues and I figured out a new way to investigate the question that didn’t rely on just what volunteers report to us.

We designed a two-part experiment. First, we 25 asked subjects to focus on a red bull’s-eye at the bottom of a computer screen for either six or 30 minutes. This task requires volunteers to exert self-control—it’s tempting to look away from the boring, unchanging bull’s-eye to the animated video 30 playing elsewhere on the screen.

Then subjects participated in a second laboratory 35 task meant to measure impulsive buying: They could conserve a real US \$5 cash endowment or purchase several household items on-site they hadn’t been looking to obtain. The task is analogous to going to the store and buying products that aren’t on your list. The idea is that self-control helps individuals rein in these impulse purchases.

Our innovation was that we did not have to 40 assume people fully complied with the video-watching task—we were actually able to measure it via their physiological responses. By tracking eye movements, we could quantify very precisely when

participants stuck to staring at the bull’s-eye—that is, when their self-control was keeping them on task.

We also measured facial expression and brain activity for a clearer understanding of what was going on with each subject.

For a while, most people could focus on the 50 boring bull’s-eye. But they’d hit a fatigue point.

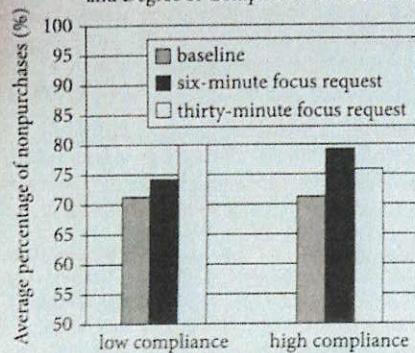
After that, if subjects hung in there and still stuck with the task, they ended up exhausting their self-control “battery.” We could see this by looking at how many impulse buys they made in the second half 55 of the study. If they’d pushed past the fatigue threshold in the previous task, they showed less self-control and ended up making more impulsive purchases. This pattern was shown in both what they “bought” in our experiment and also in the brain:

60 The prefrontal cortex showed patterns indicative of impulse-buying behavior.

On the other hand, subjects who eased off once they’d reached the fatigue threshold had a different experience. They remained in the “snowball” stage of

self-control—they practiced the skill a bit, but didn’t overdo it to the point of exhaustion. In the next task, their brains didn’t exhibit the typical impulse-buying activity patterns. Exercising self-control on the bull’s-eye task, but not overdoing it, led to more 70 self-control in our second task. These subjects did better at controlling impulse purchases than the other group of subjects who didn’t have the initial bull’s-eye-watching session that turned out to rev up self-control.

Average Percentage of Items Not Purchased in Study by Focus Request and Degree of Compliance in First Task



Adapted from Marco A. Palma et al., "Self-Control: Knowledge or Perishable Resource?" ©2017 by Marco A. Palma et al.

32

The main purpose of the passage is to

- A) discuss research that helps explain a growing trend in findings about self-control.
- B) present a study that helps resolve a long-standing question about self-control.
- C) compare the effectiveness of two different methods of assessing self-control.
- D) describe an experiment designed to find ways that people can increase self-control.

33

In the second and third paragraphs (lines 4-12), the author refers to a battery and a snowball most likely to

- A) support the validity of behavioral models by showing the validity of analogous models.
- B) emphasize the contrast between psychological theories by presenting a familiar natural contrast.
- C) identify similarities between two accounts of motivation that are typically regarded as distinct.
- D) clarify hypothesized mental processes by comparing them to accessible physical processes.

34

As used in line 7, "demonstration" most nearly means

- A) explanation.
- B) protest.
- C) act.
- D) confirmation.

35

Based on the passage, the author would most likely agree that self-control studies prior to the one he conducted with his colleagues had which problem?

- A) The studies relied in part on data that may have been inaccurate, and thus the studies may have overstated or understated participants' self-control.
- B) The studies typically used methods that exhausted participants, and thus the studies may have made participants appear to have less self-control than they actually did.
- C) The studies were designed in ways that may have encouraged participants to show more self-control than the participants would show in nonexperimental settings.
- D) The studies tended to include participants who were not representative of the populations being studied with regard to their level of self-control.

36

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-3 ("For . . . results")
- B) Lines 4-8 ("One . . . reserves")
- C) Lines 13-14 ("Part . . . research")
- D) Lines 14-19 ("Traditional . . . intended to")

37

Based on the passage, the design of the second task in the experiment was most likely intended to ensure that participants would

- A) believe that they could retain the cash endowment even if they made purchases.
- B) have good reason to refrain from making purchases.
- C) recognize that making purchases indicated a lack of self-control.
- D) make purchases only if they fully complied with the first task.

38

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 31-35 ("Then . . . obtain")
- B) Lines 37-38 ("The idea . . . purchases")
- C) Lines 39-42 ("Our . . . responses")
- D) Lines 42-45 ("By tracking . . . task")

39

Based on the findings presented in the passage, self-control is most analogous to a

- A) muscle that grows stronger the more frequently and intensely it is exercised.
- B) singing voice that benefits from a moderate warm-up but weakens if used too much in a short period.
- C) knife that grows dull with regular use but can be temporarily improved by being thoroughly sharpened.
- D) natural deposit of oil that cannot be recovered once it is used.

40

According to the figure, which group, on average, purchased the lowest percentage of items?

- A) The baseline group
- B) The high compliance participants in the six-minute focus request group
- C) The high compliance participants in the thirty-minute focus request group
- D) The low compliance participants in the thirty-minute focus request group

If the “alternative model” (line 9) were correct, how would the data for the high compliance group most likely differ from the actual data for the high compliance group shown in the figure?

- A) The average percentage of nonpurchases for the baseline group would be higher than 75%.
- B) The average percentage of nonpurchases for the six-minute focus request group would be lower than 70%.
- C) The average percentage of nonpurchases for the six-minute focus request group would be lower than the average percentage of nonpurchases for the baseline group.
- D) The average percentage of nonpurchases for the thirty-minute focus request group would be higher than the average percentage of nonpurchases for the six-minute focus request group.

42

Based on the passage and the figure, the researchers would most likely explain the difference in the data shown for the two thirty-minute focus request groups by asserting that

- A) the low compliance participants were able to maintain self-control in the second part of the experiment as a result of having especially high fatigue thresholds.
- B) the low compliance participants exhausted their self-control early and thus had none to maintain during the second part of the experiment.
- C) the high compliance participants depleted their self-control by continuing to focus beyond their fatigue thresholds in the first part of the experiment.
- D) the high compliance participants had diminished self-control because they did not sufficiently practice the skill during the first part of the experiment.

Questions 43-52 are based on the following passage.

This passage is adapted from Hal Whitehead and Luke Rendell, *The Cultural Lives of Whales and Dolphins*, ©2015 by The University of Chicago. Some humpback whales practice lobtail feeding, in which they tail slap the surface to concentrate or confuse prey; bubble-cloud feeding is the practice of surrounding prey with netlike masses of bubbles.

In the waters off Cape Cod, lobtail feeding was first seen in 1980, by just one of the 150 feeding humpback whales observed that year. In 1981, of the ^{Line} fifty-one known whales seen feeding at the surface ⁵ that year, two were lobtail feeding. The behavior spread through the 1980s. By 1989, forty-two of the eighty-three whales seen surface feeding that year were lobtail feeding. Lobtail feeding had become common through the population, with similar ¹⁰ proportions of males and females, but it was far from universal. A substantial proportion of the population was never seen to lobtail feed. Lobtail feeders would feed in the same area, sometimes on the same fish aggregation, as whales using other methods, ¹⁵ primarily standard bubble-cloud feeding, without the lobtails.

Mason Weinrich, a scientist who has dedicated decades to studying this population, tried to work out how the animals were learning this new feeding ²⁰ technique. Lobtail feeding was rare in the older animals. The whales seemed to pick up the technique from age two, although two-year-olds sometimes appeared to be “playing” or “practicing” at lobtail feeding, with smaller, less-dense bubble clouds and ²⁵ no evidence of actual food. Many of the lobtail feeders had mothers who were known not to lobtail feed. Thus, the evidence accumulated by Weinrich suggested primarily oblique or horizontal transmission of lobtail feeding among immature ³⁰ whales, or from elders to the young. Recently, Luke Rendell has been working with Weinrich, a student named Jenny Allen, and other colleagues in an analysis of the data records from the beginning of lobtail feeding in 1981 right through to 2008. This ³⁵ analysis highlighted several important points. The first was that the use of this foraging tactic was strongly related to the abundance of sand lance fish in the habitat. The incidence of lobtail feeding in the population waxed and waned roughly in line with ⁴⁰ how much sand lance was around, so lobtail feeding appears to be a specialization that takes advantage of

a particular reaction shown by this species of fish. The second was that, as in Weinrich’s original study, having a mother that did this made ⁴⁵ very little difference to whether her calf would go on to develop the behavior. Third, Rendell and his colleagues found that the data on the spread of the behavior (who took up lobtail feeding and when they started) massively supported a role for social ⁵⁰ learning: those humpbacks with many associates who were lobtail feeding themselves were much more likely to take up the habit than those with few lobtail-feeding associates.

This analysis demonstrates how ecology and ⁵⁵ culture can interact with each other—ecologically, the availability of a particular prey item, the sand lance, was varying over time. At some point, one bright, or lucky, humpback figured out that hitting the water with his or her tail did something to the ⁶⁰ sand lance (perhaps causing them to bunch together more, making the shoal easier to enclose with a bubble net), and since then this trick has been spread and maintained in the population by cultural transmission. The lack of relationship with maternal ⁶⁵ inheritance is interesting. It is a strong contrast to the pattern of mother-offspring transmission of foraging techniques among dolphins and, also, to the inheritance of migration routes in humpbacks themselves. Instead, the behavior is mostly learned ⁷⁰ after weaning, and can therefore spread rapidly within generations. This is fortunate—or maybe the result of smart use of social learning by the humpbacks—since the abundance of sand lance can vary manyfold within intervals of just two to three ⁷⁵ years.

43

Which statement best describes the overall structure of the passage?

- A) The authors summarize early research on a topic, identify significant shortcomings in that research, and report the findings of an improved research study.
- B) The authors present background information on an observed phenomenon, describe two studies about that phenomenon in greater detail, and discuss the significance of the studies’ findings.
- C) The authors describe a hypothesis proposed by researchers, explain experiments conducted to test that hypothesis, and suggest revisions to the hypothesis based on the findings.
- D) The authors outline a complex problem, summarize a failed attempt to resolve that problem, and reveal the details of a successful resolution.

44

As used in line 11, “substantial” most nearly means

- A) extraordinary.
- B) comfortable.
- C) considerable.
- D) physical.

45

According to the passage, one finding shared by the study about lobtail feeding conducted by Weinrich and the data analysis he conducted with Rendell and their colleagues is that

- A) whales as young as two years are able to master the technique.
- B) the whales’ use of the technique coincided with their use of bubble-cloud feeding.
- C) whether a whale practiced the technique as a youth generally had no effect on its likelihood of using it as an adult.
- D) whether a mother practiced the technique had little effect on her calf’s likelihood of adopting it.

16

Which choice best supports the idea that responses to certain predation strategies likely vary among different kinds of fish?

- A) Lines 35-38 ("The first . . . habitat")
- B) Lines 38-43 ("The incidence . . . fish")
- C) Lines 43-46 ("The second . . . behavior")
- D) Lines 57-64 ("At some . . . transmission")

47

As used in line 44, "original" most nearly means

- A) authentic.
- B) firsthand.
- C) novel.
- D) initial.

48

The sentence in lines 54-57 ("This . . . time") serves mainly to

- A) criticize a naive assumption about an outcome.
- B) provide an example of an unusual effect.
- C) present an opposing view of a compelling example.
- D) broaden the relevance of a research result.

49

Which choice represents a claim supported by the research of Rendell and his colleagues?

- A) Lobtail feeding is preferred to bubble-cloud feeding in humpback whale groups with a relatively high proportion of older whales.
- B) Changes in the type and availability of food sources can generate the learning of new behaviors in humpback whales.
- C) Humpback whale behavior that is acquired before weaning is less complex and less useful to the group than behavior learned after weaning.
- D) Humpback whale traits that are correlated with foraging are transmitted more quickly within groups than are other traits unrelated to foraging.

51

It can reasonably be inferred from the passage that behaviors taught to humpback whale offspring by their mothers

- A) are less likely to be communicated to other members of a population than those acquired later.
- B) eventually lead to effective social learning.
- C) have a greater effect on species survival than environmental conditions do.
- D) can simultaneously be transmitted to other animals.

50

Which choice represents an underlying assumption of the authors' discussion regarding humpback whale mothers and their calves?

- A) Mothers often transmit important knowledge to their calves.
- B) Mothers and calves continue to hunt together after weaning.
- C) Mothers delay teaching their calves certain techniques until they are older.
- D) Mothers and calves have lifelong social relationships with one another.

52

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 46-53 ("Third . . . associates")
- B) Lines 65-69 ("It is . . . themselves")
- C) Lines 69-71 ("Instead . . . generations")
- D) Lines 71-75 ("This . . . years")

Questions 1–11 are based on the following passage.

Filling in the Blank

In the human eye, the optic nerve prevents a small portion of the retina **1** to be covered by the light

- 1** .
A) NO CHANGE
B) being
C) from being
D) in order to be

sensors that collect visual information. **2** The brain compensates for this blind spot by using context clues to complete the picture; the resulting image is called inferred vision. Because inferred vision is based on an approximation made by the brain, researchers were surprised to learn that we trust it more than the visual information that comes from outside the blind spot.

A team of biopsychologists in Germany observed this effect in a series of experiments in which subjects **3** don special glasses to control the field of vision and were asked to focus on a symbol on a computer monitor. Pairs of striped circles were presented on either side of this focal point. All circles had vertical **4** stripes, in the center of some circles an area was cut out and replaced with horizontal stripes. Subjects found it easy to identify the cutouts with horizontal stripes if they were positioned outside the blind spot. However, if the cutouts were positioned inside the blind **5** spot, and inferred vision would complete the image based on the surrounding stripes, and subjects would assume the stripes were uniformly vertical. In each case, subjects were asked to identify which of the two circles in the pair had continuous stripes.

2

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

Ophthalmologists routinely dilate the human eye to conduct a thorough examination of the retina and the optic nerve.

Should the writer make this addition here?

- A) Yes, because it offers information that supports the previous sentence in the paragraph.
- B) Yes, because it provides an effective transition to the next sentence in the paragraph.
- C) No, because it gives a detail that distracts from the focus of the paragraph.
- D) No, because it contradicts the main point of the paragraph.

3

- A) NO CHANGE
- B) donned
- C) will don
- D) will have donned

4

- A) NO CHANGE
- B) stripes, however,
- C) stripes
- D) stripes, but

5

- A) NO CHANGE
- B) spot,
- C) spot; so
- D) spot; therefore,

The first experiment **6** conceded unexpected results: subjects tended to select circles presented with the center in the blind spot over circles presented with the center outside the blind spot. **7** Given that humans need information to make decisions, the researchers tested control conditions to see whether presenting the stimulus to a particular part of the eye affected the result. While they found a slight tendency of subjects to favor stimuli presented in the temporal visual field (the zone away from the focal point), the bias in favor of the blind spot remained. The researchers also **8** considered reaction times, asking subjects to pick the circle that contained the cutout with horizontal stripes; the result was that subjects showed a bias toward picking the circle with its center outside the blind spot. **9** On the basis of all these results, the researchers came to the conclusion that subjects trusted their inferred vision more than they did their direct sensory perceptions.

6

- A) NO CHANGE
- B) granted
- C) surrendered
- D) yielded

7

Which choice provides the most effective transition from the previous sentence?

- A) NO CHANGE
- B) Because this finding was counterintuitive,
- C) In light of the complexities of human anatomy,
- D) Since humans often supply missing details while assessing arguments,

8

Which choice best sets up the information that follows in the sentence?

- A) NO CHANGE
- B) looked at differences between the left and right sides of the eye,
- C) tried reversing the selective task,
- D) tested whether subjects were using probability,

9

Which choice provides the most effective transition from the preceding discussion in the paragraph?

- A) NO CHANGE
- B) Although they could have done more experiments,
- C) Since the results did not confirm their hypothesis,
- D) Building on previous studies of perception,

According to Benedikt Ehinger, a biopsychologist who worked on the study, one of the team's major findings is about something the brain does not do. "The implicit knowledge that a filled-in stimulus is less reliable than an external one does not seem to be taken into account for perceptual decision-making," he says. The researchers **10** hope to use this result. They seek to explore the causes of other visual phenomena, such **11** as: afterimages and optical illusions.

10

Which choice most effectively combines the sentences at the underlined portion?

- A) hope to use this result to explore
- B) have hopes for the use of the result in exploring
- C) hope to use this result and seek to explore
- D) hope that the result will allow them to usefully explore

11

- A) NO CHANGE
- B) as, afterimages,
- C) as—afterimages
- D) as afterimages

Questions 12–22 are based on the following passage.

The Benefits of Vernacular Architecture

[1] Unfortunately, many architects in Portugal have abandoned traditional (or vernacular) building methods in favor of modern ones, such as using concrete and steel and [12] to rely on costly heating and air-conditioning systems. [2] While such buildings may offer certain luxuries, they consume large amounts of energy during construction and occupancy. [3] In the pursuit of energy-efficient construction methods, Portuguese architects should look back to their country's architectural traditions. [4] There, in the vernacular methods of the past, architects might find inspiring models for the future of sustainable design. [13]

12

- A) NO CHANGE
- B) they rely
- C) the reliance
- D) relying

13

The writer wants to add the following sentence to the paragraph.

From the whitewashed houses of the south to the stone-built homes of the north, Portugal has a rich and centuries-old architectural history.

The best placement for the sentence is

- A) before sentence 1.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 4.

For centuries, builders in Portugal [14] prioritized the basic need for safety and shelter from harsh conditions.

In the dry southern region of Alentejo, for example, this meant crafting walls made of *taipa* (a mixture of gravel, sand, silt, and clay), while in the mountainous northern region of Beira Alta, [15] there was a lot of granite. In Beira Alta, granite was the most obvious and abundant choice of material. As Jorge Fernandes and his colleagues at the University of Minho observe in a study of

Portuguese vernacular architecture, [16] and these traditional materials are still viable options for contemporary Portuguese designs. Because the materials can be made or mined locally, the energy costs in production and transport are often lower than [17] those for imported materials such as steel and concrete.

Additionally, both materials are notably [18] durable—*taipa* and *granite*—structures have been known to last more than one thousand years.

14

Which choice most effectively sets up the information that follows in the paragraph?

- A) NO CHANGE
- B) relied almost solely on the available resources of the local landscape.
- C) improved building techniques by adopting the methodologies of other regions.
- D) resigned themselves to the limitations of their region's climate.

15

Which choice most effectively combines the sentences at the underlined portion?

- A) granite
- B) where granite was plentiful, it
- C) builders had granite; it
- D) because there was granite, it

16

- A) NO CHANGE
- B) but
- C) so
- D) DELETE the underlined portion.

17

- A) NO CHANGE
- B) imported materials such as
- C) materials that are imported such as
- D) DELETE the underlined portion.

18

- A) NO CHANGE
- B) durable, *taipa* and *granite*:
- C) durable, *taipa* and *granite*
- D) durable: *taipa* and *granite*

Long before the invention of electricity-hungry air-conditioning systems, Portuguese builders developed a **19** variety of passive, energy-free methods for regulating temperature. In both Alentejo and Beira Alta, buildings were constructed with thick exterior walls to keep interior temperatures stable. In Alentejo, which **20** experience hot summers, these structures were built on sites that minimized their sun exposure and used cooling features such as vents that could be opened at night. In Beira Alta, where the winters are harsher, **21** rainy winters followed by dry summer seasons make the land more suitable for growing crops.

While their application is limited to locales in the same climate zone as Portugal, these simple yet effective building techniques can offer promising solutions to modern architects of sustainable design. Honed over centuries in relation to local resources and regional climate, the vernacular architecture of Portugal **22** incorporates outdoor strategies, such as narrow streets and covered passages that maximize shade and store cool night air, as well.

19

- A) NO CHANGE
- B) mixed bag
- C) bunch
- D) diverse plethora

20

- A) NO CHANGE
- B) experiences
- C) have experienced
- D) are experiencing

21

Which choice best supports the main claim of the paragraph?

- A) NO CHANGE
- B) ancient castles and cathedrals situated high in the mountains preserve the architectural history of Portugal.
- C) large, south-facing balconies were designed to maximize sunlight absorption for natural heating.
- D) cattle were often housed on the lower level of two-story homes while the upper level was used for human residents.

22

Which choice most effectively concludes the passage?

- A) NO CHANGE
- B) offers promise that additional research will lead to the adaptation of tactics that better align with building codes.
- C) provides incentive for home builders to return to designs that include fireplaces, water fountains, and an abundance of windows.
- D) stands as a good reminder that sometimes the most energy-efficient methods can be found in the building traditions of the past.

Questions 23–33 are based on the following passage and supplementary material.

The Corporate Game Plan

23 Gamification—or the application of game-like rules and rewards to occupational tasks and other nongame contexts, has become **24** increasingly more popular with employers. According to a recent report, nearly 70 percent of the **25** world's largest publicly traded company's have implemented or are projected to implement some form of gamification, and government agencies are also getting in on the act. Employers hope that gamification will both engage employee interest and serve as a catalyst for greater input from workers about organizational practices—which can result in improvements in the workplace and significant financial gains.

One employer to have seen the positive results gamification can **26** bring, is the United Kingdom's Department for Work and Pensions (DWP). Like many organizations, the DWP wanted to take advantage of the ideas of its employees. **27** Nevertheless, it created Idea Street, an online platform for employees to share ideas for organizational improvements.

23

- A) NO CHANGE
- B) Gamification,
- C) Gamification:
- D) Gamification

24

- A) NO CHANGE
- B) increasingly popular
- C) more popular than it was before
- D) popular, increasingly more so

25

- A) NO CHANGE
- B) worlds' largest publicly traded companies'
- C) world's largest publicly traded companies
- D) worlds largest publicly traded company's

26

- A) NO CHANGE
- B) bring is,
- C) bring is:
- D) bring is

27

- A) NO CHANGE
- B) To that end,
- C) At the same time,
- D) In addition,

Idea Street was designed as a game that would motivate DWP employees to collaborate on idea development with colleagues across the organization. Idea Street operated according to a point system: employees who submitted ideas of their own, or assisted in the development of the ideas of others, **28** received points called DWPeas. Employees could then use these points to develop their ideas further by "hiring" other staff to assist them. They could also purchase a "stake" in a promising idea developed by someone else.

Once developed, all ideas were evaluated by the innovation group, **29** comprising a small team of employees tasked with selecting the best ideas for implementation. Selection of a particular idea for implementation meant that **30** they increased in value, earning its stakeholders additional points. Employees with the highest point totals were asked to join the innovation group for the next round of evaluations.

- 28**
- A) NO CHANGE
 - B) to receive
 - C) receiving
 - D) they received

- 29**
- A) NO CHANGE
 - B) composed of
 - C) comprised of
 - D) DELETE the underlined portion.

- 30**
- A) NO CHANGE
 - B) they increased in value, earning their
 - C) it increased in value, earning its
 - D) it increased in value, earning their

31 Though the resources needed to establish Idea Street were greater than anticipated, and though some participants objected to what they considered excessive involvement on the part of the innovation group, the game was considered a success. By 2010, Idea Street had attracted approximately **32** 1,100 participants, and these employees had generated about 1,400 ideas. Of these, sixty-three had been implemented by 2010, **33** with returns totaling about \$33 million. Idea Street is merely one example of the generally positive results associated with gamification. However, if the platform's recent adoption by other public service departments in the United Kingdom is any indication, this fast-growing trend is likely to become a feature of the work experience for millions of employees.

Results of DWP's Idea Street, November 2010

Number of users	~4,500
Ideas generated	~1,400
Ideas currently active	~1,100
Ideas implemented	63
% of ideas implemented	4.5%
Financial benefits	~\$33 million

Source: Data from Brian Burke and Mary Mesaglio, "Case Study: Innovation Squared: The Department for Work and Pensions Turns Innovation into a Game." ©2010 by Gartner, Inc.

- 31**
- A) NO CHANGE
 - B) Because
 - C) Given that
 - D) DELETE the underlined portion, adjusting the capitalization as needed.

- 32**
- Which choice provides accurate information from the table?
- A) NO CHANGE
 - B) 300
 - C) 1,400
 - D) 4,500

- 33**
- The writer wants to use information derived from the table to support the main idea of the paragraph. Which choice best accomplishes this goal?
- A) NO CHANGE
 - B) and many of the 1,100 active ideas may join them someday.
 - C) saving the department money every time.
 - D) which is 4.5% of the total number of ideas.

Questions 34–44 are based on the following passage.

Painting Space

When Washington, DC, art teacher Alma Thomas retired in 1960, she devoted herself full-time to painting until her death in 1978. Her work captured the public's attention for a unique **34** reason Thomas's paintings were inspired by American accomplishments in spaceflight in the 1960s and 1970s.

For much of her career as an artist, Thomas had **35** earned success and respect as a teacher of art. She was especially adept at abstractly suggesting motion, like that of the wind. Such a depiction can be seen in her **36** articulate 1968 painting *Wind, Sunshine, and Flowers*, which is composed of straight, vertical stripes of numerous dabbed-on colors; the white space between the colors reveals swirling, curving lines reminiscent of flowers blowing in the wind. Thomas had success in portraying scenes from nature and her own garden in this and other works, but her interests shifted from movement on Earth to movement in the sky—

37 namely, the hurtling of spacecraft through space.

34

- A) NO CHANGE
- B) reason:
- C) reason;
- D) reason,

35

Which choice provides the most effective introduction to the paragraph?

- A) NO CHANGE
- B) not been recognized as a professional by the art community.
- C) relied upon her advanced education in art, having earned a bachelor's and a master's degree.
- D) gravitated toward natural subjects such as forests, mountains, and sunsets.

36

- A) NO CHANGE
- B) expressive
- C) volatile
- D) explicative

37

The writer is considering deleting the underlined portion, adjusting the punctuation as needed. Should the underlined portion be kept or deleted?

- A) Kept, because it clarifies the point that precedes it in the sentence.
- B) Kept, because it summarizes the discussion in the paragraph.
- C) Deleted, because it adds irrelevant information to the sentence.
- D) Deleted, because it repeats a claim made in the previous paragraph.

After the 1969 moon landing, Thomas created some of her most famous pieces, in which she imagined what

38 one might see from high in the sky and what Earth looks like from space? In 1970's whimsically titled *Snoopy Sees Earth Wrapped in Sunset*, a large circle made up of dashed, vertical lines of red, yellow, and orange is set against a mottled dark-orange background. The painting **39** extracts a sense of awe at the **40** site of a planet adrift in the solar system. Also painted in 1970, *Apollo 12 "Splash Down"* employs the same dashed lines—though

38

- A) NO CHANGE
- B) might one see from high in the sky and what does Earth look like from space.
- C) might one see from high in the sky and what does Earth look like from space?
- D) one might see from high in the sky and what Earth looks like from space.

39

- A) NO CHANGE
- B) collects
- C) evokes
- D) raises

40

- A) NO CHANGE
- B) site for
- C) sight of
- D) sight for

this time horizontal rather than vertical—in a rainbow of vibrant colors to suggest a spacecraft completing **41** it's descent to Earth. **42** In 1972 Thomas continued to explore her abstract representations of space in *Starry Night and the Astronauts*. The canvas is taken up almost entirely by a large field of uneven strokes in various shades of blue. Suspended in the blue field is an incongruous shape isolated in the upper right-hand corner, suggesting a capsule shooting through space. Paintings like these resonated with a public already enthralled by the expanding reach of human exploration.

41

- A) NO CHANGE
- B) its
- C) their
- D) they're

42

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

Nonetheless, Thomas still often depicted scenes from nature in her abstract works, such as in her 1972 painting *Arboretum Presents White Dogwood*.

Should the writer make this addition here?

- A) Yes, because it provides context for Thomas's use of color in the paintings discussed in the paragraph.
- B) Yes, because it offers an additional example of works in Thomas's typical abstract style.
- C) No, because it interrupts the discussion of Thomas's spaceflight-inspired paintings with loosely related information.
- D) No, because it contradicts information about Thomas's use of natural scenes that was mentioned earlier in the paragraph.

Thomas continued to contemplate views from the air until the end of her career. She envisioned the experience of flight **43** vividly, imagining, in 1978, that "you streak through the clouds so fast you don't know whether the flower below is a violet or what. You see only streaks of color." **44** While her artistic styles before and after her retirement were disparate, Thomas's depictions of speed, distance, and movement remain captivating.

43

- A) NO CHANGE
- B) vividly; imagined
- C) vividly she imagined
- D) vividly. Imagining,

44

Which choice provides the best transition to the information that follows in the sentence?

- A) NO CHANGE
- B) Even though her paintings became more monochromatic later in her career,
- C) Although spaceflight is no longer the novelty it was in the last century,
- D) Shown in galleries including the Baltimore Museum of Art and the Columbus Museum,

1

What is the mass, in grams, of a black bear that has a mass of 135 kilograms? (1 kilogram = 1,000 grams)

- A) 0.135
- B) 1,350
- C) 13,500
- D) 135,000

2

For the linear function f , the graph of $y = f(x)$ in the xy -plane has a slope of $-\frac{1}{3}$ and a y -intercept of $(0, 9)$. Which equation defines f ?

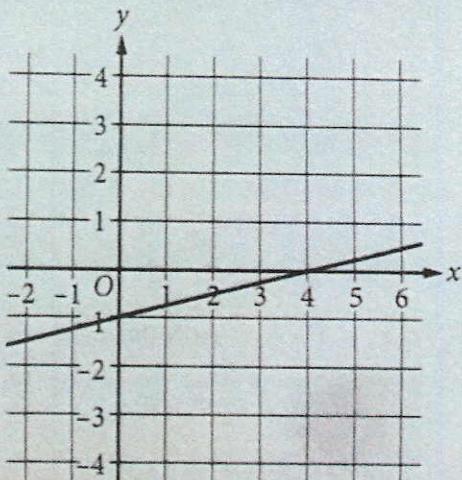
- A) $f(x) = -\frac{1}{3}x - 9$
- B) $f(x) = -\frac{1}{3}x + 9$
- C) $f(x) = 9x - \frac{1}{3}$
- D) $f(x) = 9x + \frac{1}{3}$

3

The ratio of c to d is equivalent to the ratio 3 to 1. If the value of c is multiplied by 2 and the ratio remains the same, how will the value of d change?

- A) It will be multiplied by 2.
- B) It will be multiplied by 3.
- C) It will be multiplied by 4.
- D) It will not change.

4



What is the y -intercept of the line graphed?

- A) $\left(0, \frac{1}{4}\right)$
- B) $\left(\frac{1}{4}, 0\right)$
- C) $(-1, 0)$
- D) $(0, -1)$

5

What is the y -intercept of the graph of $5x - 4y = 40$ in the xy -plane?

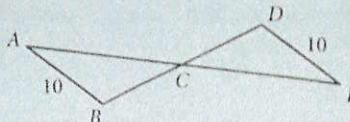
- A) $(10, 0)$
- B) $(0, 10)$
- C) $(-10, 0)$
- D) $(0, -10)$

6

For the function m defined by $m(x) = \frac{x}{2}$, what is the value of x when $m(x) = 40$?

- A) 80
- B) 42
- C) 38
- D) 20

7



In the figure shown, segments AE and BD intersect at C . Which additional piece of information is sufficient to determine whether triangle ABC is congruent to triangle EDC ?

- A) $AC = BC$
- B) $AC = CE$
- C) The measures of angles A and B are equal.
- D) The measures of angles A and E are equal.

8

$$x^2 - 18x + y^2 - 12y = -17$$

An equation of a circle in the xy -plane is shown above. If the center of the circle is $(9, k)$, where k is a constant, what is the value of k ?

- A) -9
- B) 6
- C) 10
- D) 12

9

$$|x - 15| = 2x$$

What are all possible solutions to the given equation?

- A) -15
- B) 5
- C) -5 and 5
- D) There are no solutions.

10

A spacecraft's solar panels initially generate 1,150 watts of power. The solar panels generate 2% less power than the previous year's output every year the spacecraft is in operation. Which equation represents the relationship between the amount of power generated P , in watts, and the number of years, t , the spacecraft is in operation?

- A) $P = 1,150 - 0.98^t$
- B) $P = 1,150^{0.98^t}$
- C) $P = 1,150(0.98)^t$
- D) $P = 1,150(1.02)^t$

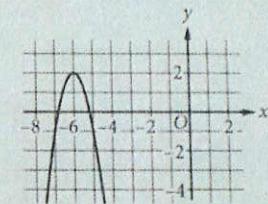
11

$$\begin{aligned} 6x + 10y &= -4 \\ ax + 5y &= 1 \end{aligned}$$

In the given system of equations, a is a constant. If the system has no solution, what is the value of a ?

- A) 1
- B) 3
- C) 4
- D) 6

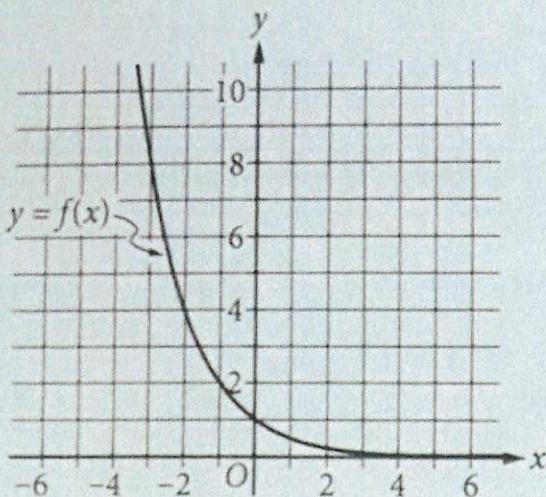
12



What is an equation of the graph shown?

- A) $y = -(x - 6)^2 - 2$
- B) $y = -(3x - 6)^2 - 2$
- C) $y = -(3x + 6)^2 + 2$
- D) $y = -3(x + 6)^2 + 2$

13



What is an equation of the graph shown?

- A) $f(x) = -2^x$
- B) $f(x) = 2^x$
- C) $f(x) = -\left(\frac{1}{2}\right)^x$
- D) $f(x) = \left(\frac{1}{2}\right)^x$

14

$$x^2 + 10x + c = 0$$

In the equation above, c is a constant. If the equation has exactly one solution, what is the value of c ?

- A) 25
- B) 10
- C) 5
- D) 0

15

Which expression is equivalent to $(ab)^{\frac{5}{8}}$, where a and b are positive constants?

- A) $a\sqrt[5]{b^8}$
- B) $a\sqrt[8]{b^5}$
- C) $(\sqrt[5]{ab})^8$
- D) $(\sqrt[8]{ab})^5$

16

The function m is defined by $m(x) = \frac{x^2 - 4}{x + 2}$, where $x \neq -2$. What is the value of $m(4)$?

17

The function g is defined by $g(x) = \frac{2}{3}x - 4$. What is the x -coordinate of the x -intercept of the graph of $y = g(x)$ in the xy -plane?

18

$$\begin{aligned}y &= 3x + 6 \\x &= 2y - 4\end{aligned}$$

If (x, y) is the solution to the system of equations shown, what is the value of y ?

19

$$x^2 - 8x - 15 = 0$$

The solutions to the given equation can be written as $\frac{8 \pm \sqrt{k}}{2}$, where k is a constant. What is the value of k ?

20

$$(5 - i)(5 + i)$$

In the complex number system, the given product is equivalent to $a + bi$, where a and b are real numbers. What is the value of a ? (Note: $i = \sqrt{-1}$)

1

What value of m is the solution to the equation $12m - 3 = m + 41$?

- A) $\frac{44}{13}$
- B) $\frac{38}{11}$
- C) 4
- D) 11

3

In one week, Mary earned a total of \$690 by working at her regular job and at a second job doing consulting work. The equation $17h + 12c = 690$ represents this situation, where h is the number of hours worked at her regular job and c is the number of hours worked at her second job. Which of the following is the best interpretation of 17 in this context?

- A) The amount, in dollars, Mary earned for each hour she worked at her regular job
- B) The amount, in dollars, Mary earned for each hour she worked at her second job
- C) The number of hours Mary worked in one week at her regular job
- D) The number of hours Mary worked in one week at her second job

2

According to the United States Bureau of Labor Statistics, the health-care industry is expected to add an additional 15.6 million new jobs over the next decade. The number of new jobs added in the health-care industry is expected to be 2 million less than 11 times the number of new jobs added in the construction industry over the next decade. Which of the following equations can be used to find the number of millions of new jobs added in the construction industry, c , over the next decade?

- A) $\frac{1}{11}c - 2 = 15.6$
- B) $\frac{1}{11}c + 2 = 15.6$
- C) $11c - 2 = 15.6$
- D) $11c + 2 = 15.6$

4

Which expression is equivalent to $(5x + y) - (3x + y)$?

- A) $2x + 2y$
- B) $2x - y$
- C) $2x$
- D) $8x$

5

Darnell made a list of the amount of time, in minutes, he spent practicing the piano for each of the last 7 days. Darnell's list is shown.

21, 15, 22, 31, 35, 91, 18

After making the list, Darnell realized that the outlier of 91 minutes was an error, and he corrected it to 19 minutes. Which of the following best describes how the median time changed when the outlier of 91 minutes was corrected to 19 minutes?

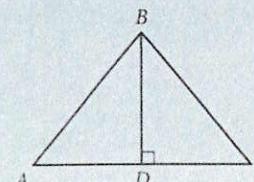
- A) The median increased.
- B) The median decreased.
- C) The median stayed the same.
- D) There is not enough information to determine how the median changed.

6

If $\frac{1}{2}(a + 1) + 2 = 8$, what is the value of $a + 1$?

- A) 3
- B) 5
- C) 12
- D) 20

7



Note: Figure not drawn to scale.

Triangle ABD is congruent to triangle CBD , such that A corresponds to C . The measure of $\angle BAD$ is 50° . What is the measure of $\angle ABC$?

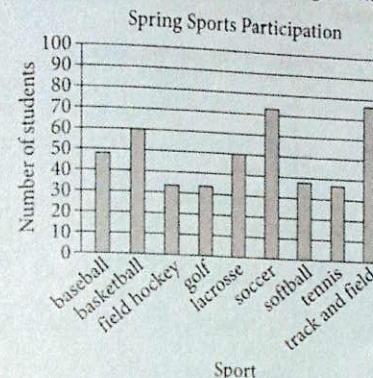
- A) 40°
- B) 50°
- C) 80°
- D) 100°

8

During a medical procedure, a patient is administered a chemical tracer. Every 4.8 period, the mass of the tracer in the patient decreases by half the mass present at the beginning of that period. Which of the following best models the relationship between the mass of the tracer in the patient and the time since it was first administered?

- A) A linear model, where the mass of the tracer in the patient increases as time increases
- B) A linear model, where the mass of the tracer in the patient decreases as time increases
- C) An exponential model, where the mass of the tracer in the patient increases as time increases
- D) An exponential model, where the mass of the tracer in the patient decreases as time increases

Questions 9 and 10 refer to the following information.



The bar graph shows the number of students who participated in each of the nine sports offered by a high school in the spring. None of the 450 students participated in more than one sport.

9

The median number of participants for the nine sports is m . Which of the sports has m participants?

- A) Baseball
- B) Soccer
- C) Tennis
- D) Track and field

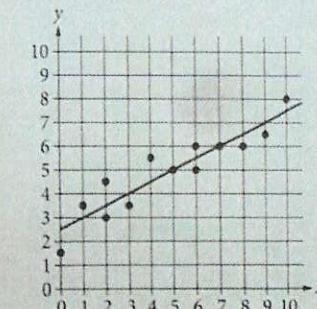
10

In the spring, approximately 37.7% of all students at the school participated in sports. Which of the following could be the number of students who attended the school in the spring?

- A) 170
- B) 488
- C) 827
- D) 1,194

11

The scatterplot shows the relationship between two variables, x and y . A line of best fit for the data is also shown.



Which of the following could be an equation of the line of best fit shown?

- A) $y = 2.5 - 0.5x$
- B) $y = 2.5 + 0.5x$
- C) $y = 0.5 - 2.5x$
- D) $y = 0.5 + 2.5x$

12

The graph of the polynomial function f , where $y = f(x)$, has x -intercepts of $(1, 0)$ and $(7, 0)$. Which of the following must be true?

- A) $f(0) = 1$
- B) $f(1) = 7$
- C) $f(7) = 0$
- D) $f(8) = 0$

Questions 13 and 14 refer to the following information.

Foods that Contain Vitamin C

Food	Serving size	Vitamin C (mg)	Energy content (kcal)
Papaya	1 medium-sized fruit	168.08	118.7
Bell pepper	1 cup	117.48	28.5
Broccoli	1 cup	101.24	54.6
Brussels sprouts	1 cup	96.72	56.2
Strawberries	1 cup	84.67	46.1
Pineapple	1 cup	78.87	82.5
Orange	1 medium-sized fruit	69.69	61.6

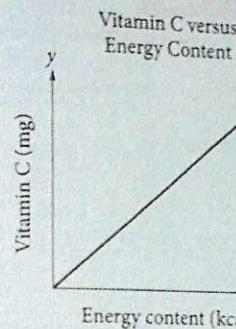
The table shows the serving size, the amount of vitamin C, in milligrams (mg), and the energy content, in kilocalories (kcal), per serving for seven foods that contain vitamin C.

13

Joaquin will make juice from 1 medium-sized papaya and n medium-sized oranges. Which of the following functions f can Joaquin use to estimate the number of milligrams of vitamin C in the fruit used to make the juice?

- A) $f(n) = n + 168$
- B) $f(n) = 60n + 119$
- C) $f(n) = 70n + 168$
- D) $f(n) = 168n + 70$

14



The graph shows the relationship between the amount of vitamin C and energy content for brussels sprouts. The equation of the line is $y = mx$. What does m represent in this context?

- A) 1.72 $\frac{\text{mg}}{\text{kcal}}$
- B) 1.72 $\frac{\text{kcal}}{\text{mg}}$
- C) 0.58 $\frac{\text{mg}}{\text{kcal}}$
- D) 0.58 $\frac{\text{kcal}}{\text{mg}}$

15

The mass of an insect larva increased over a 48-hour period. At the beginning of the period, the mass of the larva was 8.0 grams, and at the end of the period, the mass was 12 grams. If the increase in the mass was linear, what was the mass of the larva 6 hours after its mass was 9.0 grams?

- A) 9.3 grams
- B) 9.5 grams
- C) 9.8 grams
- D) 10 grams

Project Mercury was the first US human space flight program. For this program, the ratio of human flights that orbited Earth to human flights that did not orbit Earth was 2 to 1. There were a total of 6 Project Mercury human flights. How many of these flights did not orbit Earth?

- A) 1
- B) 2
- C) 3
- D) 4

17

Line k in the xy -plane is defined by the equation

$$y = \frac{2}{3}x + 4.$$

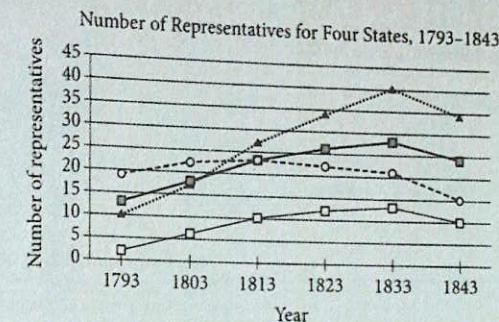
Line n is perpendicular to line k .

What is the slope of line n ?

- A) $\frac{3}{2}$
- B) $\frac{2}{3}$
- C) $-\frac{2}{3}$
- D) $-\frac{3}{2}$

Questions 18 and 19 refer to the following information.

Year	Total number of representatives
1793	105
1803	141
1813	182
1823	213
1833	240
1843	223



The table shows the total number of representatives in the US House of Representatives for certain years from 1793 through 1843. The figure shows the number of representatives from four states for the same years.

18

In how many of the four states shown was the number of representatives in 1793 greater than the number of representatives in 1843?

- A) None
- B) One
- C) Two
- D) Three

19

Which of the following is closest to the percent increase in the number of representatives from New York from 1793 to 1843?

- A) 2.4%
- B) 24%
- C) 240%
- D) 2,400%

20

$$\sqrt{(x+1)^2} = x+1$$

What is the least value of x that is a solution to the given equation?

- A) -2
- B) -1
- C) 0
- D) 1

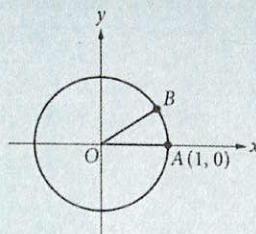
21

$$\frac{(x - \sqrt{3})(x + \sqrt{3})}{3(x^2 - 3)}$$

Which of the following is equivalent to the given expression for values of x not equal to $\sqrt{3}$ or $-\sqrt{3}$?

- A) $\sqrt{3}$
- B) $\frac{\sqrt{3}}{3}$
- C) $\frac{2}{3}$
- D) $\frac{1}{3}$

22

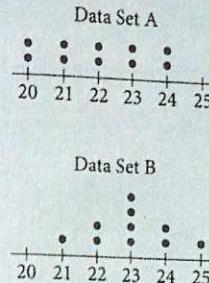


Points A and B lie on the unit circle with center O , as shown. The measure of angle AOB is $\frac{\pi}{6}$ radians. What is the y -coordinate of point B ?

- A) $\frac{1}{2}$
- B) 1
- C) $\frac{\sqrt{3}}{2}$
- D) $\sqrt{3}$

23

Each dot plot represents a data set.



Which of the following statements best compares the means and the standard deviations of the two data sets?

- A) The mean of data set A is less than the mean of data set B, and the standard deviation of data set A is greater than the standard deviation of data set B.
- B) The mean of data set A is greater than the mean of data set B, and the standard deviation of data set A is less than the standard deviation of data set B.
- C) The mean of data set A is less than the mean of data set B, and the standard deviation of data set A is less than the standard deviation of data set B.
- D) The mean of data set A is greater than the mean of data set B, and the standard deviation of data set A is greater than the standard deviation of data set B.

24

A running-shoe manufacturer will conduct a study to investigate whether a new shoe improves athletic performance. There will be two groups used in the study. Participants in one group will use the new shoe, and participants in the other group will use the currently produced shoe. Which of the following is a necessary aspect of the study in order to provide evidence for a cause-and-effect relationship between the use of the new shoe and athletic performance?

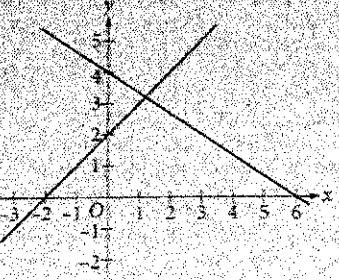
- A) Each group is assigned the same number of participants.
- B) Each group has at least 30 participants.
- C) Each participant is randomly assigned to a group.
- D) A different person measures the athletic performance for each participant.

25

$$P(t) = 12.5(1.04)^t$$

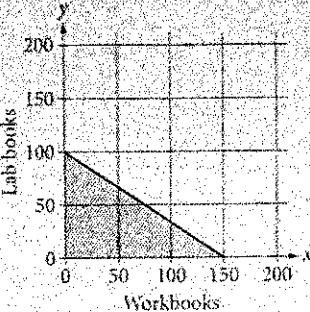
The given function models the population, in thousands, of a town t years from now. According to the model, by what percent is the population expected to grow each year?

- A) 1.04%
- B) 2.50%
- C) 4.00%
- D) 12.50%



The graphs shown represent which of the following systems of equations?

- A) $x - y = -2$
 $4x + 6y = 24$
- B) $x - y = -2$
 $4x + 6y = 24$
- C) $x + y = -2$
 $4x - 6y = 24$
- D) $x + y = -2$
 $4x + 6y = 24$



The shaded region shown models the possible numbers of workbooks, x , and lab books, y , that a school's science department can buy with \$1,500. Which of the following inequalities represents this relationship for $x \geq 0$ and $y \geq 0$?

- A) $10x + 15y \leq 1,500$
- B) $15x + 10y \leq 1,500$
- C) $100x + 150y \leq 1,500$
- D) $150x + 100y \leq 1,500$

19
The area of a rectangular rug is 112 square feet. The rug's width, x , in feet, is 6 feet shorter than its length. Which equation represents this situation?

- A) $x^2 - 6x - 112 = 0$
- B) $x^2 - 6x + 112 = 0$
- C) $x^2 + 6x - 112 = 0$
- D) $x^2 + 6x + 112 = 0$

$$r + 16x = r^2 + 8$$

The given equation is quadratic. Which of the following equivalent equations displays the minimum value of r as a constant or coefficient?

- A) $y = x^2 - 16x + 8$
- B) $y = (x - 8)^2 + (-56)$
- C) $f = x^2 - 2(8x - 4)$
- D) $y = (x - 8 - 2\sqrt{14})(x - 8 + 2\sqrt{14})$

27

Which expression is equivalent to increasing the positive quantity x by 6.1%?

- A) $0.061x$
- B) $0.610x$
- C) $1.061x$
- D) $1.610x$

31

The density of aluminum is 2.70 grams per cubic centimeter. What is the mass, in grams, of an aluminum block with a volume of 130.0 cubic centimeters?

32

A triangular prism has a height of 5 centimeters and a volume of 50 cubic centimeters. What is the area of the base of the prism, in square centimeters? (The volume of a triangular prism is equal to Bh , where B is the area of the base and h is the height of the prism.)

33

This January, an online store selected a number of days to apply a 10% discount to all orders placed on those days. Based on the table, what fraction of weekend days were days that applied the discount?

	Discount	No discount	Total
Weekday	16	7	23
Weekend day	5	3	8
Total	21	10	31

34

$$\begin{aligned}3x + 5y &= 17 \\ 5x + 3y &= 23\end{aligned}$$

The solution to the given system of equations is (x, y) . What is the value of $x + y$?

35

3.1	4.2	5.4	6.7	7.5	8.9	x
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For the list of data shown, the median is 6.7 and the range is 6.3. What is the value of x ?

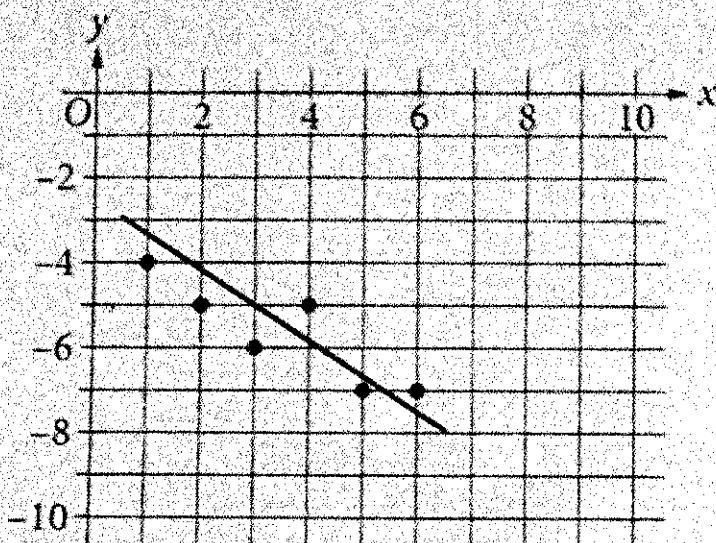
36

$$6x - 5 = tx - 3$$

In the given equation, t is a constant. The equation has no solution. What is the value of t ?

37

The scatterplot shows the relationship between two variables, x and y . A line of best fit for the data is also shown.



For how many of the data points is the y -value predicted by the line of best fit greater than the actual y -value?

38

The solution to the given system of equations is (x, y) . What is the value of x ?

$$\begin{aligned}y &= (x - 2)(x - 3) \\y &= x - 3\end{aligned}$$