Chapter 21
Practice Test 10

Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

Questions 1–10 are based on the following passage.

This passage is excerpted from Gloria Steinem, *My Life on the Road*. ©2015 by Random House. The narrator, a writer, recalls her childhood in the United States of America.

There were only a few months each year when my father seemed content with a house-dwelling life. Every summer, we stayed in the small house he had
Line built across the road from a lake in rural Michigan,
5 where he ran a dance pavilion on a pier over the water. Though there was no ocean within hundreds of miles, he had named it Ocean Beach Pier, and given it the grandiose slogan "Dancing Over the Water and Under the Stars."
10   On weeknights, people came from nearby farms and summer cottages to dance to a jukebox. My father dreamed up such attractions as a living chess game, inspired by his own love of chess, with costumed teenagers moving across the squares of the dance floor.
15 On weekends, he booked the big dance bands of the 1930s and 1940s into this remote spot. People might come from as far away as Toledo or Detroit to dance to this live music on warm moonlit nights. Of course, paying the likes of Guy Lombardo or Duke Ellington
20 or the Andrews Sisters meant that one rainy weekend could wipe out a whole summer's profits, so there was always a sense of gambling. I think my father loved that, too.
    But as soon as Labor Day had ended this precarious
25 livelihood, my father moved his office into his car. In the first warm weeks of autumn, we drove to nearby

country auctions, where he searched for antiques amid the household goods and farm tools. After my mother, with her better eye for antiques and her reference
30 books, appraised them for sale, we got into the car again to sell them to roadside antique dealers anywhere within a day's journey. I say "we" because from the age of four or so, I came into my own as the wrapper and unwrapper of china and other small items that
35 we cushioned in newspaper and carried in cardboard boxes over country roads. Each of us had a role in the family economic unit, including my sister, nine years older than I, who in the summer sold popcorn from a professional stand my father bought her.
40   But once the first frost turned the lake to crystal and the air above it to steam, my father began collecting road maps from gas stations, testing the trailer hitch on our car, and talking about such faraway pleasures as thin sugary pralines from Georgia, all-
45 you-can-drink orange juice from roadside stands in Florida, or slabs of salmon fresh from a California smokehouse.
    Then one day, as if struck by a sudden whim rather than a lifelong wanderlust, he announced that it was
50 time to put the family dog and other essentials into the house trailer that was always parked in our yard, and begin our long trek to Florida or California.
    Sometimes this leave-taking happened so quickly that we packed more frying pans than plates, or left a
55 kitchen full of dirty dishes and half-eaten food to greet us like Pompeii on our return. My father's decision

always seemed to come as a surprise, even though his fear of the siren song of home was so great that he refused to put heating or hot water into our small
60 house. If the air of early autumn grew too chilly for us to bathe in the lake, we heated water on a potbellied stove and took turns bathing in a big washtub next to the fireplace. Since this required the chopping of wood, an insult to my father's sybaritic soul, he had invented
65 a wood-burning system all his own: he stuck one end of a long log into the fire and let the other protrude into the living room, then kicked it into the fireplace until the whole thing turned to ash. Even a pile of cut firewood in the yard must have seemed to him a
70 dangerous invitation to stay in one place.

After he turned his face to the wind, my father did not like to hesitate. Only once do I remember him turning back, and even then my mother had to argue strenuously that the iron might be burning its way
75 through the ironing board. He would buy us a new radio, new shoes, almost anything rather than retrace the road already traveled.

1

Over the course of the passage, the main focus shifts from

A) a description of the narrator's father to a portrayal of a significant place the family often visited.

B) a depiction of the family's settled life to a description of the family's life on the road.

C) an allegorical display of domesticity to an example of its rejection by the narrator's father.

D) an anecdote about the poverty of the narrator's childhood to a speculation concerning the causes of that poverty.

2

The main purpose of the second paragraph (lines 10–23) ("On weeknights . . . too") is to

A) analyze the source of the father's compulsive desire to travel.

B) introduce the figures who play a role in the narrator's remembrances.

C) illustrate the father's delusions of grandeur that harmed the family's financial well-being.

D) describe the father's unique approach to living life that is expanded upon later in the passage.

3

The word "precarious" is used in line 24 to

A) emphasize the danger inherent to dancing over the water.

B) caution against burning firewood in an unapproved manner.

C) underscore the joy that this dancehall brought to so many.

D) highlight the uncertainty regarding the summer profits.

4

The narrator indicates that she participated in the family business

A) in a way that matched her age and abilities.

B) much less than her older siblings.

C) despite not being paid for her work.

D) on a volunteer basis until her teenage years.

CONTINUE

5

With which of the following statements about her father would the narrator most likely agree?

A) He objected to train travel as a mode of transportation.

B) He had no consideration for his family's wishes.

C) He feared the expense of installing a heater into the family home.

D) He seemed mostly discontent with a settled, domestic life.

6

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

A) Lines 1–2 ("There . . . life")

B) Lines 22–23 ("I think . . . too")

C) Lines 36–39 ("Each . . . her")

D) Lines 59–60 ("he refused . . . house")

7

As used in line 48, "struck" most nearly means

A) battered.

B) boycotted.

C) inspired.

D) disturbed.

8

It can reasonably be inferred from the passage that the main reason that the narrator's father started the cross-country trip is because

A) he was struck by a sudden desire to escape the monotony of the house.

B) his desire to travel stemmed from a basic personality trait.

C) the family had already depleted the resources at one site.

D) he was surprised by the sudden change in the weather.

9

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

A) Lines 25–28 ("In the . . . tools")

B) Lines 40–47 ("But once . . . smokehouse")

C) Lines 48–52 ("Then . . . California")

D) Lines 53–56 ("Sometimes . . . return")

10

Which statement best characterizes the mother's role in the family?

A) She resented the father's impulsive nature.

B) She shared the father's wanderlust equally.

C) She sometimes played a more practical role than the father did.

D) She rescued the family's possessions from the flames.

CONTINUE ➡

Questions 11–21 are based on the following passage and supplementary material.

This passage is adapted from "Stanford researchers uncover patterns in how scientists lie about their data," by Bjorn Carey, originally published in November 2015 by Stanford University.

Even the best poker players have "tells" that give away when they're bluffing with a weak hand. Scientists who commit fraud have similar, but even more subtle, tells, and a pair of Stanford researchers have cracked the writing patterns of scientists who attempt to pass along falsified data. The work, published in the *Journal of Language and Social Psychology*, could eventually help scientists identify falsified research before it is published.

There is a fair amount of research dedicated to understanding the ways liars lie. Studies have shown that liars generally tend to express more negative emotion terms and use fewer first-person pronouns. Fraudulent financial reports typically display higher levels of linguistic obfuscation—phrasing that is meant to distract from or conceal the fake data—than accurate reports.

To see if similar patterns exist in scientific academia, Jeff Hancock, a professor of communication at Stanford, and graduate student David Markowitz searched the archives of PubMed, a database of life sciences journals, from 1973 to 2013 for retracted papers. They identified 253, primarily from biomedical journals, that were retracted for documented fraud and compared the writing in these to unretracted papers from the same journals and publication years, and covering the same topics.

They then rated the level of fraud of each paper using a customized "obfuscation index," which rated the degree to which the authors attempted to mask their false results. This was achieved through a summary score of causal terms, abstract language, jargon, positive emotion terms and a standardized ease of reading score.

"We believe the underlying idea behind obfuscation is to muddle the truth," said Markowitz, the lead author on the paper. "Scientists faking data know that they are committing a misconduct and do not want to get caught. Therefore, one strategy to evade this may be to obscure parts of the paper. We suggest that language can be one of many variables to differentiate between fraudulent and genuine science."

The results showed that fraudulent retracted papers scored significantly higher on the obfuscation index than papers retracted for other reasons. For example, fraudulent papers contained approximately 1.5 percent more jargon than unretracted papers. "Fraudulent papers had about 60 more jargon-like words per paper compared to unretracted papers," Markowitz said. "This is a non-trivial amount."

The researchers say that scientists might commit data fraud for a variety of reasons. Previous research points to a "publish or perish" mentality that may motivate researchers to manipulate their findings or fake studies altogether. But the change the researchers found in the writing, however, is directly related to the author's goals of covering up lies through the manipulation of language. For instance, a fraudulent author may use fewer positive emotion terms to curb praise for the data, for fear of triggering inquiry.

In the future, a computerized system based on this work might be able to flag a submitted paper so that editors could give it a more critical review before publication, depending on the journal's threshold for obfuscated language. But the authors warn that this approach isn't currently feasible given the false-positive rate. "Science fraud is of increasing concern in academia, and automatic tools for identifying fraud might be useful," Hancock said. "But much more research is needed before considering this kind of approach. Obviously, there is a very high error rate that would need to be improved, but also science is based on trust, and introducing a 'fraud detection' tool into the publication process might undermine that trust."

Frequencies of Language Categories in Publications, Reviewed by Markowitz and Hancock
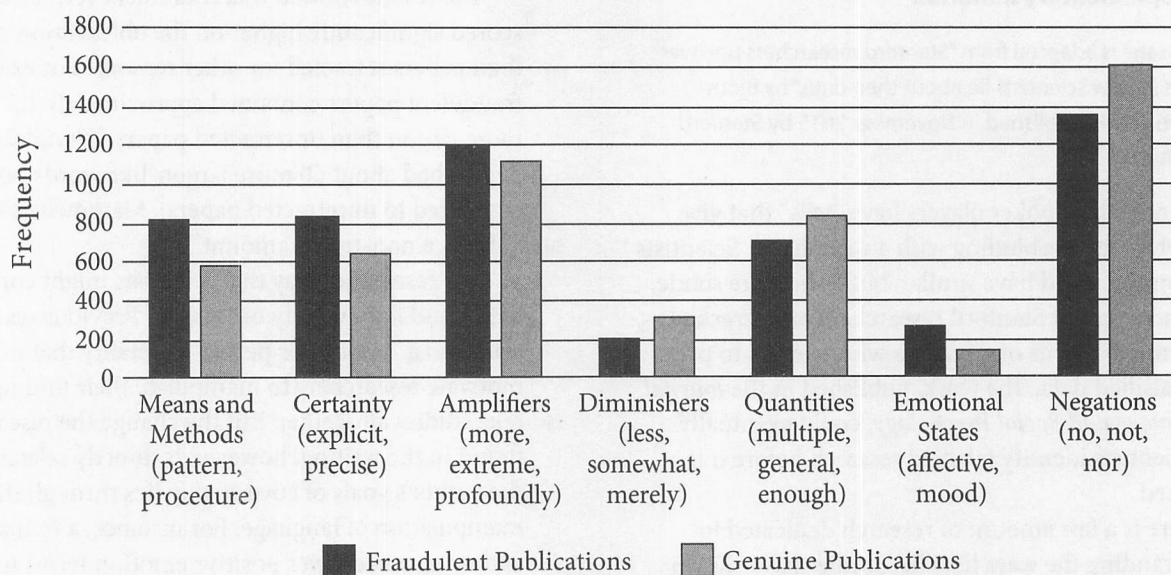
Data sourced from "Linguistic Traces of a Scientific Fraud: The Case of Diederik Stapel," © David M. Markowitz and Jeffrey T. Hancock, August 25, 2014. http://journals.plos.org/plosone/article/figure?id=10.1371/journal.pone.0105937.t001

11

The primary purpose of this passage is to

A) defend scientists who have incorporated fraudulent data into their reports in order to succeed in a competitive field.

B) contrast various methodologies for spotting false information in different industries and research fields.

C) describe an experiment designed to find the differences between fraudulent and genuine scientific data and caution against a possible solution.

D) reveal the secrets of those who successfully convince others of the veracity of false information.

12

The first paragraph serves mainly to

A) introduce a concept at the foundation of the research discussed in the passage.

B) propose additional applications for the results of the study in the passage.

C) introduce the development of general methods of fraud detection.

D) present an idea about scientific development that will be questioned later in the passage.

13

As used in line 10, "fair" most nearly means

A) ample.

B) lawful.

C) equal.

D) favorable.

CONTINUE

14

As used in line 40, "obscure" most nearly means

A) hide.

B) blind.

C) distort.

D) characterize.

15

The passage indicates that scientific papers with fraudulent data can potentially be spotted by looking for

A) references to research studies that did not happen.

B) writing that uses deliberately distracting and confusing words and phrases.

C) results that differ from those of other studies by more than 1.5 percent.

D) authors who have published more than 60 papers in academic journals.

16

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

A) Lines 31–34 ("This . . . score")

B) Lines 43–45 ("The results . . . reasons")

C) Lines 58–60 ("For instance . . . inquiry")

D) Lines 61–65 ("In the . . . language")

17

Which hypothetical situation would Hancock most likely agree could be a consequence of action without further research into science fraud?

A) A scientist runs his paper through a computer program to check for confusing language before publication.

B) A scientist includes fraudulent data in a paper that does not affect the conclusion of the experiment.

C) A scientist publishes a genuine paper in a journal that has been known to publish fraudulent papers.

D) A scientist is less likely to submit a paper to a journal that uses automatic tools to detect fraud.

18

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

A) Lines 39–40 ("Therefore . . . paper")

B) Lines 52–55 ("Previous . . . altogether")

C) Lines 65–67 ("But the . . . rate")

D) Lines 71–74 ("Obviously . . . trust")

19

According to the graph, the greatest difference between the language used in fraudulent and genuine research occurred in which category?

A) Means and Methods

B) Amplifiers

C) Quantities

D) Emotional States

CONTINUE ➡

Which of the following statements is supported by the graph?

A) Scientists who published fraudulent data were more likely to use quantities-related language in their papers than were scientists who published genuine data.

B) Scientists who published fraudulent data used means and methods-related language nearly as often as they used certainty-related language.

C) Scientists who used more negation-related language were more likely to have published fraudulent data than scientists who used less negations-related language.

D) Scientists who used more amplifiers and diminishers were more likely to publish genuine data than scientists who used fewer amplifiers and diminishers.

Based on information in the graph and passage, which statement from the passage best supports the claim that jargon would be classified as "means and methods?"

A) Lines 2–6 ("Scientists . . . data")

B) Lines 11–13 ("Studies . . . pronouns")

C) Lines 47–49 ("Fraudulent . . . said")

D) Lines 69–71 ("But much . . . approach")

Questions 22–31 are based on the following passage and supplementary material.

This passage is adapted from "The Story of YInMn Blue," originally published by Mas Subramanian, Joseph Tang, and Oregon State University.

YInMn Blue, or "MasBlue" as it is commonly referred to at Oregon State University ("OSU"), is a serendipitous discovery of a bright blue pigment by scientists led by Mas Subramanian at OSU while researching materials for electronics applications. The pigment contains the elements Yttrium, Indium, Manganese, and Oxygen.

In 2009, graduate student Andrew Smith was exploring the electronic properties of manganese oxide by heating it to approximately 1,200°C (~2,000°F). Instead of a new, high-efficiency electronic material, what emerged from the furnace was a brilliant blue compound—a blue that Subramanian knew immediately was a research breakthrough. "If I hadn't come from an industry research background—DuPont has a division that developed pigments and obviously they are used in paint and many other things—I would not have known this was highly unusual, a discovery with strong commercial potential," he says.

Blue pigments dating back to ancient times have been notoriously unstable—many fade easily and contain toxic materials. The fact that this pigment was synthesized at such high temperatures signaled to Subramanian that this new compound was extremely stable, a property long sought in a blue pigment, he says. . . .

The chemical formula of YInMn Blue is $YIn_{1-x}Mn_xO_3$. These compositions adopt a crystal structure in which the chromophore responsible for the intense blue color (Mn^{3+}) resides in the trigonal bipyramidal site. The intensity of the color can be systematically tuned by adjusting the In:Mn ratio. . . .

By measuring the spectral properties of this series, it was found that $YIn_{1-x}Mn_xO_3$ exhibits high absorbance in the UV region and high reflectivity in the near-infrared region when compared to currently-used Cobalt Blue pigments. . . .

In May 2012, the Subramanian team received a patent with the U.S. Patent Office for the new pigment (US82822728). Shepherd Color Co. subsequently began rigorous testing of the pigment. They concluded that the increased UV absorbance and stability in outdoor weathering and heat buildup tests demonstrate that YInMn blue is superior to Cobalt Blue ($CoAl_2O_4$). In addition, the high solar reflectance (compared to similarly colored pigments) indicates that this 'cool pigment' can find use in a variety of exterior applications by reducing surface temperatures, cooling costs, and energy consumption. As a result of this testing, Shepherd Color Co. has licensed the patent for commercialization efforts.

Recently, several local artists (including OSU art students) have used this pigment in their own professional endeavors, utilizing it in watercolors and drypoint.

The excitement of discovering a brilliant blue, heat reflecting, thermally stable, and UV absorbing pigment did not stop them from exploring beyond the blues. Since then, Subramanian and his team have expanded their research and have made a range of new pigments to include almost every color, from bright oranges to shades of purple, turquoise and green.

They continue to search for a new stable, heat reflecting, and brilliant red, the most elusive color to synthesize.

CONTINUE

Reflectance vs. Wavelength

Figure 1
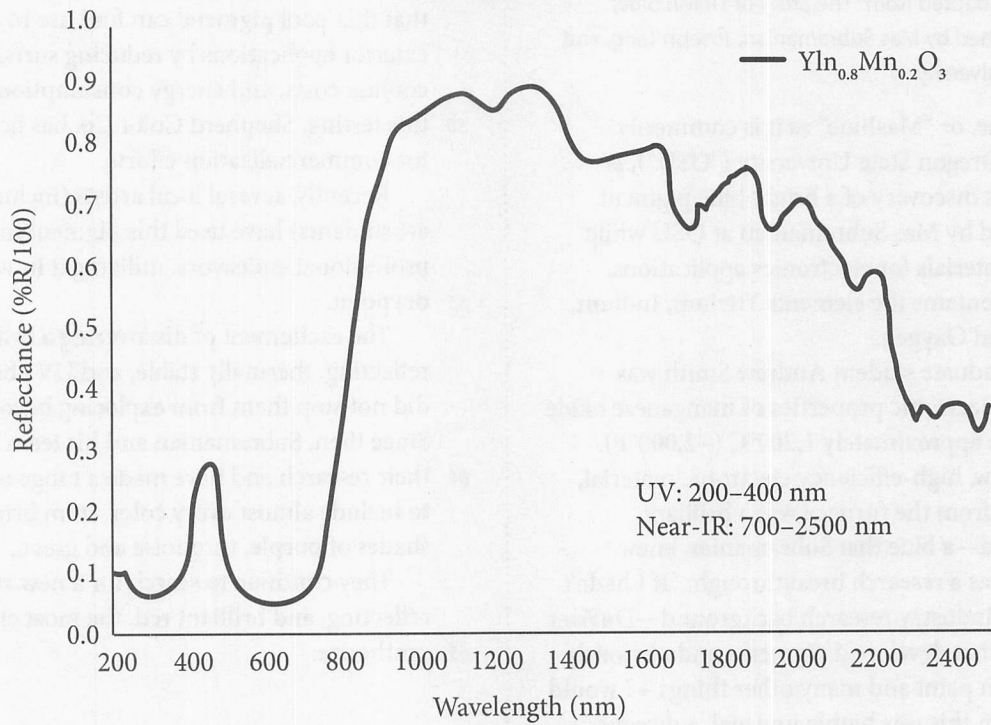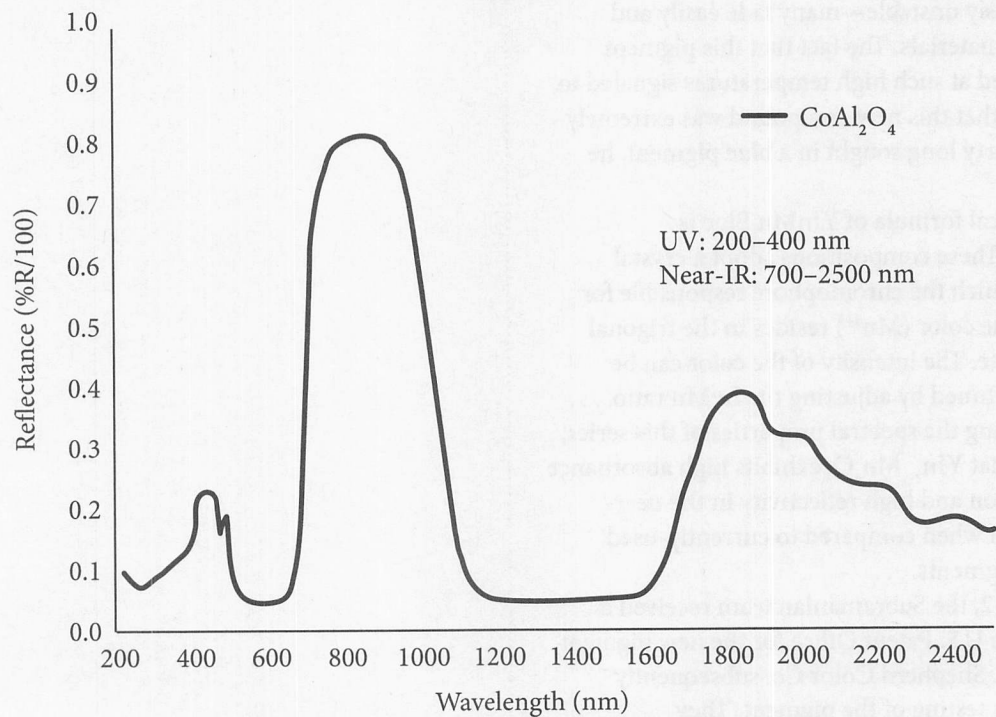

Yln$_{0.8}$Mn$_{0.2}$O$_3$

UV: 200–400 nm
Near-IR: 700–2500 nm

Figure 2

CoAl$_2$O$_4$

UV: 200–400 nm
Near-IR: 700–2500 nm

Images provided courtesy of Oregon State University.

CONTINUE

22

One main idea of the passage is that

A) chemically engineered substances can be both beneficial and dangerous.

B) unexpected findings can have significant implications.

C) pigments can be described most effectively in terms of chemical composition.

D) increased UV absorbance is directly related to pigment stability.

23

Which choice best describes the overall structure of the passage?

A) A description of a discovery, a scientific explanation, and the practical applications of the discovery

B) A comparison of the properties of a synthetic compound and the presentation of a natural compound alternative

C) A historical account of several accidental discoveries and an unbiased critique of the resulting products

D) A listing of chemical compounds, a description of how those compounds work together, and a comparison of the benefits of each compound

24

As used in line 5, "applications" most nearly means

A) requests.

B) forms.

C) uses.

D) industries.

25

Which choice provides the best evidence for the claim that Smith did not intend for his experiment to produce the results that it did?

A) Lines 6–7 ("The pigment . . . Oxygen")

B) Lines 11–14 ("Instead . . . breakthrough")

C) Lines 49–51 ("As a . . . efforts")

D) Lines 63–65 ("They . . . synthesize")

26

As used in line 21, "unstable" most nearly means

A) impermanent.

B) threatening.

C) careless.

D) antiquated.

27

According to the passage, researchers have identified which of the following factors as most indicative of stable pigments?

A) Toxic materials

B) Oxygenated indium

C) Extreme temperatures

D) High pressure

CONTINUE

28

Based on the passage, which choice best describes the relationship between the new YInMn Blue pigment and the Cobalt Blue pigment currently used?

A) Cobalt Blue is superior for exterior conditions, while YInMn Blue is preferred for interior conditions.

B) YInMn Blue was specifically engineered to provide a color that can be chemically adjusted for intensity, while Cobalt Blue was not.

C) YInMn Blue pigment is as hard to synthesize as purple pigment is, while Cobalt Blue is simpler.

D) Cobalt Blue has a lower UV absorbency and infrared reflectivity than does YInMn Blue.

29

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

A) Lines 20–22 ("Blue . . . materials")

B) Lines 34–37 ("$YIn_{1-x}Mn_xO_3$ . . . pigments")

C) Lines 41–45 ("They . . . ($CoAl_2O_4$)")

D) Lines 56–58 ("The excitement . . . blues")

30

According to figure 2, at which of the following wavelengths does $CoAl_2O_4$ have a reflectance of 0.4%?

A) 2400 nm

B) 1800 nm

C) 1200 nm

D) 600 nm

31

Based on information in the passage and the graph, which of the following ranges of wavelengths most clearly illustrates the thermal advantages of YInMn Blue over Cobalt Blue?

A) 200–400

B) 400–600

C) 800–1000

D) 1200–1400

CONTINUE

Questions 32–41 are based on the following passages.

Passage 1 is adapted from President Grover Cleveland's *1895 Annual Message to the Congress of the United States*. Passage 2 is adapted from William Jennings Bryan's speech at the 1896 Democratic National Convention. The Coinage Act of 1873 ended the United States' federal policy of accepting both gold- and silver-backed currency, establishing a gold monetary standard. This decision was a primary point of contention in the 1896 presidential race.

Passage 1

While I have endeavored to make a plain statement of the disordered condition of our currency and the present dangers menacing our prosperity and to suggest a way which leads to a safer financial system, I
5 have constantly had in mind the fact that many of my countrymen, whose sincerity I do not doubt, insist that the cure for the ills now threatening us may be found in the single and simple remedy of the free coinage of silver. They contend that our mints shall be at once
10 thrown open to the free, unlimited, and independent coinage of both gold and silver dollars of full legal-tender quality, regardless of the action of any other government and in full view of the fact that the ratio between the metals which they suggest calls for 100
15 cents' worth of gold in the gold dollar at the present standard and only 50 cents in intrinsic worth of silver in the silver dollar.

Were there infinitely stronger reasons than can be adduced for hoping that such action would secure for
20 us a bimetallic currency moving on lines of parity, an experiment so novel and hazardous as that proposed might well stagger those who believe that stability is an imperative condition of sound money.

No government, no human contrivance or act of
25 legislation, has ever been able to hold the two metals together in free coinage at a ratio appreciably different from that which is established in the markets of the world.

Those who believe that our independent free
30 coinage of silver at an artificial ratio with gold of 16 to 1 would restore the parity between the metals, and consequently between the coins, oppose an unsupported and improbable theory to the general belief and practice of other nations; and to the
35 teaching of the wisest statesmen and economists of the world, both in the past and present, and, what is far more conclusive, they run counter to our own actual experiences.

Twice in our earlier history our lawmakers,
40 in attempting to establish a bimetallic currency, undertook free coinage upon a ratio which accidentally varied from the actual relative values of the two metals not more than 3 per cent. In both cases, notwithstanding greater difficulties and cost
45 of transportation than now exist, the coins whose intrinsic worth was undervalued in the ratio gradually and surely disappeared from our circulation and went to other countries where their real value was better recognized.

50 Acts of Congress were impotent to create equality where natural causes decreed even a slight inequality.

Passage 2

If they tell us that the gold standard is the standard of civilization, we reply to them that this, the most enlightened of all nations of the earth, has never
55 declared for a gold standard, and both the parties this year are declaring against it. If the gold standard is the standard of civilization, why, my friends, should we not have it? So if they come to meet us on that, we can present the history of our nation. More than that, we
60 can tell them this, that they will search the pages of history in vain to find a single instance in which the common people of any land ever declared themselves in favor of a gold standard. They can find where the holders of fixed investments have.

65 Mr. Carlisle said in 1878 that this was a struggle between the idle holders of idle capital and the struggling masses who produce the wealth and pay the taxes of the country; and my friends, it is simply a question that we shall decide upon which side the
70 Democratic Party shall fight. Upon the side of the idle holders of idle capital, or upon the side of the struggling masses? That is the question that the party must answer first; and then it must be answered by each individual hereafter. The sympathies of the
75 Democratic Party, as described by the platform, are on the side of the struggling masses, who have ever been the foundation of the Democratic Party.

There are two ideas of government. There are those who believe that if you just legislate to make the
80 well-to-do prosperous, that their prosperity will leak through on those below. The Democratic idea has been that if you legislate to make the masses prosperous

CONTINUE ➡

their prosperity will find its way up and through every class that rests upon it.

85   You come to us and tell us that the great cities are in favor of the gold standard. I tell you that the great cities rest upon these broad and fertile prairies. Burn down your cities and leave our farms, and your cities will spring up again as if by magic. But destroy our farms
90 and the grass will grow in the streets of every city in the country.

32

As used in line 3, "present" most nearly means

A) prompt.

B) current.

C) instant.

D) gifted.

33

What does Passage 1 suggest about the proponents of implementing a bimetallic system of currency?

A) They doubt the use of gold to back a currency in any situation.

B) They have an honest belief in the potential of their proposed solution.

C) They would rather Congress become impotent than submit to bimetallic currency.

D) They resent the great cities that are pushing the gold standard on the people of the prairies.

34

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

A) Lines 4–9 ("I have . . . silver")

B) Lines 9–13 ("They . . . government")

C) Lines 29–34 ("Those . . . nations")

D) Lines 37–38 ("they . . . experiences")

35

In the final sentence of Passage 1, the main purpose of Cleveland's reference to "Acts of Congress" is to

A) emphasize a disparity between government forces and market forces.

B) summarize Congress's argument for implementing the gold standard.

C) propose a natural alternative to the complex problem facing the nation.

D) assert that only the passage of a law could solve a seemingly intractable debate.

36

As used in line 66, "idle" most nearly means

A) abandoned.

B) ambitious.

C) inactive.

D) cheap.

37

Based on Passage 2, Bryan would be most likely to agree with which claim about the controversy over the gold standard?

A) It would only be settled if gold were the preferred standard of civilization.

B) It has consistently lacked support from large segments of society.

C) It motivated further investigation of the silver standard worldwide.

D) It could have been avoided if Congress had not listened to the prosperous.

CONTINUE ➡

38

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

A) Lines 56–58 ("If the . . . it")

B) Lines 59–63 ("More . . . standard")

C) Lines 74–77 ("The sympathies . . . Party")

D) Lines 78–81 ("There . . . below")

39

Both passages discuss the issue of the gold standard in relation to

A) Congress.

B) the Democratic Party.

C) economists.

D) other nations.

40

In the context of each passage as a whole, the historical references in line 39 of Passage 1 and line 65 of Passage 2 primarily function to help each speaker

A) establish that a debate has been ongoing.

B) cite established precedent to support a position.

C) challenge the gold standard status quo.

D) question whether progress has been made.

41

Which choice identifies a central tension between the two passages?

A) Cleveland advocates for new legislation to enact the gold standard, but Bryan questions the necessity of such a move without elite support.

B) Cleveland questions the validity of a proposed solution, but Bryan argues that the alternative is an even more unreasonable path forward.

C) Cleveland demands gold standard proponents reconsider their position, and Bryan defends the specifics of that position.

D) Cleveland presents studies in support of the gold standard, and Bryan asserts that the sources of the evidence are biased.

CONTINUE

Questions 42–52 are based on the following passage.

This passage is adapted from "Zombie ant fungi 'know' brains of their hosts," originally published on August 22, 2014 by Chuck Gill, Penn State College of Agricultural Sciences.

A parasitic fungus that reproduces by manipulating the behavior of ants emits a cocktail of behavior-controlling chemicals when encountering the brain of its natural target host, but not when infecting other ant species, a new study shows. The findings, which suggest that the fungus "knows" its preferred host, provide new insights into the molecular mechanisms underlying this phenomenon, according to researchers. "Fungi are well known for their ability to secrete chemicals that affect their environment," noted lead author Charissa de Bekker, a Marie Curie Fellow in Penn State's College of Agricultural Sciences, and Ludwig Maximilian of the University of Munich. "So we wanted to know what chemicals are employed to control so precisely the behavior of ants."

The research focused on a species from the genus *Ophiocordyceps*—known as "zombie ant fungi"—which control their ant hosts by inducing a biting behavior. Although these fungi infect many insects, the species that infect ants have evolved a mechanism that induces hosts to die attached by their mandibles to plant material, providing a platform from which the fungus can grow and shoot spores to infect other ants. To study this mechanism, the researchers combined field research with a citizen-scientist in South Carolina, infection experiments under laboratory conditions, and analysis using metabolomics, which is the study of the chemical processes associated with the molecular products of metabolism. The scientists used a newly discovered fungal species from North America— initially called *Ophiocordyceps unilateralis sensu lato* while it awaits a new name—that normally controls an ant species in the genus *Camponotus*. To test whether a species of fungus that has evolved to control the behavior of one ant species can infect and control others, they infected nontarget hosts from the same ant genus and another genus (*Formica*).

They found that this obligate killer can infect and kill nontarget ants, but it cannot manipulate their behavior. "The brain of the target species was the key to understanding manipulation," de Bekker said. The researchers next removed ant brains, keeping the organs alive in special media. The fungus then was grown in the presence of brains from different ant species to determine what chemicals it produced for each brain. "This was 'brain-in-a-jar' science at its best," said co-author David Hughes, assistant professor of entomology and biology, Penn State. "It was necessary to reduce the complexity associated with the whole, living ant, and just ask what chemicals the fungus produces when it encounters the ant brain. "You don't get to see a lot of behavior with fungi," he said. "You have to infer what they are doing by examining how they grow, where they grow and most important, what chemicals they secrete."

"We could see in the data that the fungus behaved differently in the presence of the ant brain it had co-evolved with," said de Bekker, whose Penn State co-authors also included Andrew Patterson, assistant professor of molecular toxicology, and Phil Smith, director of the Metabolomics Core Facility. The researchers found thousands of unique chemicals, most of them completely unknown. This, according to Hughes, is not surprising, since little previous work has mined these fungi for the chemicals they produce. But what did stand out were two known neuromodulators, guanobutyric acid (GBA) and sphingosine. These both have been reported to be involved in neurological disorders and were enriched when the fungus was grown in the presence of brains of its target species. "There is no single compound that is produced that results in the exquisite control of ant behavior we observe," de Bekker said. "Rather, it is a mixture of different chemicals that we assume act in synergy. "But whatever the precise blend and tempo of chemical secretion," she said, "it is impressive that these fungi seem to 'know' when they are beside the brain of their regular host and behave accordingly."

Noted Hughes, "This is one of the most complex examples of parasites controlling animal behavior because it is a microbe controlling an animal—the one without the brain controls the one with the brain. By employing metabolomics and controlled laboratory infections, we can now begin to understand how the fungi pull off this impressive trick." The research also is notable, the scientists contend, because it is the first extensive study of zombie ants in North America.

CONTINUE

42

The primary purpose of the passage is to

A) correct a misconception about the interactions between fungi and host organisms.

B) present the findings of a study that is one of the first of its kind.

C) detail a research study that discovered a new genus of ant.

D) explain the difference between a symbiotic relationship and a parasitic relationship.

43

According to the passage, which statement best explains why the fungi have evolved to control the behavior of the ants?

A) When the infected ant bites a non-infected ant, the fungus is able to spread and grow.

B) When an infected ant dies while biting a plant, the fungus can reproduce more easily.

C) When the infected ant dies on the ground, its corpse is an ideal breeding ground for the fungus.

D) There is no evolutionary benefit for the fungus to control the ant's behavior.

44

In line 37, the mention of the *Formica* genus primarily serves to

A) introduce another ant genus newly discovered to be controlled by the fungus.

B) provide the scientific name of the ant genus most affected by the fungus.

C) present a new finding about a specific genus of fungus.

D) name a genus of ant that scientists tested to extend their research on the fungus.

45

The use of phrases such as "exquisite control" (line 72), "most complex examples" (lines 79–80), and "impressive trick" (line 85) in the passage communicate a tone that is

A) amused.

B) informative.

C) critical.

D) admiring.

46

Which choice describes a scenario in which the zombie ant fungi would NOT successfully reproduce?

A) Fungus spores infect both *Camponotus* and *Formica* ants.

B) An infected *Camponotus* ant attaches to a twig and dies.

C) A spore-releasing stalk grows from the head of a dead, infected *Camponotus* ant.

D) An infected *Formica* ant dies on a plant-free patch of soil.

47

As used in line 43, "media" most nearly means

A) communications.

B) material.

C) channels.

D) periodicals.

CONTINUE ➡

48

Based on the passage, which part of the research process was the most effective for obtaining an unprecedented amount of information?

A) The researchers grew the fungus in the presence of isolated ant brains.

B) The researchers infected ants not normally targeted by the fungus.

C) The researchers removed the brains from the ants.

D) The researchers observed how the fungus behaved while in the ant brains.

49

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

A) Lines 29–33 ("The scientists . . . *Camponotus*")

B) Lines 43–46 ("The fungus . . . brain")

C) Lines 61–63 ("The researchers . . . unknown")

D) Lines 65–67 ("But what . . . sphingosine")

50

Based on the passage, a unique outcome of the chemicals produced by the fungus is

A) a reaction from the host organism that could only be reproduced in the lab.

B) a contagious infection that could not be controlled in the lab.

C) a parasitic relationship notably different from those usually found in nature.

D) a result that can be applied to neurological disorders in human patients.

51

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

A) Lines 16–19 ("The research . . . behavior")

B) Lines 38–40 ("They . . . behavior")

C) Lines 56–58 ("We could . . . de Bekker")

D) Lines 79–82 ("This . . . brain")

52

Based on the passage, in studying the zombie ants, the research team made the most extensive use of which type of evidence?

A) Observation of the interplay between the ant and the fungus in the natural world

B) Predictions based on research obtained from experiments with a different genus of ant

C) Chemical analysis of the brains of fungi

D) Data obtained from laboratory experiments designed to isolate particular factors

STOP
If you finish before time is called, you may check your work on this section only.
Do not turn to any other section in the test.

No Test Material On This Page

Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1–11 are based on the following passage and supplementary material.

Fast Fashion Slows Down

In most U.S. cities, the presence of blue recycling bins alongside the ubiquitous black trash bins is no longer **1** an innovation. Most people are used to separating recyclable materials from their landfill-bound trash, even in public waste bins. In many cities, composting is even becoming a standard third component of waste separation, but one area that is just **2** kicking off is textile recycling.

1
A) NO CHANGE
B) a deviation.
C) a novelty.
D) a miracle.

2
Which choice best maintains the style and tone of the passage?
A) NO CHANGE
B) fixing to start
C) getting in gear
D) gaining traction

CONTINUE ➡

A few cities have begun to collect textiles as part of their curbside recycling programs, along with the more customary cardboard and glass, but such programs generally require specially designed multi-compartment recycling [3] trucks—(which most cities don't have). Many areas that don't have curbside textile recycling instead have designated drop-off bins where residents can recycle unwanted clothing and other household textiles, such as sheets and towels.

Textile recycling is in its infancy, but it has the potential to make a big impact. The average American discards 70 pounds of [4] clothing each year, only 15% of which is recycled. Of the most commonly recycled materials, only [5] rubber and leather are recycled at a higher rate than is clothing. Not only can cities save on trash pick-up and disposal costs by encouraging their residents to recycle unwanted textiles, [6] and re-using clothing can also save resources by reducing the amount of new clothing that needs to be manufactured. [7] For example, producing enough virgin cotton for one pair of jeans requires 1,800 gallons of water; buying a pair of jeans second-hand saves that water.

Estimated Recycling Rates in the United States
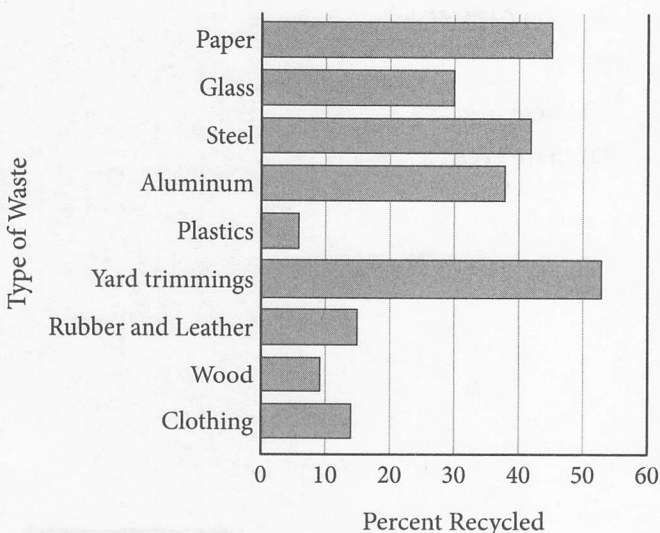
3

A) NO CHANGE
B) trucks which
C) trucks—which
D) trucks (which

4

The writer wants to include information from the graph that is consistent with the description of textiles in the passage. Which choice most effectively accomplishes this goal?
A) NO CHANGE
B) paper each year, only 45%
C) rubber and leather each year, only 15%
D) wood each year, only 9%

5

The writer wants to support the paragraph's main idea with accurate, relevant information from the graph. Which choice most effectively accomplishes this goal?
A) NO CHANGE
B) plastic and wood are recycled at a lower
C) yard trimmings are recycled at a higher
D) glass is recycled at a higher

6

A) NO CHANGE
B) yet
C) but
D) for

7

A) NO CHANGE
B) Surprisingly,
C) However,
D) Moreover,

CONTINUE

So-called "fast fashion" chains that produce trendy, low-cost (and, according to critics, low-quality) clothing, are often singled out as one of the primary causes of the increase in clothing waste in the United States in recent decades. But at least one such chain, the Swedish retailer H&M, is also trying to **8** rain in, clothing waste by offering 15%-off coupons to consumers who bring unwanted clothing, of any brand, to their stores for recycling. Since the program began in 2013, H&M has collected over 44,000 tons of clothing to recycle. The company's goal is to eventually collect 25,000 tons of clothing for recycling each year.

9 Hopefully other retailers will institute similar programs. The first step is reuse: any items still in useable condition are sold second-hand. Non-useable items are shredded for use as insulation, **10** they are repurposed as cleaning rags, or recycled to make fabric for new clothing.

The technology for recycling textile fibers into new fabrics **11** are currently limited, however. The ultimate goal of H&M and other environmentally conscious retailers is to establish a "closed loop" manufacturing system, in which 100% of the fibers they use to create their clothing can be recycled into new clothing. This may seem like a lofty goal, but it is worth pursuing.

8
A) NO CHANGE
B) rain in
C) rein in,
D) rein in

9

Which choice provides the most effective transition from the previous paragraph?
A) NO CHANGE
B) Recycling that quantity of clothing is done in several steps.
C) Low-quality fast fashion should make that goal easily attainable.
D) Offering a bigger discount might help H&M meet its goal.

10
A) NO CHANGE
B) repurposed as cleaning cloths,
C) cleaning cloths are repurposed,
D) alternatively they are repurposed as cleaning cloths,

11
A) NO CHANGE
B) is
C) were
D) have been

CONTINUE

Questions 12–22 are based on the following passage.

Celebrating Death

At dusk on the night of November 1, Lake Pátzcuaro in the southern Mexican state of Michoacán begins to glow as residents float across the lake in candlelit boats. The people are going to the island of Janitzio for an all-night vigil at the cemeteries where [12] its loved ones are buried. This vigil is the culmination of the Day of the Dead celebrations that begin with the construction of [13] *ofrendas. Ofrendas* are altars that honor the dead. The festivities begin in early October, when towns host markets [14] dedicated to the bright skeleton decorations and colorful flowers used to adorn the altars.

[1] The origins of the Mexican Day of the Dead tradition date back nearly 3,000 years to pre-Columbian times, when dead ancestors were celebrated in rituals that lasted for an entire month in the late summer of the Aztec calendar. [2] After Europeans brought Catholicism to North America, the Aztec rituals were combined with the Christian tradition of All Souls Day and moved to November 1–2. [3] During these two days, the spirits of the dead are believed to come back to the land of the living to visit their families. [4] The Aztec tradition was that the dead would be offended by mourning, [15] but it's sad when family members die. [5] The *ofrendas* that help to

12

A) NO CHANGE

B) it's

C) they're

D) their

13

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

A) *ofrendas*, in Spanish; those are

B) *ofrendas*; the Spanish word *ofrendas* means

C) *ofrendas*,

D) *ofrendas*; moreover, *ofrendas* are

14

A) NO CHANGE

B) dedicated, to the bright skeleton decorations,

C) dedicated to the bright, skeleton, decorations,

D) dedicated to the bright skeleton decorations—

15

Which choice most effectively completes the explanation of the Aztec tradition?

A) NO CHANGE

B) so they are remembered in a spirit of celebration rather than sadness.

C) though it can be difficult to tell whether an invisible spirit is offended.

D) and the Aztec didn't want to disrespect the wishes of the dead.

CONTINUE

celebrate the dead often have items similar to [16] those found on church altars, such as candles and pictures. [17]

Many Day of the Dead altars are built in private homes, but they can also be found in cemeteries, at churches, in government buildings, and in public squares. Some public altars are meant to call attention to a specific cause. Others are built by local artists, [18] of which many are best known for their elaborate *ofrendas*.

For many families, preparing an *ofrenda* is similar to preparing for a visit from living relatives. The bright colors and fragrance of marigolds are said to lead spirits back to their families. Altars are loaded with food and drink [19] (which smell delicious) and sometimes include pillows and blankets (which provide a resting spot for the spirits). Some families put personal items that belonged to the deceased on the altars, and altars dedicated to children

---

[16]
A) NO CHANGE
B) church
C) churches and
D) the structures of church

[17]
To make this paragraph most logical, sentence 3 should be placed
A) where it is now.
B) before sentence 1.
C) before sentence 2.
D) before sentence 5.

[18]
A) NO CHANGE
B) many
C) many of whom
D) many of them

[19]
Which choice provides information that is most consistent in style and content with the information about why pillows and blankets are included on the altars?
A) NO CHANGE
B) (including *pan de muerto*)
C) (which are often homemade)
D) (which provide sustenance for the travelling spirits)

often include toys. [20] It's more work to provide food for living relatives than for dead ones.

Many of the same items that decorate altars are also part of the cemetery vigils on Janitzio. Graves are covered with candles and [21] marigolds, and families bring ample picnics to sustain both themselves and the spirits of the departed through the night. Living family members spend the night eating, drinking, singing, and telling stories. Rather than focusing on the finality of death, [22] the people's merriment celebrates life.

20

Which choice most effectively concludes the paragraph?

A) NO CHANGE

B) Regardless of what specifically is included on an altar, the dead are always welcomed home, just as they were when they were alive.

C) The toys for children can be new or old.

D) Some altars include religious items such as crucifixes and images of saints.

21

A) NO CHANGE

B) marigolds just as altars are,

C) marigolds like those that also decorate altars,

D) marigolds that attract spirits with their bright colors,

22

A) NO CHANGE

B) life is celebrated by the people through their merriment.

C) the merriment of the people celebrates life.

D) the people celebrate life through their merriment.

CONTINUE

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

Bank Tellers: Machine v. Human

When automated teller machines (ATMs) were first installed in the 1970s, there were widespread predictions that the machines would replace human bank tellers. Such predictions did not immediately come true, however. **23** In fact, throughout the 1990s, as the number of ATMs increased most quickly, the number of human bank tellers also increased.

[1] While many simple bank transactions now happen at ATMs, people still rely on human tellers to cash **24** checks, transfer money between accounts; provide specific bill denominations, and dispense information about bank products and services. [2] Some of these duties, particularly the marketing aspect of advising customers about bank services, have changed with the advent of ATMs. [3] They also limit the amount of cash a customer can get in a single day, place restrictions on how soon funds from deposits are available, and generally don't offer much choice in currency denominations. [4] Before the rise of banking machines, tellers were primarily responsible for handling cash, but machines have proven to be faster and **25** more rock solid with cash than people are.

23

A) NO CHANGE
B) As a result,
C) For example,
D) Therefore,

24

A) NO CHANGE
B) checks; transfer money between accounts;
C) checks; transfer money between accounts,
D) checks, transfer money between accounts,

25

Which choice best fits with the tone of the rest of the passage?
A) NO CHANGE
B) more impeccable
C) more reliable
D) safer

26 [5] On the other hand, ATMs are far more vulnerable to theft. **27**

26

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

Annual Wage Comparison:
Tellers versus Other Occupations
Median annual wages, May 2016

Median annual wages (thousands of dollars)
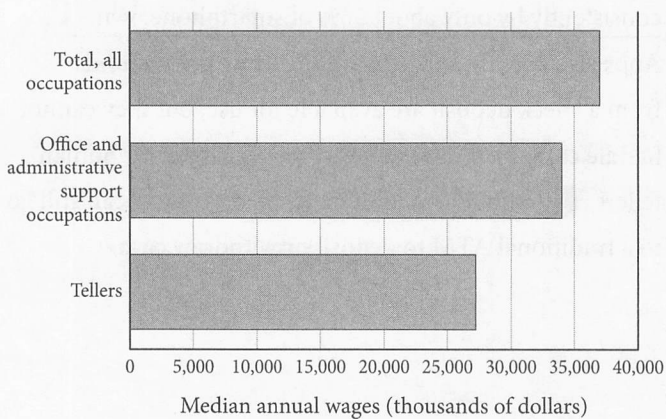
Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Should the writer make this addition here?

A) Yes, because it provides evidence that supports the idea that the number of bank tellers is rising.

B) Yes, because it effectively contradicts the idea that ATMs are faster at counting money than people are.

C) No, because it does not make a comparison between wages for tellers and those for loan officers.

D) No, because it gives information that distracts from the paragraph's focus on the duties performed by tellers.

27

To make this paragraph most logical, sentence 3 should be placed

A) where it is now.

B) after sentence 1.

C) after sentence 4.

D) after sentence 5.

CONTINUE ▸

With the rise of tech-savvy customers who are increasingly **28** custom to using their smartphones in all aspects of life, mobile banking apps are the latest mechanized challenge to the need for human bank tellers. Apps are also beginning to improve upon some banking functions that had largely been taken over by ATMs. Mobile apps **29** are used consistently by only about 50% of smartphone owners. Apps also usually offer less waiting time before funds from a check deposit are available for use, but they cannot handle cash. That doesn't mean there's a need for human tellers, **30** though. Without a teller, customers can still go to a traditional ATM to deposit or withdraw cash.

28

A) NO CHANGE

B) accustomed for

C) accustomed to

D) custom at

29

Which choice provides the best supporting example for the main idea of the paragraph?

A) NO CHANGE

B) can quickly and easily perform the more complex balance inquiries and transfers that not all ATMs are capable of.

C) are not always designed well, though user ratings through an app store can help consumers decide which one is best.

D) are also highly susceptible to theft or fraud, particularly when they are used over public Wi-Fi networks.

30

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

A) though:

B) though, because it's true that

C) though, without them

D) though; it's the case that

Physical banks have begun to respond to the rising popularity of mobile banking by replacing their old-fashioned teller windows **31** with an automated kiosk that combine all the functions of both mobile banking apps and ATMs.

Such kiosks are not replacing ATMs, nor are they replacing humans altogether. What they are doing is changing, again, the job description of human bank employees. Todd Barnhart, head of branch distribution for PNC bank, stresses the continued need for humans in bank branches. Employees are now trained to answer questions about how to use mobile apps, **32** as well as trained to handle deposits and provide loan advice. "We're not building branches with teller lines but with places where customers and employees can have meaningful conversations," he said. So while the old-fashioned notion of a bank teller may be on the way **33** out, machines are not yet close to replacing human bank employees altogether.

31

A) NO CHANGE

B) to an automated kiosk

C) each for automated kiosks

D) with automated kiosks

32

A) NO CHANGE

B) as well as handle

C) also to answer questions about

D) and in addition to handle

33

A) NO CHANGE

B) out; machines

C) out. Machines

D) out, nevertheless machines

Questions 34–44 are based on the following passage.

Bacteria in Space

Ever since antibiotics began to be widely used in the 1940s, scientists have been engaged in an arms race against bacteria. Bacteria continue to evolve and develop resistance to antibiotics; **34** as a result, scientists must continually develop newer, stronger antibiotics to overcome the resistant bacteria. Since scientists generally want to **35** count the number of bacteria mutations, it may seem strange that they would intentionally make bacteria more aggressive, but researchers from Arizona State University (ASU) are doing just that by sending some strains of bacteria to the International Space Station to be studied.

NASA scientists first began studying bacteria and other pathogens in space because they wanted to keep astronauts healthy. Extended trips to space **36** that last a long time have long been understood to weaken astronauts' immune systems, so studies were designed to determine whether pathogens, including bacteria, are similarly affected by microgravity. Scientists were surprised

34

A) NO CHANGE
B) however,
C) nevertheless,
D) for example,

35

Which choice most effectively establishes the scientists' goal, related to information presented earlier in the paragraph?

A) NO CHANGE
B) facilitate
C) stay ahead of
D) shoot at

36

A) NO CHANGE
B) that are extensive
C) continuing for many weeks
D) DELETE the underlined portion.

CONTINUE ➡

to find that pathogens of any kind **37** mutated more
rapidly and became more virulent in space. A team led by
Cheryl Nickerson of the Biodesign Institute at ASU
38 speculated that microgravity would cause a fluid
shear stress reduction (the friction between cells and the
fluids they interact with). Fluid shear stress affects gene
expression in pathogens, and reducing it allows mutations
to occur more quickly. The ASU scientists believe that
microgravity mimics the reduced fluid shear stress
conditions that bacteria encounter inside the
human body **39** .

37

A) NO CHANGE

B) had mutated more rapidly and had become

C) mutates more rapidly and becomes

D) mutate more rapidly and becomes

38

A) NO CHANGE

B) thought that fluid shear stress would be reduced
by microgravity

C) speculated that microgravity reduces fluid shear
stress

D) believed that microgravity lessens the shear stress
caused by fluid

39

At this point, the writer is considering adding the
following:

so that studying something like *Salmonella* in
space allows, in effect, a glimpse into how that
pathogen behaves in the human digestive tract

Should the writer make this addition here?

A) Yes, because it makes clear that researchers cannot
actually see inside the human digestive tract.

B) Yes, because it further explains the benefits of
conducting bacteria studies in space.

C) No, because it repeats information stated earlier in
the paragraph.

D) No, because it is not relevant to the discussion of
what fluid shear stress is.

CONTINUE ➡

Although pathogen studies in space were initially intended just to help protect astronauts' health during flight, the implications of these [40] subjects now have a much broader application. Scientists are looking more closely at the specific mechanics of various pathogens' mutations so that they [41] could have developed treatments, especially vaccines, that attack those changes. Nickerson and her team are working on developing a vaccine for *Salmonella*. The virus is one of the leading [42] causes of food-borne illness, in the United States and one of the leading causes of infant mortality worldwide, so an effective vaccine has the potential to have a major impact on public health.

[40]

Which choice provides the most precise description of the proceeding depicted in the first part of the sentence?

A) NO CHANGE

B) examinations

C) experiments

D) tests

[41]

A) NO CHANGE

B) can develop

C) were developing

D) developed

[42]

A) NO CHANGE

B) causes of food-borne illness in the United States

C) causes, of food-borne illness in the United States

D) causes of food-borne illness, in the United States,

CONTINUE

43 *Salmonella* is already playing an important role in vaccine research, though in an unexpected way. A promising new vaccine technology, recombinant attenuated *Salmonella* vaccine (RASV), uses a genetically modified form of *Salmonella* as a delivery vehicle. RASVs quickly and efficiently deliver **44** antigens, substances, that stimulate the production of antibodies to multiple body systems with just a single dose, and can be taken orally, eliminating the need for more expensive vaccine shots. Such a vaccine already exists for *Streptococcus pneumonia*, the bacterium responsible for pneumonia and meningitis among other things. Next up on the researchers' list: an RASV to guard against *Salmonella* itself.

43

Which choice provides the most effective transition between ideas in the paragraph?

A) NO CHANGE

B) Such a vaccine hasn't yet been developed for *Salmonella*, however.

C) Researchers would also like to be able to develop better vaccines against a number of other particularly nasty bacteria.

D) This potential positive impact is part of the reason the *Salmonella* studies have expanded beyond the International Space Station.

44

A) NO CHANGE

B) antigens, substances that stimulate the production of antibodies, to multiple body systems

C) antigens, substances that stimulate the production of antibodies to multiple body systems,

D) antigens substances that stimulate the production of antibodies to multiple body systems

STOP
If you finish before time is called, you may check your work on this section only.
Do not turn to any other section in the test.

Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 16–20,** solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE

$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

$A = \frac{1}{2} bh$

$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell w h$

$V = \pi r^2 h$

$V = \frac{4}{3} \pi r^3$

$V = \frac{1}{3} \pi r^2 h$

$V = \frac{1}{3} \ell w h$

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

CONTINUE ➡

1

Time (minutes)
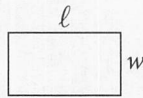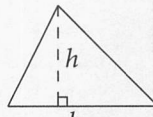
In a certain game, players start with a certain number of coins and then spend their coins. The graph above shows the number of coins, c, possessed by Erica at m minutes. Which of the following equations correctly relates c and m?

A) $c = -\dfrac{1}{7}m$

B) $c = -m$

C) $c = -m + 7$

D) $c = -7m + 7$

2

$$\frac{2A + B + 2C}{5} = D$$

Based on the number of pages of algebra homework, A, biology homework, B, and chemistry homework, C, she is assigned, Katerina uses the above formula to determine the amount of time, D, in hours, she spends per page of homework assigned by her teachers. Which of the following correctly gives B, in terms of A, C, and D?

A) $B = \dfrac{2A + 2C - D}{5}$

B) $B = \dfrac{D - 2A - 2C}{5}$

C) $B = 2A + 2C - 5D$

D) $B = 5D - 2A - 2C$

3

$$a + a - 9 = 4a + a + a - 3 - 1$$

In the equation above, what is the value of a?

A) -1

B) $\dfrac{9}{4}$

C) $\dfrac{13}{5}$

D) 5

CONTINUE

4

$$3y < 7$$
$$x < 3y + 4$$

Which of the following consists of the x-coordinates of all the points that satisfy the system of inequalities above?

A) $x < \dfrac{7}{3}$

B) $x < 3$

C) $x < \dfrac{19}{3}$

D) $x < 11$

5
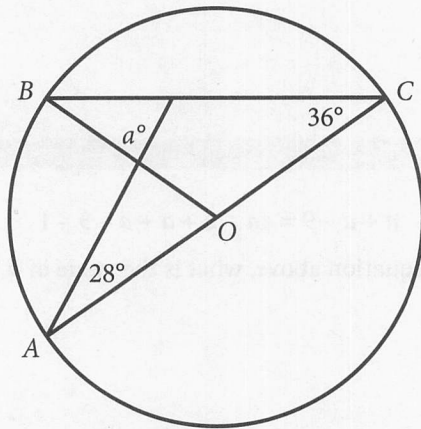
In the figure above, O is the center of the circle. What is the value of a ?

A) 100

B) 80

C) 72

D) 64

6

A traffic island is shaped like an isosceles triangle. The equal sides each have a length of s meters, and the third side is 4 meters shorter than the equal sides. Which of the following represents the perimeter, in meters, of the traffic island in terms of s ?

A) $2s - 4$

B) $\dfrac{s^2 - 4s}{2}$

C) $3s - 4$

D) $\dfrac{s - 4}{2}$

7

Point A has coordinates $(-11, 1)$, point B has coordinates $(-11, 7)$, and $\overline{AB}$ is the diameter of a circle. What is the equation of that circle?

A) $(x - 11)^2 + (y + 4)^2 = 9$

B) $(x + 11)^2 + (y - 1)^2 = 36$

C) $(x - 11)^2 + (y - 7)^2 = 36$

D) $(x + 11)^2 + (y - 4)^2 = 9$

8

$$a - 6 = \sqrt{8a - 7} - 4$$

What is the solution set of the equation above?

A) $\{0\}$

B) $\{1\}$

C) $\{11\}$

D) $\{1, 11\}$

CONTINUE

9

$$h(a) = a^2 + a - 20$$
$$k(a) = a^3 - 16a$$

Which of the following is equal to $\dfrac{h(a)}{k(a)}$, for $a > 4$?

A) $\dfrac{a+5}{a(a+4)}$

B) $\dfrac{a+5}{a(a-4)}$

C) $\dfrac{a+5}{a+4}$

D) $a + 5$

10
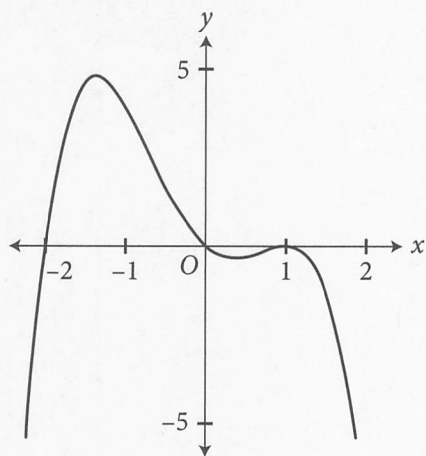
Which of the following could be the equation of the graph above?

A) $y = -x(x-1)(x+2)$

B) $y = -x(x+1)(x-2)$

C) $y = -x(x-1)^2(x+2)$

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

11

If $\dfrac{x}{3y} = 3$, what is the value of $\dfrac{y}{x}$?

A) $\dfrac{1}{9}$

B) $\dfrac{1}{3}$

C) 3

D) 9

12

Taylor's garden produced 296 tomatoes, and he is preserving all the tomatoes in jars that hold either 3 or 5 tomatoes each. Taylor has a total of 80 jars. If he fills all the jars and preserves all the tomatoes, exactly how many of the jars hold 3 tomatoes?

A) 50

B) 52

C) 54

D) 56

13

$$f(x) = 2 - [g(x)]^2$$
$$g(x) = 3x - 3$$

The functions f and g are defined above. Which of the following is the value of $f(0)$?

A) -7

B) -3

C) 2

D) 11

CONTINUE

14

The population of Bulgaria was approximately 9 million people in 1989. Bulgaria's population decreased to 7.4 million people in 2011. If the decrease in population was linear, which of the following linear functions P best models the population of Bulgaria, in millions of people x years after the year 1989 ?

A) $P(x) = -\dfrac{74}{220}x + 9$

B) $P(x) = -\dfrac{16}{220}x + 9$

C) $P(x) = \dfrac{16}{220}x + 9$

D) $P(x) = \dfrac{74}{220}x + 9$

15

$$y = x^2 + 2x + k$$
$$y = 2x$$

If the system of equations above has exactly one real solution, which of the following is the value of k ?

A) -4

B) 0

C) 2

D) 4

CONTINUE

DIRECTIONS

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.

2. Mark no more than one circle in any column.

3. No question has a negative answer.

4. Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If $3\;1\;/\;2$ is entered into the grid, it will be interpreted as $\frac{31}{2}$, not as $3\frac{1}{2}$.)

6. **Decimal Answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer: $\frac{7}{12}$ Answer: 2.5

Write answer in boxes.   ← Fraction line

Grid in result.

← Decimal point

Acceptable ways to grid $\frac{2}{3}$ are:

Answer: 201 – either position is correct

NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

CONTINUE ➤

16

When $a^2 + 2a + 4$ is subtracted from $3a^2 - 4a + 27$, the result can be written in the form $xa^2 + ya + z$, where x, y, and z are constants. What is the value of $y + z$?

17

$$n^2 - n - 30 = 0$$

What is the positive solution to the equation above?

18

A student is modeling the number of assignments she has completed in a semester. She models the number of completed assignments by writing an equation in the form $y = mx + b$, where y is the number of assignments she has completed and x is the number of weeks since the start of the month. If at the start of the month she has completed 12 assignments and she completes 3 assignments per week, what is the value of m?

CONTINUE

19
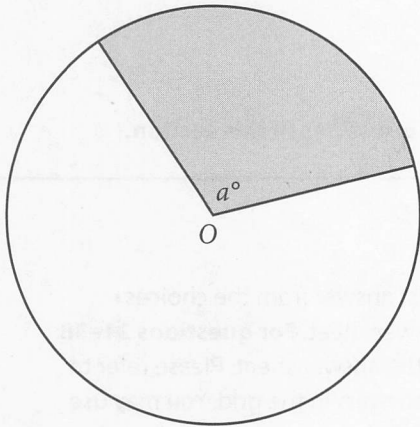
Note: Figure not drawn to scale.

In the figure above, O is the center of the circle and $a = 110$. If the area of the circle is 72, what is the area of the shaded region?

20

$$9x + 2y = 17.75$$
$$x + 2y = 3.75$$

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

STOP

If you finish before time is called, you may check your work on this section only.
Do not turn to any other section in the test.

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 31–38**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

1. The use of a calculator **is permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE

$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

$A = \frac{1}{2} bh$

$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell wh$

$V = \pi r^2 h$

$V = \frac{4}{3}\pi r^3$

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\ell wh$
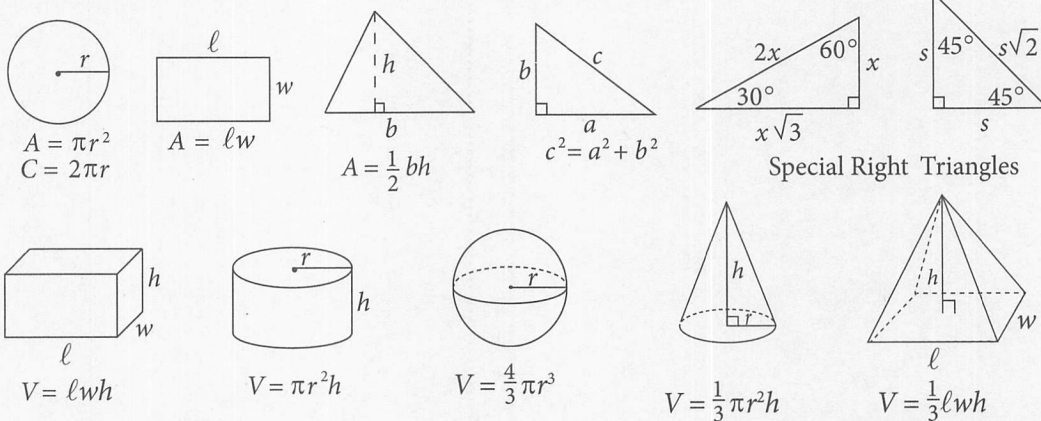
The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

CONTINUE ➡

1

The figure below shows the total number of tenants living in an apartment building between January 1st of 2005 and January 1st of 2010.
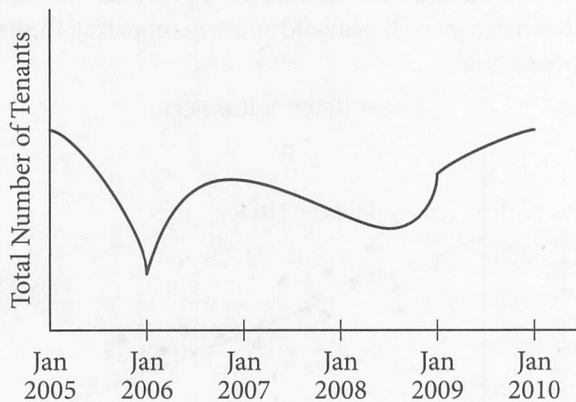
During which of the following years of operation does the number of tenants in the building increase the fastest?

A) 2005

B) 2006

C) 2007

D) 2009

2

A doctor randomly selects 500 residents of an island and finds that 4 of these residents have a specific gene mutation. Based on these results, approximately how many of the island's 15,000 residents likely have this mutation?

A) 75

B) 90

C) 105

D) 120

3

Chris buys one box of cookies for n dollars. At this rate, how much does he pay, in dollars, for 4 boxes of cookies?

A) $\dfrac{n}{4}$

B) $\dfrac{4}{n}$

C) $4n$

D) $n + 4$

4
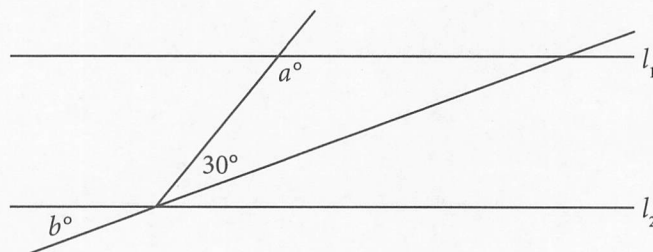
In the figure above, lines l_1 and l_2 are parallel and $a = 110$. What is the value of b ?

A) 40

B) 70

C) 80

D) 140

CONTINUE

5

A newspaper sells both paper and digital subscriptions. The newspaper reports that 1,800 total subscriptions were sold last month and the total revenue from those subscription sales was $20,760. The digital subscriptions, d, cost $8 a month, and the paper subscriptions, p, cost $20 a month. Which of the following systems of equations could be used to solve for the number of each type of subscription that was sold by the newspaper last month?

A) $d + p = 1,800$
   $20d + 8p = 20,760$

B) $d + p = 1,800$
   $8d + 20p = 20,760$

C) $d + p = 20,760$
   $8d + 20p = 1,800$

D) $d + p = 1,800$
   $8d (20p) = 20,760$

6

A study tracked the maximum heart rate for runners competing in a marathon. The data and line of best fit are shown in the scatterplot below. Based on the line of best fit, what would be the predicted maximum heart rate of a 60-year-old runner competing in the marathon?

Heart Rates of Runners
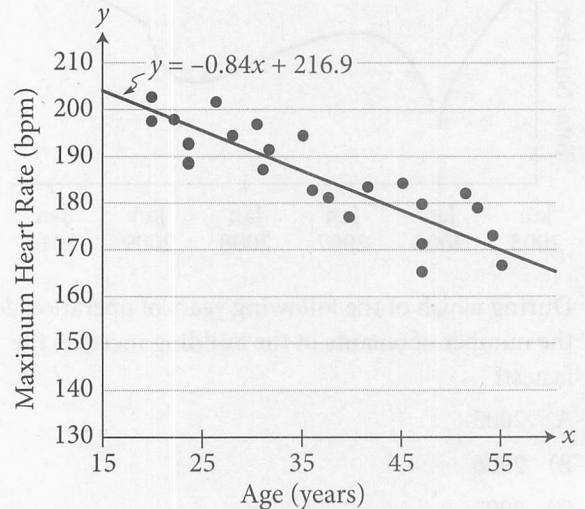
A) 166.5

B) 170.7

C) 183.4

D) 216.9

7

$$\frac{3}{c - 2} = c - 2$$

Which of the following values of $c - 2$ satisfies the equation above?

A) 5

B) 3

C) $\sqrt{3}$

D) $\sqrt{3} - 2$

CONTINUE

8

Which of the following equations, when graphed in the xy-plane, results in a line with a y-intercept of -1 ?

A) $y = x - \dfrac{1}{2}$

B) $y = \dfrac{1}{2}x - 1$

C) $y = -x$

D) $y = 2x + 1$

9

Sarah works at an art school and is purchasing canvases for \$6 each and bottles of paint for \$4 each. She budgets a total of \$1,700 for canvases and paint. She goes over-budget, but purchases more than 360 items. Which of the following systems of inequalities represents all the possible values for the number of canvases, a, and the number of paint bottles, b, that she buys?

A) $6a + 4b < 1,700$
$a + b > 360$

B) $6a + 4b < 1,700$
$a + b < 360$

C) $6a + 4b > 1,700$
$a + b < 360$

D) $6a + 4b > 1,700$
$a + b > 360$

Questions 10–12 refer to the following information.
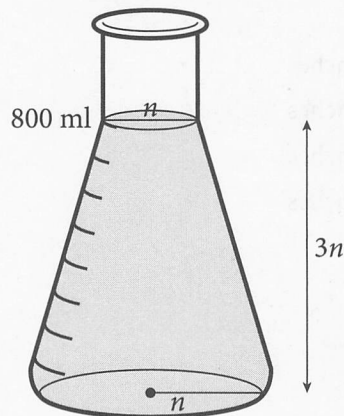
A beaker that can be filled to a maximum volume of 800 milliliters is shown above. For safety reasons, it cannot be filled above the 800-milliliter line. The radius of the base is equal to the diameter of the top, and the volume in cubic inches of the beaker is given by the equation $V = \dfrac{21\pi n^3}{12}$.

10

How many beakers of this size, filled to the 800-milliliter line, would be needed to hold 4 liters of a solution? (1 liter = 1,000 mL)

A) 2

B) 4

C) 5

D) 8
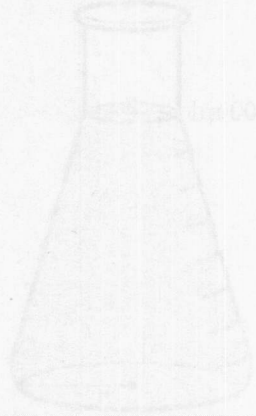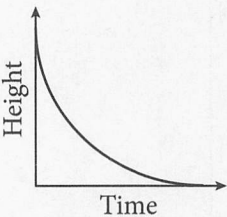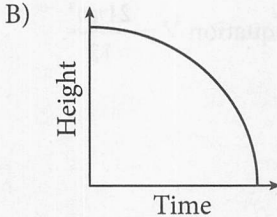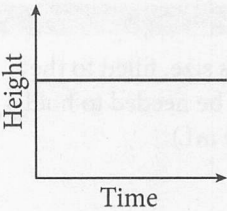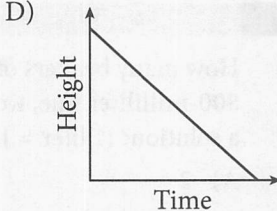
CONTINUE

11

Given that the volume of 800 milliliters of liquid is approximately 13.2 cubic inches, which of the following is closest to the radius of the base of the beaker?

A) 1.34 inches

B) 2.28 inches

C) 4.23 inches

D) 8.04 inches

12

The beaker is filled with a solution to the 800-milliliter line and then left outside in the sun where the solution evaporates at a constant rate. The graph of the height of the solution remaining in the beaker over time would have which of the following shapes?

A)

B)

C)

D)

13

The amount of work done to move an object is equal to the product of the mass of the object, in kilograms; the distance the object moves, in meters; and the gravitational constant of 9.8 meters per second squared. What is the power rating of a machine that can move a 100-kilogram object 3.6 meters in 18 seconds? (Power is work per unit time.)

A) 196

B)   54

C) 19.6

D)   5.4

14

If $y = \dfrac{1}{x^3}$, which of the following gives x in terms of y ?

A) $y^{\frac{1}{3}}$

B) $y^{-\frac{1}{3}}$

C) $-y^3$

D) y^3

CONTINUE

15

The function $f(x) = \dfrac{5}{x^2 - 5x + 4}$ is graphed in the xy-plane. Which of the following values of x is NOT in the domain of $f(x)$?

A) −1

B) 0

C) 1

D) 5

16

Number of Eggs Laid by Chickens

Number of Eggs	8	7	6	5	4	2
Frequency	1	3	8	5	2	5

A farmer has 24 chickens. At the end of a week, he counts the total number of eggs each chicken laid that week. The table above shows the distribution of the number of eggs laid by the chickens. Which of the following statements about the mean, median, and mode of the number of eggs laid is true?

A) The mean is greater than both the mode and the median.

B) The mean is less than both the mode and the median.

C) The mean is greater than the mode but less than the median.

D) The mean is equal to both the mode and the median.

17
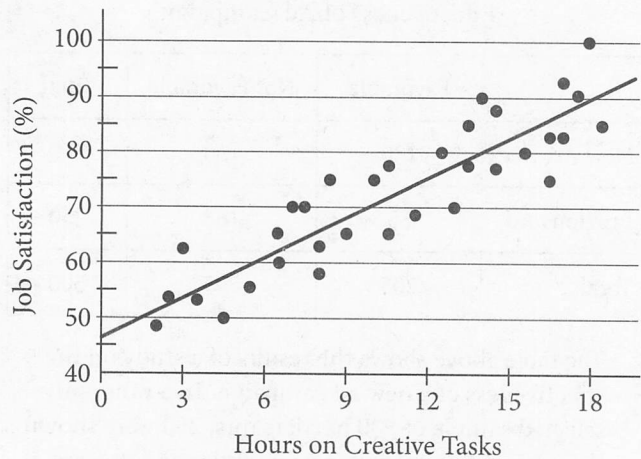
A Human Resources department seeking to increase employee retention commissioned a study to determine the relationship between job tasks and employee satisfaction. The scatterplot above shows the relationship for employees in a particular field between the number of work hours spent on creative tasks per week and their overall job satisfaction. The line of best fit is shown on the figure.

An employee that works in the same field but was not part of the study indicates that he spends 12 hours a week on creative tasks. Which of the following is the best approximation of his predicted job satisfaction based on the line of best fit?

A) 68%

B) 75%

C) 80%

D) 84%

CONTINUE

18

Effectiveness of Ad Campaign

	Favorable	Not Favorable	Total
New Ad	120	130	250
Previous Ad	85	165	250
Total	205	295	500

The table above shows the results of a study on the effectiveness of a new ad campaign. In a randomly selected sample of 500 participants, 250 were shown the new ad campaign for a car while the rest were shown the previous ad campaign. The participants then reported whether their opinion of the car was favorable or not. What proportion of participants who watched the new ad campaign had a favorable opinion?

A) $\dfrac{12}{25}$

B) $\dfrac{41}{100}$

C) $\dfrac{6}{25}$

D) $\dfrac{24}{41}$

Questions 19 and 20 refer to the following information.

Months since January 1st, 2008
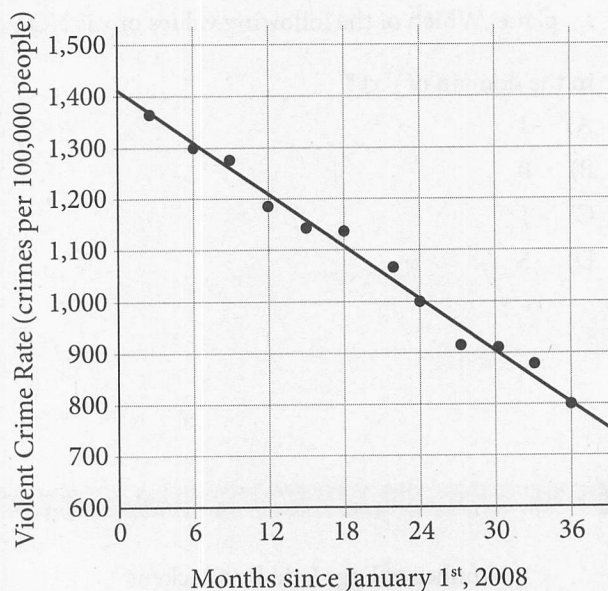
On January 1st, 2008, a city implemented a new program to combat crime. The graph above shows the violent crime rate in the city, measured in violent crimes per 100,000 residents, from January 1st, 2008, to the end of 2010. The line of best fit has the equation $y = 1,412 - 16.8x$, where y is the violent crime rate and x is the number of months since the implementation of the program.

19

Which of the following is closest to the percent decrease in the violent crime rate in the city from January 1st, 2010, to January 1st, 2011 ?

A)   8%

B)   20%

C)   80%

D)   140%

CONTINUE

20

What does the coefficient 16.8 represent in the line of best fit equation?

A) The number of months since the crime reduction program was implemented

B) The average crime rate per month since January 2008

C) The average monthly reduction in the violent crime rate during the first three years that the crime reduction program was in place

D) The violent crime rate in January 2008

21

Samuel's annual salary is $49,500. If he completes an MBA program with a tuition of $73,320, his annual salary will be $64,500. If n represents the number of years that Samuel works at his job after completing his MBA, which of the following inequalities demonstrates the value of n for which his total additional income exceeds the cost of the tuition?

A) $n > \dfrac{73{,}320}{(64{,}500 - 49{,}500)}$

B) $n < \dfrac{73{,}320}{(64{,}500 - 49{,}500)}$

C) $n > \dfrac{(73{,}320 - 49{,}500)}{64{,}500}$
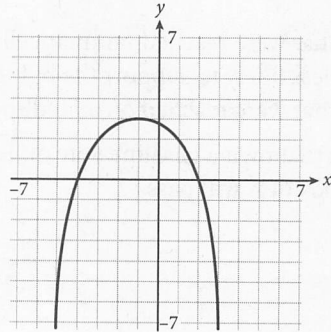
D) $n < \dfrac{(73{,}320 - 49{,}500)}{64{,}500}$

22

Polynomial function g is graphed in the xy-plane. This function has zeros at -4 and 2, and its range is the set of all real numbers such that $g(x) \geq -3$. Which of the following graphs represents function g?

A)

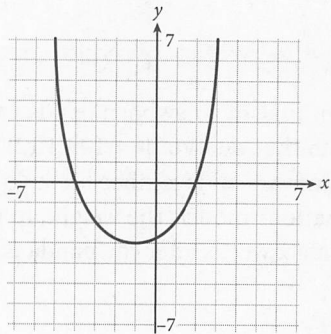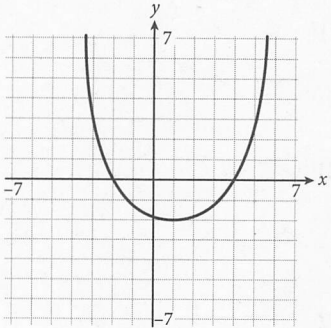

B)

C)

D)

CONTINUE
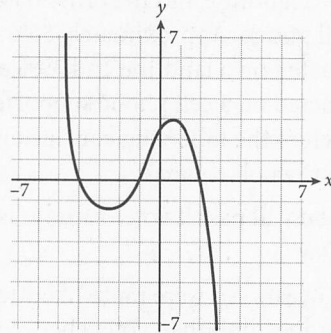
23

To determine support for a proposition on the state ballot, residents were called on the phone. Of those residents called, 20% did not answer the phone. Approximately 35% of the residents who did answer were contacted on a landline and the other 65% were contacted on a cell phone. Approximately 55% of the respondents contacted on a landline and 30% of the respondents contacted on a cell phone supported the proposition. Which of the following conclusions is best supported by the poll results?

A) The proposition will pass if voter turnout is high on Election Day.

B) Voters over 35 years old were more likely to support the proposition than voters between 18 and 35 were.

C) Participants that were reached on their cell phones were less likely to support the bill than participants that were reached on a landline.

D) If only voters that own a landline vote on Election Day, the proposition will pass.

24

The weight w, in grams, of a newborn panda can be approximated with the equation $w = 109(1.12)^n$, where n represents the number of days since birth. Which of the following equations models the weight, in grams, of a newborn panda x weeks after the panda is born?

A) $w = 109(2.21)^{\frac{x}{7}}$

B) $w = 109(1.12)^{\frac{x}{7}}$

C) $w = 109(1.84)^x$

D) $w = 109(1.12)^{7x}$

25

An activist group wants to determine how frequently the average resident of a county uses the library. The group plans to ask everybody that enters one of the library branches on a Saturday to estimate how many times per year they visit a library. Based on these responses, the group will estimate the number of library visits that the average resident makes each year. Which of the following statements is true?

A) The proposed survey has a small sample size and therefore the results will likely be an unreliable estimate of the average library use of the county's residents.

B) The proposed survey will likely produce a reliable estimate of the average library use of the county's residents only if the group conducts it on both a Saturday and a weekday.

C) The proposed survey will likely produce a reliable estimate of the average library use of the county's residents if the group conducts the survey at the busiest library in the county.

D) Due to a flawed sampling method, the proposed survey will likely produce a biased estimate of the average library use of the county's residents regardless of the sample size and the days of the week on which the survey is conducted.

26

The point (c, d) lies on a line with a slope of 2 in the xy-plane. The point $(3, 2d)$ lies on a different line with a slope of -3. If the two lines have the same y-intercept and $\dfrac{c}{d} = \dfrac{3}{2}$, what is the value of d ?

A) $-\dfrac{9}{4}$

B) $-\dfrac{2}{3}$

C) $\dfrac{3}{2}$

D) $\dfrac{9}{2}$

27

Unemployment Rate in Country X

Year	2010	2013
Unemployment Rate	11.5%	13%

The table above shows the unemployment rate for Country X in 2010 and 2013. If the unemployment rate and year have a linear relationship, which of the following expressions best approximates the unemployment rate of the country n years after 2010 ?

A) $1.5n + 11.5$

B) $0.5(n - 2,010) + 11.5$

C) $0.5n + 11.5$

D) $-1.5n + 11.5$

28

A pool has 750 gallons of water in it when a hose begins adding water at a constant rate. The pool contains 60% more water after the hose has run for 5 hours. Which of the following expressions gives the number of gallons of water in the pool after the hose has run for a total of t hours?

A) $750 + 90t$

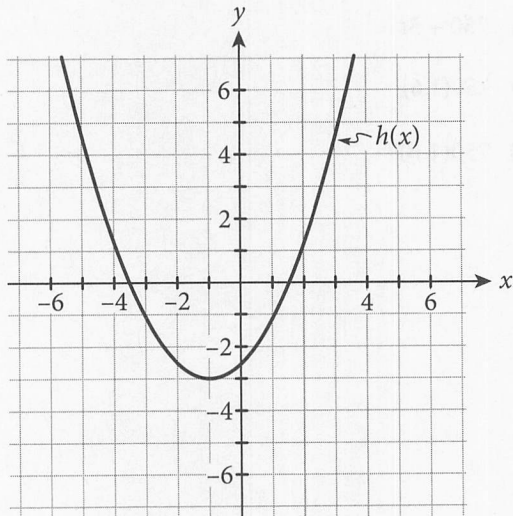B) $750 + 5t$

C) $750(1.6)^{\frac{t}{5}}$

D) $750(1.6)^{5t}$
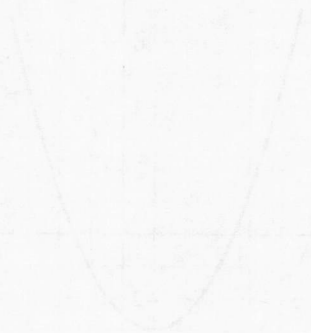
CONTINUE

29

A table of values for function $f(x)$ and the graph of function $h(x)$ are shown below. If the vertex of $h(x)$ is (a, b), what is $f(h(a))$?

x	−3	−2	−1	0	1	2	3
$f(x)$	11	8	5	2	−1	−4	−7

A) −1

B) 2

C) 5

D) 11

30

Researchers allowed 15 participants in a study to get a full night's sleep, while another 15 were awoken after only 3 hours of sleep. The researchers then gave the participants a series of mental tasks and calculated each participant's average completion time. The results are shown below.

Completion time (sec)
Normal Sleep

Completion time (sec)
Reduced Sleep
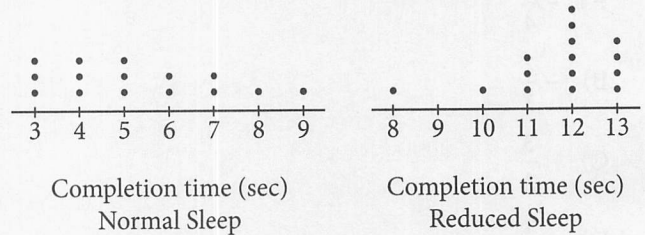
If the participants with normal sleep make up Group A and the participants with 3 hours of sleep make up Group B, which of the following statements regarding the standard deviations and ranges of the groups is true?

A) The range of Group B is larger than the range of Group A.

B) The standard deviation of Group B is smaller than the standard deviation of Group A.

C) The standard deviation of Group B is equal to the standard deviation of Group A.

D) The range of Group B is equal to the range of Group A.

CONTINUE

DIRECTIONS

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.

2. Mark no more than one circle in any column.

3. No question has a negative answer.

4. Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If [3 1 / 2] is entered into the grid, it will be interpreted as $\frac{31}{2}$, not as $3\frac{1}{2}$.)

6. **Decimal Answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer: $\frac{7}{12}$

Write answer in boxes. → Fraction line

Grid in → result.

Answer: 2.5

← Decimal point

Acceptable ways to grid $\frac{2}{3}$ are:

Answer: 201 – either position is correct

NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

CONTINUE →

$$nx - 8y = 18$$
$$7x - 4y = 9$$

The equations above both represent line l in the xy-plane. If n is a constant, what is the value of n ?
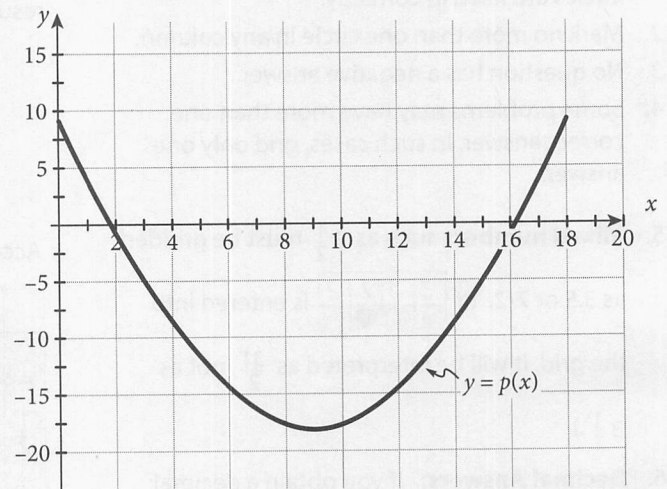
One liter of a solution contains one milligram of Solute A and three milligrams of Solute B. How many milligrams of Solute B are there in 22 liters of the solution?

$$\frac{1}{3}c + x = 0$$

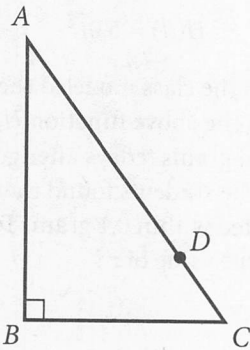The equation above is true when $x = -3$. What is the value of c ?

The function p is defined by the equation

$p(x) = \frac{1}{3}(x - 9)^2 - 18$. A portion of the graph of p

is shown above. Function q (not shown) is defined

by the equation $q(x) = 15 - 5x$. If $p(x)$ intersects the

graph of $q(x)$ at the point (r, s) where $r > 0$, what

is the value of r ?

CONTINUE

35

In the figure above, if cos ($\angle DBA$) = 0.3, what is the value of cos ($\angle DBA$) + sin ($\angle DBC$) ?

36

October 28 and 29, 1929, are known as Black Monday and Black Tuesday, respectively. During two days of trading, the Dow Jones Industrial Average lost 68.9 points. If there were 5 hours of trading during each of the two days, on average how many points per <u>minute</u>, to the nearest hundredth, did the Dow Jones Industrial Average lose during those two days?

CONTINUE

Questions 37 and 38 refer to the following information.

Days since germination
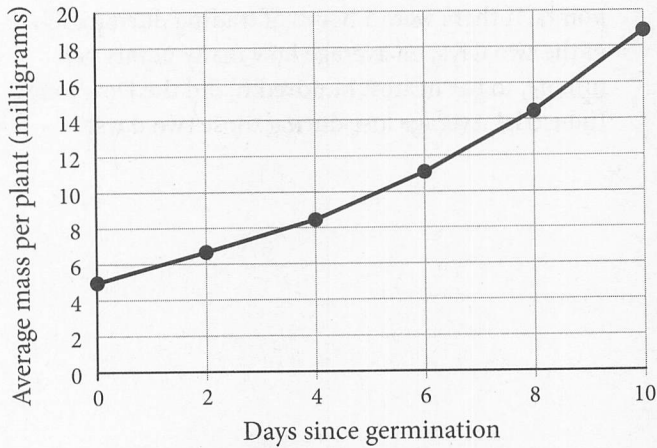
Days since germination	0	2	4	6	8	10
Average mass per plant (milligrams)	5.0	6.6	8.4	11.1	14.4	18.8

Once a seed has germinated and the first leaves begin producing carbohydrates through photosynthesis, a plant grows rapidly until it begins flowering or its growth is restricted by a lack of nutrients or light. An agriculture class grew *Zea mays L.* (sweet corn) in its greenhouse and measured the mass of each plant every other day. The average mass per plant was determined and presented in the graph and table above.

$$H(d) = 5.0r^{\frac{d}{2}}$$

The students in the class modeled the average mass per plant using the above function H, where H is average mass in grams d days after germination, and r is a constant. The students found their model matched the data collected within 0.1 gram. To the nearest tenth, what is the value of r ?

According to the table, what is the positive difference on average, in grams, between a group of 4 plants that germinated 4 days ago and a group of 3 plants that germinated 8 days ago?

STOP
If you finish before time is called, you may check your work on this section only.
Do not turn to any other section in the test.

Experimental: Writing and Language Skills

20 MINUTES, 18 QUESTIONS

Turn to Section 5 of your answer sheet to answer the questions in this section.

DIRECTIONS

The passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of the passage. Other questions will direct you to a location in the passage or ask you to think about the passage as a whole.

After reading the passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1–18 are based on the following passage.

Metric Mayhem

[1] In the fall of 1999, the metric system caused the $125 million Mars Climate Orbiter to crash on Mars **1** . [2] Somehow, neither group realized the units were different, and the result was that the trajectory of the probe was miscalculated and it crashed. [3] This, at least, is the argument of **2** people who are against adopting the metric system in the United States. [4] The problem was that two different groups that worked on the project used different systems of measurement. [5] One group used pounds of force per second, a U.S. Customary measurement, and the other group **3** uses newtons, the equivalent metric measurement of force. **4**

1

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

> instead of going into orbit around the planet to collect and transmit data

Should the writer make this addition here?

A) Yes, because it gives details that clarify that the crash was unexpected.

B) Yes, because it establishes an important shift in focus in the paragraph's discussion of the Mars Climate Orbiter.

C) No, because it contains information that is not directly related to the main focus of the paragraph.

D) No, because it repeats information given later in the paragraph.

2

A) NO CHANGE

B) them

C) they

D) those ones

3

A) NO CHANGE

B) had used

C) used

D) will have used

4

To make this paragraph most logical, sentence 2 should be placed

A) where it is now.

B) after sentence 3.

C) after sentence 4.

D) after sentence 5.

CONTINUE

The history of the metric system in the Western world began soon after the replacement of Roman numerals with the base-ten Arabic numbering **5** system. The replacement of Roman numerals with Arabic numerals happened in the 15th century. The earliest known treatise promoting the **6** idea, of a decimal, or base-ten system of measurement was printed in 1586. The foundations of the metric system as we know it today were developed over the next two **7** centuries, as commerce, across great distances, became more common. A universal system makes trade vastly simpler because weights and prices can be easily understood, **8** so cheating is difficult.

5

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

A) system; this replacement

B) system, which

C) system—the adoption of Arabic numerals

D) system, an occurrence that largely

6

A) NO CHANGE

B) idea of a decimal, or base-ten,

C) idea, of a decimal or base-ten,

D) idea of a decimal—or base-ten,

7

A) NO CHANGE

B) centuries as commerce, across great distances

C) centuries as commerce, across great distances,

D) centuries as commerce across great distances

8

Which choice most effectively completes the explanation of how the metric system was important for trade over long distances?

A) NO CHANGE

B) since different currencies make long-distance trade hard enough.

C) regardless of whether buyers and sellers are from the same place.

D) whether the goods are spices, wine, or textiles.

CONTINUE

France was the first country to officially adopt the metric system in the late 18th century, and [9] they organized several international conferences to establish what the universal standards would be. Much of Europe [10] got on board with the metric system quickly on the heels of France, with the exception of Britain. [11] Since the American colonies were part of the British Empire, they used the British Imperial System of measurement. When the United States was established, the Constitution specified that Congress had the power to "fix the Standard of Weights and Measures," and Thomas Jefferson and Ben Franklin were both among the proponents of [12] sacrificing the British system in favor of the metric system.

9

A) NO CHANGE
B) they were organizing
C) it organized
D) it had organized

10

Which choice best maintains the style and tone of the passage?
A) NO CHANGE
B) singled out
C) adopted
D) pinned down

11

A) NO CHANGE
B) Although
C) Therefore,
D) Nevertheless,

12

A) NO CHANGE
B) ducking
C) evading
D) abandoning

In the late 18th century, [13] for example, politics and distance turned out to be insurmountable roadblocks to adopting the metric system in the United States. Although France had been an American ally during the Revolutionary [14] War. It quickly turned hostile towards the United States as diplomatic relations between the United States and Britain warmed after the war. There was also concern in the United States about the cost of sending a delegation to France [15] for learn about the metric system and worry that political upheaval within France might mean the quick demise of the new system. In the end, the British system was retained, though we now know it as the United States Customary System.

[16] There have been multiple attempts over the years to establish the metric system in the United States. In fact, the metric system was made legal (though not mandatory) by Congress in 1866, and our standards for yards and pounds are defined as fractions of meters and

13

A) NO CHANGE
B) moreover,
C) thus,
D) however,

14

A) NO CHANGE
B) War, it
C) War; it
D) War: it

15

A) NO CHANGE
B) to
C) by
D) of

16

Which choice provides the best introduction to this paragraph?

A) NO CHANGE
B) The metric system continued in France, despite Napoleonic rule.
C) Congress deals with a lot of issues that might not seem like they have a big impact on everyday life.
D) Political upheaval also happens in the United States.

CONTINUE ➡

kilograms, respectively. When Congress passed the Metric Conversion Act in 1975, **17** metric enthusiasts who admired that system were optimistic that the United States was finally going to make the switch. But the bill was later amended to make metric conversion voluntary, **18** which is why our speed limit signs are in miles per hour instead of kilometers per hour, and at least in part why the Mars Climate Orbiter crashed.

17

A) NO CHANGE

B) those in enthusiastic favor of the metric system

C) metric enthusiasts

D) enthusiastic metric system admirers

18

Which choice most effectively concludes the essay?

A) NO CHANGE

B) but even though it isn't official, many school children learn about the metric system from an early age.

C) so some businesses have opted to go metric, while most government agencies haven't fully made the switch.

D) which means no one is motivated to make the change even though it wouldn't be that hard.

END OF TEST

DO NOT RETURN TO A PREVIOUS SECTION.