Part 1 — English Language Arts

57 Questions

Revising/Editing

QUESTIONS 1-10 (PART A AND PART B)

REVISING/EDITING PART A

DIRECTIONS: Read and answer the following questions. You will be asked to recognize and correct errors so that the sentences or short paragraphs follow the conventions of standard written English. You may write in your test booklet as needed to take notes. You should reread relevant parts of the sentences or paragraphs, while being mindful of time, before marking the **best** answer for each question.

1.   Which pair of revisions needs to be made in this paragraph?

> (1) Both Italian gelato and American ice cream are delightful treats to have on a hot summer day, but many people wonder: what is the difference between the two? (2) To start with, the butterfat content is much higher in ice cream than it is in gelato, making the Italian treat a wiser decision for people looking to make healthier choices. (3) Additionally, the mixing process, which adds less air to the frozen treat, makes gelato denser than ice cream. (4) Finally, gelato is served 10 to 15 degrees warmer than ice cream, which enhances the texture and flavor of the gelato, and allow it to melt more quickly.

   A. Sentence 1: Delete the colon after *wonder* AND change *is* to **are**.
   B. Sentence 2: Delete the comma after *with* AND change *it is* to **they are**.
   C. Sentence 3: Delete the comma after *process* AND change *makes* to **make**.
   D. Sentence 4: Delete the comma after *gelato* AND change *allow* to **allows**.

2. What is the **best** way to combine the sentences?

> (1) Scientists now believe that Jupiter may have as many as seventy-nine moons.
>
> (2) One of Jupiter's moons is named Io.
>
> (3) Io has the greatest number of active volcanoes in the solar system.

   E. Io, which is one of Jupiter's moons, has the greatest number of active volcanoes in the solar system, and scientists now believe that Jupiter may have as many as seventy-nine moons.

   F. Scientists now believe that Jupiter may have as many as seventy-nine moons, and one of them is named Io, which has the greatest number of active volcanoes in the solar system.

   G. Scientists now believe that Jupiter may have as many as seventy-nine moons, including one named Io, which has the greatest number of active volcanoes in the solar system.

   H. Io, a moon with the greatest number of active volcanoes in the solar system, is one of Jupiter's moons, and scientists now believe that Jupiter may have as many as seventy-nine moons.

3. Which sentence contains an error in its construction and should be revised?

> (1) The blobfish, a creature that certainly resembles its name, is an unusual fish whose body is mostly composed of pink, gelatinous flesh. (2) Because it has very few muscles and its density is close to that of water, the blobfish spends its life floating slightly above the ocean floor. (3) It must wait patiently for whatever edible matter might float by its mouth. (4) The blobfish's downturned mouth, slimy skin, and pale coloring caused them to be voted the World's Ugliest Animal in 2013.

   A. sentence 1

   B. sentence 2

   C. sentence 3

   D. sentence 4

4. Which sentence contains an error in its construction and should be revised?

(1) In 1976, the National Basketball Association (NBA) absorbed several teams of the American Basketball Association (ABA), including the New York Nets, who played in the Long Island area at the time. (2) The owner of the Nets decided to take the team to New Jersey after the team had financial troubles, where the team played for thirty-five seasons. (3) The New Jersey Nets had sixteen playoff appearances, including two appearances in the NBA finals. (4) In 2012, the team changed ownership and returned to New York, where the team now plays under the name the Brooklyn Nets.

E. sentence 1
F. sentence 2
G. sentence 3
H. sentence 4

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DIRECTIONS: Read the text below and answer the questions following it. You will be asked to improve the writing quality of the text and to correct errors so that the text follows the conventions of standard written English. You should reread relevant parts of the text, while being mindful of time, before marking the **best** answer for each question.

Moving through Mountains

(1) An age-old proverb says that necessity is the mother of invention. (2) Centuries of human ingenuity in the face of obstacles prove this to be true. (3) For many years the Swiss Alps, a mountain range spanning southern Switzerland and northern Italy, were such an obstacle. (4) Roads and railways had to navigate around the mountains or through winding tunnels inside the mountains, making the transportation of people and goods difficult and time consuming. (5) In 2016 these burdens were eased with the completion of the Gotthard Base Tunnel.

(6) Construction of the high-speed railway tunnel began in 1996. (7) The tunnel was created through the use of tunnel-boring machines, which are giant drills with a flat rotating head called a cutter head. (8) Each of the tunnel-boring machines used during the construction of the tunnel was about the length of four football fields arranged end-to-end. (9) During the seventeen-year construction period, 28 million tons of rock were removed, enough to rebuild the Great Pyramid of Giza five times. (10) This massive construction project is reported to have cost $12 billion. (11) After that, 4 million cubic meters of concrete, or enough concrete to build eighty-four Empire State Buildings, were used to construct and support the tunnel.

(12) In a few years, the high-speed railway will carry more than 250 freight trains and 55 passenger trains a day, with most traveling at speeds of around 100 to 125 miles per hour. (13) It will be faster for people to travel between northern and southern Europe. (14) The travel time between the European cities of Zurich, Switzerland, and Milan, Italy, will be reduced by an hour. (15) Many European leaders compare the Gotthard Base Tunnel to the Channel Tunnel, a 33-mile underwater tunnel that connects the United Kingdom and France. (16) While there is no roadway in the Channel Tunnel, people can drive their cars onto special trains that will carry vehicles through to the other side.

(17) Just as traffic congestion in major cities led to the construction of underground local transportation, natural formations, such as mountain ranges, have also sent people underground for faster, easier, and cheaper methods of transportation across larger areas. (18) There is renewed interest in constructing innovative methods of transportation that will help eliminate problems associated with traveling to and from certain areas.

5. Which sentence should be added after sentence 5 to introduce the main topic of the passage?

    A. The construction of the Gotthard Base Tunnel was approved by Swiss voters in 1992 and was funded by tolls, fuel taxes, and government loans.

    B. Leaders from several European countries attended the opening ceremonies for the Gotthard Base Tunnel, a Swiss tunnel.

    C. The Gotthard Base Tunnel is the world's longest and deepest railway tunnel, stretching 35.5 miles straight through the base of the Swiss Alps.

    D. The Gotthard Base Tunnel continues to help reduce the number of freight trucks on the roadways in the Swiss Alps.

6. Which sentence should be added to follow and support sentence 7?

    E. The tunnel-boring machine is helpful to tunnel builders in the modern era and has been an improvement over dynamite.

    F. These enormous tunnel-boring machines function somewhat like a cheese grater, with the cutter head grinding slowly through rock and stone.

    G. Engineers had considered making a tunnel under the mountains for many years, but it was impossible to do without modern tunnel-boring machines.

    H. Different types of cutter heads are used with tunnel-boring machines depending on the geology of the area where the tunnel is being created.

7. Where should sentence 11 be moved in order to improve the organization of the second paragraph (sentences 6–11)?

    A. to the beginning of the paragraph (before sentence 6)

    B. between sentences 6 and 7

    C. between sentences 8 and 9

    D. between sentences 9 and 10

8. Which sentence presents information that shifts away from the main topic of the third paragraph (sentences 12–16) and should be removed?

    E. sentence 13

    F. sentence 14

    G. sentence 15

    H. sentence 16

9. Which transition phrase should be added to the beginning of sentence 18?

    A. Although the Gotthard Base Tunnel is mainly for freight trains,

    B. With the Gotthard Base Tunnel taking ten years to complete,

    C. Because of the successful completion of the Gotthard Base Tunnel,

    D. As the number of trains using the Gotthard Base Tunnel increases,

10. Which concluding sentence should be added after sentence 18 to support the topic presented in the passage?

    E. There is proof that underground tunnels such as the Gotthard Base Tunnel are beneficial to the economy of the surrounding area.

    F. The Gotthard Base Tunnel is an extraordinary example of how human ingenuity and persistence can overcome great obstacles.

    G. The completion of the Gotthard Base Tunnel shows that people can work together to achieve important goals.

    H. The Swiss government is confident that the economic impact of the Gotthard Base Tunnel will be worth its construction cost.

Reading Comprehension
Questions 11–57

DIRECTIONS: Read each of the following six texts, and answer the related questions. You may write in your test booklet as needed to take notes. You should reread relevant parts of each text, while being mindful of time, before marking the **best** answer for each question. Base your answers only on the content within the text.

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Excerpt from "The World Has an E-Waste Problem"

by Alana Semuels

1 As a tech-hungry nation . . . gets ready to upgrade to the next generation of lightning-fast 5G devices, there is a surprising environmental cost to be reckoned with: a fresh mountain of obsolete[1] gadgets. About 6 million pounds of discarded electronics are already processed monthly at recycling giant ERI's Fresno plant. Pallets[2] of once beloved but now outdated devices . . . arrive here daily. Workers with hammers hack at the bulkiest devices, while others remove dangerous components like lithium-ion batteries. The scene is like a twisted . . . movie, with doomed gadgets riding an unrelenting conveyor belt into a machine that shreds them into piles of copper, aluminum and steel.

2 "In our society, we always have to have the new, best product," said Aaron Blum, the co-founder and chief operating officer of ERI, on a tour of the facility. Americans spent $71 billion on telephone and communication equipment in 2017, nearly five times what they spent in 2010 even when adjusted for inflation, according to the Bureau of Economic Analysis. . . . When we buy something new, we get rid of what's old. That cycle of consumption has made electronics waste the world's fastest-growing solid-waste stream.

3 That stream is expected to turn into a torrent[3] as the world upgrades to 5G, the next big step in wireless technology. 5G promises faster speeds and other benefits. But experts say it will also result in a dramatic increase in e-waste, as millions of smartphones, modems and other gadgets incompatible with 5G networks are made obsolete. "I don't think people understand the magnitude of the transition," says ERI co-founder and executive chairman John Shegerian. "This is bigger than the change of black-and-white to color, bigger than analog to digital, by many multitudes."

4 . . . Less than a quarter of all U.S. electronic waste is recycled, according to a United Nations estimate. The rest is incinerated or ends up in landfills. That's bad news, as e-waste can contain harmful materials like mercury and beryllium that pose environmental risks.

5 Part of the problem is regulatory. Only 19 states have laws banning electronics from the regular trash. In states without such rules, like Nevada, electronics often end up in garbage and recycling bins, said Jeremy Walters, a community-relations manager for waste collector Republic Services. Environmental concerns aside, compacting flammable lithium-ion batteries with paper recycling can be dangerous; recycling centers have reported an uptick in fires.

6 Even when e-waste rules exist, it's left up to consumers to handle their old devices properly. But recycling them can be a pain. Rather than just drop a used phone in a bin outside their homes, lots of people have to take their electronics to a store, which may pay them for it but could also charge them to get rid of it. Many consumers, paralyzed by the hassle or put off by the expense,

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[1]**obsolete:** outdated and no longer useful

[2]**Pallets:** wooden platforms used to store or transport materials in a warehouse

[3]**torrent:** an outpouring

simply throw their devices into the trash or stash them in a drawer, hoping they'll just disappear. "We don't necessarily have the measures to make sure people aren't throwing it away," Walters said.

7   One solution is to make electronics last as long as they once did. At ERI's facility, Shegerian showed TIME [magazine] dozens of televisions from the 1970s and 1980s that stopped working only recently. Yet instead, technology companies are speeding the pace of obsolescence. Most smartphone batteries can't be easily replaced when they stop holding a charge, new laptops don't accept old cables, and software companies push upgrades that won't run on old devices. "Our products today don't last as long as they used to, and it's a strategy by manufacturers to force us into shorter and shorter upgrade cycles," said Kyle Wiens, the founder of iFixit, which publishes do-it-yourself repair guides. . . .

8   Some environmental groups say multibillion-dollar companies . . . should pick up the cost of recycling the devices they sell. Lawmakers in parts of Europe and Canada and in some U.S. states have passed so-called Extended Producer Responsibility (EPR) laws, which require manufacturers to establish and fund systems to recycle or collect obsolete products. . . .

9   . . . Some companies are increasing their recycling efforts on their own, whether for the economic benefit or the public relations boost.

ENVIRONMENTAL IMPACTS OF PERSISTENT BIOACCUMULATIVE TOXIC CHEMICALS IN ELECTRONIC DEVICES
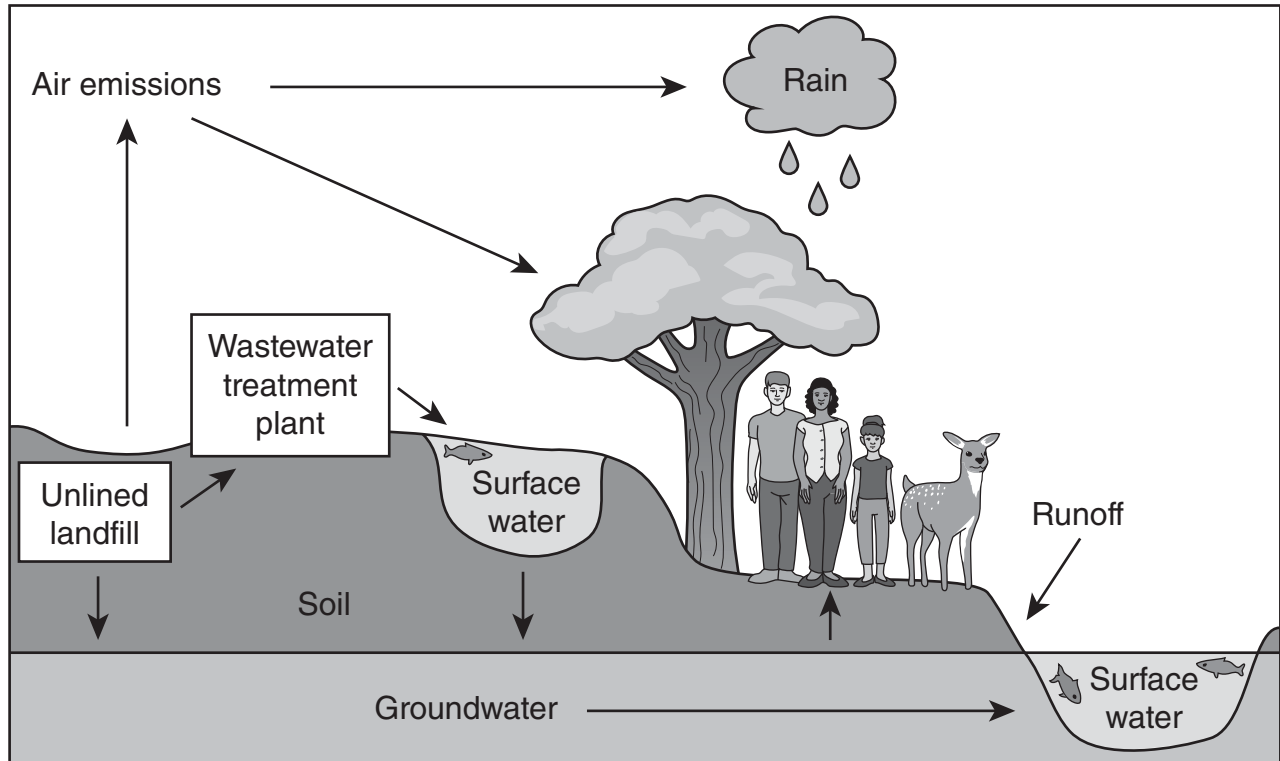
Electronics such as smartphones, computers, cameras, and large appliances contain toxins like lead, chromium, zinc, nickel, mercury, beryllium, and cadmium. These substances are bioaccumulative, which means that they accumulate over time in living organisms.

11. Read this sentence from paragraph 1.

> **The scene is like a twisted . . . movie, with doomed gadgets riding an unrelenting conveyor belt into a machine that shreds them into piles of copper, aluminum and steel.**

The words "twisted," "doomed," and "unrelenting" **most** affect the sentence by

A. emphasizing that discarded devices are condemned to an unfortunate fate.

B. expressing a sense of desperation about the amount of waste from discarded devices.

C. implying that discarded devices are often disposed of in an inappropriate manner.

D. suggesting a feeling of doubt about solving the problem of discarded devices.

12. How does paragraph 2 build on what the reader learns in paragraph 1?

    E. Paragraph 2 explains the underlying cause of the massive amounts of recycling that are described in paragraph 1.

    F. Paragraph 2 discusses the past trends that have led to the technological innovation mentioned in paragraph 1.

    G. Paragraph 2 cites statistics that support the claim about technology that is stated at the beginning of paragraph 1.

    H. Paragraph 2 expresses disapproval of the consumers who throw away the products that are discussed in paragraph 1.

13. Which sentence from the excerpt suggests that electronic devices are purposely designed to be disposed of after a short time?

    A. " 'In our society, we always have to have the new, best product,' said Aaron Blum, the co-founder and chief operating officer of ERI, on a tour of the facility." (paragraph 2)

    B. "Even when e-waste rules exist, it's left up to consumers to handle their old devices properly." (paragraph 6)

    C. "Most smartphone batteries can't be easily replaced when they stop holding a charge, new laptops don't accept old cables, and software companies push upgrades that won't run on old devices." (paragraph 7)

    D. "Some environmental groups say multibillion-dollar companies . . . should pick up the cost of recycling the devices they sell." (paragraph 8)

14. The details in paragraphs 4–5 develop a central idea of the excerpt mainly by suggesting that

    E. the toxic components of e-waste make waste collectors reluctant to process electronic devices.

    F. communities across the nation have taken different approaches to the management of e-waste.

    G. increased amounts of e-waste will further intensify a problem that is already inadequately addressed.

    H. the methods that are used for disposing of non-electronic waste are inefficient for e-waste.

15. What is the role of paragraphs 7–9 in the organization of the excerpt?

    A. They emphasize the contrast between successful and unsuccessful efforts to regulate electronic waste.

    B. They suggest that the electronic devices that were manufactured in the past created less pollution.

    C. They imply that manufacturers are willing to comply with regulations that protect the environment.

    D. They shift the focus from a discussion of individual behavior to a discussion of corporate responsibility.

16. The idea that e-waste regulations can be ineffective is conveyed in the excerpt through

    E. a statistic indicating that only a few states have chosen to adopt e-waste regulations.

    F. an observation about typical consumer behavior in response to e-waste regulations.

    G. an acknowledgment that electronics stores sometimes profit from e-waste regulations.

    H. a comment that manufacturers are making an effort to recycle even without e-waste regulations.

17. How does the diagram after paragraph 9 **most** support the claim made in paragraph 4?

    A. The diagram suggests that people send large amounts of recyclable e-waste to landfills.

    B. The diagram emphasizes that toxic chemicals in e-waste can easily spread from landfills.

    C. The diagram implies that most landfills are poorly designed to accommodate e-waste.

    D. The diagram shows that water sources near landfills are endangered by e-waste.

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The narrator's summer job is collecting marine specimens in Puget Sound, Washington. In this excerpt, he is looking for specimens in the mudflats before daybreak. Mudflats, or flats, are coastal landforms created when sediment and silt from tides are deposited as the tides recede.

Excerpt from *The Highest Tide*

by Jim Lynch

1 I rounded the oyster beds, to the far side. . . . It was low tide by then, and I saw the water hesitating at its apex, neither leaving nor returning, patiently waiting for the gravitational gears to shift. Dozens of anxious clams started squirting in unison like they did whenever vibrating grains of sand warned them predators were approaching. I stopped and waited with them, to actually see the moment when the tide started returning with its invisible buffet of plankton for the clams, oysters, mussels and other filter feeders. It was right then, ankle deep in the Sound, feet numbing, eyes relaxed, that I saw the nudibranch.[1]

2 In all my time on the flats I'd never seen one before. I'd read about them, sure. I'd handled them at aquariums but never in the wild, and I'd never even seen a photo of one this stunning. It was just three inches long but with dozens of fluorescent, orange-tipped hornlike plumes jutting from the back of its see-through body that appeared to be lit from within.

3 Nudibranchs are often called the butterflies of the sea, but even that understates their dazzle. Almost everything else in the northern Pacific is dressed to blend with pale surroundings. Nudibranchs don't bother, in part because they taste so lousy they don't need camouflage to survive. But also, I decided right then, because their beauty is so startling it earns them a free pass, the same way everyday life brakes for peacocks, parade floats. . . .

4 The dark mudflats loomed like wet, flattened dunes stretching deep into Skookumchuck Bay in front of our house. From a distance, they looked too barren to support sea life. Up close, they still did, unless you knew where to find the hearty clams, worms and tiny creatures that flourish in mud. . . . I'm not sure why I decided to take a look. It was still an hour before sunrise, and I knew exactly what the bars[2] looked like in the moonlight, but for some reason, I couldn't resist.

5 I heard it long before I saw it. It was an exhale, a release of sorts, and I instantly wondered if a whale was stranded again. We had a young minke[3] stuck out there two summers prior, and it made similar noises until the tide rose high enough for rescuers to help free it. . . . I looked for a hulking silhouette but couldn't find one. I waited, but there were no more sounds. Still, I went toward what I thought I'd heard, avoiding stepping into the mud until I had to. I knew the flats well enough to know I could get stuck just about anywhere. The general rule was you didn't venture out past the shells and gravel with an incoming tide. I sank up to my knees twice, and numbing water filled my boots.

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[1]nudibranch: type of sea slug

[2]bars: sandbars

[3]minke: species of small whale

6 . . . I kept stepping toward the one sound I'd heard, a growing part of me hoping I'd find nothing at all. When I stopped to rest and yank up my socks, my headlamp crossed it. My first thought? A giant octopus.

7 Puget Sound has some of the biggest octopi in the world. They often balloon to a hundred pounds. Even the great Jacques Cousteau[4] himself came to study them. But when I saw the long tubular shape of its upper body and the tangle of tentacles below it, I knew it was more than an octopus. I came closer, within fifty feet, close enough to see its large cylindrical siphon[5] quiver. I couldn't tell if it was making any sounds at that point, because it was impossible to hear anything over the blood in my ears. . . .

8 The creature's body came to a triangular point above narrow fins that lay flat on the mud like wings, but it was hard to be sure exactly where it all began or ended, or how long its tentacles truly were, because I was afraid to pry my eyes off its jumble of arms for more than half a second. I didn't know whether I was within reach, and its arms were as big around as my ankle and lined with suckers the size of half-dollars. If they even twitched I would have run. So, I was looking at it and not looking at it while my heart spangled my vision. I saw fragments, pieces, and tried to fuse them in my mind but couldn't be certain of the whole. I knew what it had to be, but I wouldn't allow myself to even think the two words. Then I gradually realized the dark shiny disc in the middle of the rubbery mass was too perfectly round to be mud or a reflection.

9 It was too late to smother my scream. Its eye was the size of a hubcap.[6]

[4]**Jacques Cousteau:** renowned French oceanographer

[5]**siphon:** tube-like organ that is used for drawing in or removing fluids

[6]**hubcap:** removable cap over the end of a wheel axle

18. In paragraph 3, the phrase "the butterflies of the sea" conveys the idea that

    E. nudibranchs do not have to work as hard as other animals to survive in the ocean.

    F. nudibranchs have colorful features that make them stand out.

    G. nudibranchs are delicate and have trouble adapting to their environment.

    H. nudibranchs are rare and difficult to find in the ocean.

19. Read these sentences from paragraph 4.

> **I'm not sure why I decided to take a look. It was still an hour before sunrise, and I knew exactly what the bars looked like in the moonlight, but for some reason, I couldn't resist.**

The sentences contribute to the overall structure of the excerpt by

A. introducing the mysterious creature that the narrator discovers.
B. indicating a shift from the narrator recalling the past to the narrator reflecting on the present.
C. establishing a struggle with fear that the narrator must overcome.
D. building tension through indicating that the narrator is going to see something unexpected.

20. Which sentence from paragraph 5 supports the idea that the narrator is taking a risk?

E. "It was an exhale, a release of sorts, and I instantly wondered if a whale was stranded again."
F. "I looked for a hulking silhouette but couldn't find one."
G. "I waited, but there were no more sounds."
H. "I knew the flats well enough to know I could get stuck just about anywhere."

21. Read this sentence from paragraph 6.

> **I kept stepping toward the one sound I'd heard, a growing part of me hoping I'd find nothing at all.**

How do the narrator's actions develop a central idea of the excerpt?

A. The narrator's concern about the origin of the noise shows dedication to helping preserve sea life in the mudflats.
B. The narrator's curiosity about the sea life in the mudflats outweighs any fear about the situation.
C. The narrator's knowledge about a variety of sea life encourages a search for more specimens to study.
D. The narrator's eagerness about new specimens of sea life outweighs the reality that the area is an unlikely place to find them.

22. Read these sentences from paragraph 8.

> **So, I was looking at it and not looking at it while my heart spangled my vision. I saw fragments, pieces, and tried to fuse them in my mind but couldn't be certain of the whole.**

The sensory language "spangled my vision," "I saw fragments, pieces," and "tried to fuse them in my mind" conveys the narrator's

E. extreme excitement about making a great discovery.
F. reluctant acceptance that he needs to leave the mudflats.
G. terrified confusion about the creature in the mudflats.
H. sudden concern about his personal safety.

23. The author develops the narrator's point of view when the narrator sees the creature by

A. describing the narrator's movements as he approaches the creature.
B. emphasizing the odds of finding the creature in an area inhabited by a rival species.
C. showing the narrator's growing realization of the creature's identity.
D. comparing the size of the creature to the size of a vehicle.

24. How does the setting affect the plot of the excerpt?

E. The darkness of the mudflats before sunrise causes the narrator to pay close attention to his surroundings.
F. The rugged terrain of the mudflats makes it more difficult for the narrator to do his job.
G. The slow return of the tide along the mudflats forces the narrator to be patient during his journey.
H. The barren appearance of the mudflats creates a sense of mystery that unsettles the narrator.

Going Solar in China

1　In the Anhui province of China, 166,000 floating solar panels are strung together atop the rippling surface of a lake. It is the largest solar-power farm in the world, an immense blanket of renewable energy strong enough to power 15,000 homes.

2　The floating solar-power farm, which harvests the sun's rays for power, was first conceived by the Sungrow Power Supply Company after heavy rains flooded a collapsed coal mine and created a lake. Sang Dajie, a former coal miner from the area, is now an electrician for the farm, which occupies the original mine site where he used to work. Now, instead of working under the dangerous conditions at the mine, he spends his days maintaining the solar panels on the water. "The coal mine," says Dajie, "was very hot and the air was bad. . . . But here I feel safe. The new energy is safe." People in China rely primarily on the burning of coal in massive power plants to create electricity. While the burning of fossil fuels, like coal, is a reliable source of energy, the process releases massive amounts of carbon dioxide into the atmosphere, creating air pollution and harming Earth. Solar power, on the other hand, is clean and safe for the environment.

3　Solar panels are typically placed on rooftops or in open fields, but experts in China determined that the newly formed lake was a great spot for the solar-power farm. Solar-power farms over water are efficient because the water keeps the panels cool. A water-based solar-power farm can potentially generate more power than one based on land. Additionally, with the solar-power farm on the lake, the land in the surrounding area remains available for farming, which is another source of income for Anhui residents.

4　Originally, China displayed minimal interest in solar energy. The use of solar energy was limited primarily to rural areas that had no access to a power grid. Without access to other means of electricity, people in these areas used solar panels as an alternative to lighting candles and kerosene lamps. China began to manufacture solar panels for other countries in the late 1990s when the German government offered its people financial incentives for installing solar panels. The heightened demand for solar panels was instantaneous, and Chinese businesses were quick to seize the opportunity. Soon the governments of Spain and Italy also offered incentives for using solar technology, and Chinese manufacturers were ready for the increased demand.

5　Between 2008 and 2013, China improved its manufacturing technology and processes so much that it effectively lowered the worldwide cost of using solar energy by 80 percent, further increasing demand. However, a point came when Chinese manufacturers had become so efficient at producing solar-power equipment that they outpaced the demand. The manufacturers were producing two solar panels for every one solar panel they sold. In order to make manufacturing a profitable industry again, the Chinese government offered its own financial incentives to Chinese citizens for using solar energy. Now, projects like the floating solar-power farm are putting those surplus panels to use, in addition to providing jobs and cleaner energy.

6　A second solar-power farm has already been constructed near the massive one in Anhui as part of a government initiative to build more low-emission power plants. The goal is to meet 20 percent of the country's energy needs with renewable, clean energy sources by the year 2030.

7　As Sang Dajie puts it, "I'm glad we are reusing this area to create a better future." China's dedication to increasing its production of renewable energy through solar power demonstrates that patience, time, and flexibility can result in transformation.

25. The phrases "166,000 floating solar panels are strung together atop the rippling surface of a lake" and "an immense blanket of renewable energy" in paragraph 1 convey that the solar-power farm

    A. produces the maximum amount of energy possible for its size.

    B. meets and exceeds the energy needs of the area.

    C. blends in with the surrounding landscape.

    D. produces a large amount of energy and is in an unusual location.

26. The author includes the statements from Dajie in paragraphs 2 and 7 **most likely** to

    E. prove that the solar-energy industry benefits the economy of China by providing jobs.

    F. provide the reasons why traditional energy sources are being replaced with solar-power farms.

    G. highlight how replacing fossil fuels with solar energy offers more than just financial benefits.

    H. argue that additional solar-power farms should be built in the Anhui province.

27. How does paragraph 2 contribute to the development of ideas in the article?

    A. It explains the series of events that led a former coal miner to become an electrician at a solar-power farm.

    B. It provides details on how a shift from coal mining to collecting solar power can improve conditions for energy workers and the environment.

    C. It describes the reasons a company chose to transform a lake created by a collapsed coal mine into a solar-power farm that floats on the water.

    D. It presents an overview of how a collapsed coal mine became a productive floating solar-power farm over several years.

28. Which statement **best** describes how the chronological structure of paragraphs 4–5 contributes to the development of ideas in the article?

    E. It reveals how China's businesses lowered the cost of solar energy over time for other countries.

    F. It depicts how China's government helped the Chinese solar-energy industry respond to growth in the international demand for solar energy.

    G. It reveals how China's position on using solar energy changed because of a surplus supply of solar panels.

    H. It depicts how China's solar-energy industry improved the manufacturing of solar panels in order to increase revenue.

29. How do the details in paragraph 6 about the solar-power goals of the Chinese government convey a central idea of the article?

    A. They indicate that the Chinese government wants China to be the world leader in solar-energy production.

    B. They show that the Chinese government understands the benefits of transitioning to renewable energy sources such as solar power.

    C. They suggest that constructing solar-power farms is the best way for the Chinese government to put excess solar panels to use.

    D. They imply that solar farms are a good way for the Chinese government to make solar power the main source of energy in China.

30. China's role in the increase of solar-energy use around the world is illustrated in the article mainly through the inclusion of

    E. information about where Chinese businesses sold solar panels and other materials for solar-power farms.

    F. explanations of how solar-power use in China demonstrated that solar power could replace other energy sources.

    G. details about how the Chinese government encouraged its citizens to use solar energy.

    H. facts indicating that Chinese manufacturing processes helped make solar power more affordable.

31. The author's purpose for writing the article is **best** conveyed by the

   A. information about the positive outcomes China has achieved by producing renewable energy.

   B. facts about how China has influenced other countries to use solar power as a source of renewable energy.

   C. statements that present solar power as one of several forms of energy used throughout China.

   D. details that emphasize how China developed its solar-power industry primarily as a means of financial gain.

32. How do the details in paragraph 4 about Germany, Spain, and Italy contribute to a central idea of the article?

   E. They indicate why businesses in China worked to become proficient producers of solar panels.

   F. They emphasize the global need for solar power as a source of renewable energy.

   G. They reveal that European countries were competing to see which country could reach its renewable-energy goals first.

   H. They suggest that other countries viewed China as a model for constructing solar-power farms in unlikely places.

Excerpt from "How Exercise Could Help You Learn a New Language"

by Gretchen Reynolds

1 Many scientists suspect that exercise alters the biology of the brain in ways that make it more malleable and receptive to new information, a process that scientists refer to as plasticity.

2 But many questions have remained unanswered about movement and learning, including whether exercise is most beneficial before, during or after instruction and how much and what types of exercise might be best.

3 So for a new study, which was published recently in *PLOS One*, researchers in China and Italy decided to home in on language learning and the adult brain.

4 Language learning is interesting. As young children, almost all of us picked up our first language easily. We didn't have to be formally taught; we simply absorbed words and concepts.

5 But by early adulthood, the brain generally begins to lose some of its innate language capability. It displays less plasticity in areas of the brain related to language. As a result, for most of us, it becomes harder to learn a second language after childhood.

6 To see what effects exercise might have on this process, the researchers first recruited 40 college-age Chinese men and women who were trying to learn English. The students had some facility with this second language but were far from proficient.

7 The researchers then divided the students into two groups. Those in one group would continue to learn English as they had before, primarily while seated in rote vocabulary-memorization sessions.

8 The others would supplement these sessions with exercise.

9 Specifically, the students would ride exercise bikes at a gentle pace (about 60 percent of their maximum aerobic capacity) beginning 20 minutes before the start of the lessons and continuing throughout the 15 minutes or so of instruction.

10 Both groups learned their new vocabulary by watching words projected onto large screens, together with comparable pictures, such as "apple" and a Red Delicious. They were shown 40 words per session, with the sequence repeated several times.

11 Afterward, the students all rested briefly and then completed a vocabulary quiz, using computer keys to note as quickly as possible whether a word was with its correct picture. They also responded to sentences using the new words, marking whether the sentences were accurate or, in the case of "The apple is a dentist," nonsensical. Most linguists[1] feel that understanding sentences shows greater mastery of a new language than does simple vocabulary improvement.

12 The students completed eight vocabulary sessions over the course of two months.

---

[1]**linguists:** scientists who study language

13 And at the end of each lesson, the students who had ridden bikes performed better on the subsequent vocabulary tests than did the students who sat still.

14 They also became more proficient at recognizing proper sentences than the sedentary students, although that difference did not emerge until after several weeks of instruction.

15 Perhaps most interesting, the gains in vocabulary and comprehension lingered longest for the cyclists. When the researchers asked the students to return to the lab for a final round of testing a month after the lessons—without practicing in the meantime—the cyclists remembered words and understood them in sentences more accurately than did the students who had not moved.

16 "The results suggest that physical activity during learning improves that learning," says Simone Sulpizio, a professor of psychology and linguistics at the University Vita-Salute San Raffaele in Milan, Italy, and a study co-author.

17 These improvements extend beyond simply aiding in memorization, she added. The exercise also deepened language learners' grasp of how to use their newly acquired words.

18 This study involved college students performing relatively light exercise, though, and cannot tell us whether other people completing other types of exercise would achieve the same results.

19 It also offers no clues about what is occurring inside the brain that might be contributing to the benefits of the exercise. But many past studies have shown that exercise prompts the release of multiple neurochemicals in the brain that increase the number of new brain cells and the connections between neurons, Dr. Sulpizio says. These effects improve the brain's plasticity and augment the ability to learn.

20 From a real-world standpoint, the study's implications might seem at first to be impractical. Few classrooms are equipped with stationary bicycles. But specialized equipment is probably unnecessary, Dr. Sulpizio says.

21 "We are not suggesting that schools or teachers buy lots of bicycles," she says. "A simpler take-home message may be that instruction should be flanked by physical activity."

33. How does the author's use of comparison in paragraphs 4 and 5 contribute to the development of ideas in the excerpt?

    A. It identifies why many adults are never able to learn a second language.

    B. It demonstrates why the study of adult language learning tries to include physical activity.

    C. It highlights why more is known about language learning in children than about language learning in adults.

    D. It explains why adults were the subjects of the study rather than children.

34. Read this sentence from paragraph 6.

> **To see what effects exercise might have on this process, the researchers first recruited 40 college-age Chinese men and women who were trying to learn English.**

Which statement describes the function of the sentence in the overall structure of the excerpt?

    E. It indicates a shift from describing the results of the study to describing the process.

    F. It introduces the aspect of the research that was most critical to determining the results.

    G. It marks the change from explaining why the study was conducted to explaining how the study was conducted.

    H. It shows how questions were raised that could be addressed in further research.

35. In the study described in the excerpt, researchers asked English learners to assess the sense of words in context because that task is

    A. better at determining the capability learners have of language than simple vocabulary recall.

    B. consistent with the way earlier research was conducted on adult language learners.

    C. a better way for learners to absorb the meaning of individual vocabulary words.

    D. more difficult for learners to perform after an extended period of time has passed.

36. Which evidence from the excerpt is **most** relevant to the author's claim that there are many unanswered questions about the relationship between movement and learning?

    E. the method of the study using one type of exercise and people from one age group

    F. the statement from Dr. Sulpizio explaining past studies on neurochemicals in the brain

    G. the finding of the study that exercise helps people recall information over a long period of time

    H. the statement from Dr. Sulpizio describing how the results of the study can be applied

37. Read these sentences from paragraph 17.

> **These improvements extend beyond simply aiding in memorization, she added. The exercise also deepened language learners' grasp of how to use their newly acquired words.**

Which sentence from the excerpt **best** explains why Dr. Sulpizio feels confident in the conclusion stated in these sentences?

    A. "They were shown 40 words per session, with the sequence repeated several times." (paragraph 10)

    B. "They also responded to sentences using the new words, marking whether the sentences were accurate or, in the case of 'The apple is a dentist,' nonsensical." (paragraph 11)

    C. "And at the end of each lesson, the students who had ridden bikes performed better on the subsequent vocabulary tests than did the students who sat still." (paragraph 13)

    D. "They also became more proficient at recognizing proper sentences than the sedentary students, although that difference did not emerge until after several weeks of instruction." (paragraph 14)

38. Paragraph 18 shows that the author's perspective toward the study described in the excerpt is that

    E. though the study allowed some conclusions to be drawn, these conclusions are limited.

    F. while the study focused on moderate exercise, it would have been better to focus on difficult exercise.

    G. while the study was performed appropriately, it is doubtful the results can be duplicated.

    H. though the study was about learning language, its conclusions can be applied to learning in general.

39. Which sentence is the **best** summary of the research procedure used in the study in the excerpt?

    A. Researchers had a group of non-English-speaking students learn new English vocabulary by matching words and images on a computer screen, and also by analyzing words in context; some students exercised and some students sat still while learning.

    B. Researchers first divided non-English-speaking students into two groups with one group exercising before and while studying English and the other group studying English without exercising; then, after instruction, student learning was assessed.

    C. Researchers first had non-English-speaking students sit on stationary bikes and pedal for 20 minutes before instruction and 15 minutes during instruction; then, after a rest period, students indicated whether English sentences made sense.

    D. Researchers asked non-English-speaking students to study English while sitting or biking; then the students' vocabulary skills were assessed after a short break period and also after a break of a full month without their having studied any of the materials.

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Located underground near Geneva, Switzerland, the Large Hadron Collider (LHC) helps scientists study and understand how the smallest particles of matter interact with one another. The LHC propels atomic particle beams along a 17-mile-long ring.

Looking for the Smallest Spark of Everything

There are the things the world is made of,
things we can see and feel, and then
there are the things even smaller, things that seem
to exist only when we are looking right at them.

5 So beneath the level of molecules are atoms,
and beneath the level of atoms, we find
protons, electrons, neutrons; and beneath that—
what, exactly? Because we are talking about
everything here: your fingernail,
10 the candy at the back of your mouth,
the coffee your teacher drank this morning,
your little sister, and the stuffed dog
she used to carry around with her everywhere.
And everywhere.

15 Everything and everywhere
are made up of the same stuff, whatever
it is. How do we find it? We can listen for it
in the wavelengths from deep space,
talking back to us from unimaginable
20 distances. Or we can build long,
deep circular tunnels beneath the surface
of this Earth and race particles
(like racing cars, only very tiny cars
flashing along at close to the speed of light)
25 until everything we think we know
bangs against everything else we know.

And there, in the explosion, in the darkness,
briefly incandescent, they appear:
the quarks, the leptons, and the bosons;
30 the baryons and the mesons. Their names
sound like dinosaurs or maybe bands
playing terrible music in someone's garage.

The one thing we know for sure
is that they spin. This is how gravity
35 enters our world, how our world is held
both together and apart, what keeps
together the pencil in your hand right now

as well as separate from, say,
Jupiter. They spin, and it is only down there
40 in the darkness—in the vast garage
where physicists jot down
what they can, whatever seems most real—
that they let us perceive their wild dancing,
combusting to the music they make.

40. Read lines 5–8 from the poem.

> **So beneath the level of molecules are atoms,**
> **and beneath the level of atoms, we find**
> **protons, electrons, neutrons; and beneath that—**
> **what, exactly?**

The lines help develop a central idea of the poem by revealing the speaker's

E. interest in determining how the parts of matter work together.

F. curiosity about what makes up matter.

G. desire to prove that particles make up matter.

H. questions about what tools are needed to study matter.

41. The break between the second stanza (lines 5–14) and the third stanza (lines 15–26) serves as a transition from

A. identifying common physical objects to explaining how the particles that make up all physical things are observed.

B. suggesting that the visible world is made up of simple materials to revealing why invisible materials make the world complicated.

C. discussing the methods used to study particles in space to describing how matter is researched on Earth.

D. describing an environment that feels comfortable to characterizing an environment that seems unstable.

42. The main purpose of the comparison in lines 23–24 of the poem is to show

    E. that the particles' size makes them difficult to see.
    F. how the particles move within the tunnel.
    G. that the particles have a familiar shape.
    H. how the particles can be seen only in darkness.

43. Read lines 25–26 from the poem.

> **until everything we think we know**
> **bangs against everything else we know.**

The lines help develop a central idea in the poem by suggesting that

    A. creative methods for researching particles are frequently being invented.
    B. ongoing research continues to add to our knowledge of particles.
    C. our understanding of particles is limited by the equipment available to study them.
    D. competing theories about particles provoke scientific debate.

44. Read lines 27–28 from the poem.

> **And there, in the explosion, in the darkness,**
> **briefly incandescent, they appear:**

The imagery in the lines reveals that the speaker

    E. envies the physicists who research colliding particles.
    F. has personally observed colliding particles.
    G. admires the powerful reactions that occur when particles collide.
    H. has a simplistic understanding of how particles collide.

45. Read lines 30–32 from the poem.

> **Their names**
> **sound like dinosaurs or maybe bands**
> **playing terrible music in someone's garage.**

The speaker refers to familiar objects and events in the lines **most likely** to

A. explain confusing information in simple terms to help the reader understand more about the topic.

B. demonstrate how scientific ideas can be explained by describing situations that many people are familiar with.

C. emphasize that the process being used to research particles is still in the early stages of development.

D. suggest that the scientific language used to describe particles seems silly by making a humorous comparison.

46. Read lines 36–39 from the poem.

> **both together and apart, what keeps**
> **together the pencil in your hand right now**
> **as well as separate from, say,**
> **Jupiter.**

The poet includes these lines **most likely** to emphasize that

E. it is important for physicists to continue their research about particles.

F. these particles have a powerful effect on everything.

G. the discoveries about particles provide little information.

H. the study of particles and the study of objects in space are similar.

47. The last stanza (lines 33–44) concludes the poem by emphasizing which central idea?

    A. The exciting work that physicists conduct provides information about fundamental aspects of the universe.

    B. The unusual work of physicists is carried out in unconventional locations and in special conditions.

    C. Physicists are learning about the unpredictable behavior of particles that break up matter in the universe.

    D. Physicists enthusiastically share the discoveries their research yields because most people can relate to their findings.

48. Read lines 39–44 from the poem.

> **They spin, and it is only down there**
> **in the darkness—in the vast garage**
> **where physicists jot down**
> **what they can, whatever seems most real—**
> **that they let us perceive their wild dancing,**
> **combusting to the music they make.**

The lines reveal the speaker's

    E. frustration with the research facilities physicists use.

    F. belief that physicists are frantically working toward a new discovery.

    G. interest in physicists and their study of particles.

    H. certainty that physicists are working in secrecy.

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Zitkala-Sa (Gertrude Simmons Bonnin) was a Native American writer, musician, teacher, and political activist who was raised on the Yankton Sioux Reservation in South Dakota. In 1900 she published "Impressions of an Indian Childhood" (the term Indian *was commonly used at the time to refer to Native American people) to expose readers to what life is like on a reservation.*

Excerpt from "Impressions of an Indian Childhood"

by Zitkala-Sa

1 Soon after breakfast Mother sometimes began her beadwork. On a bright, clear day, she pulled out the wooden pegs that pinned the skirt of our wigwam[1] to the ground, and rolled the canvas part way up on its frame of slender poles. Then the cool morning breezes swept freely through our dwelling, now and then wafting the perfume of sweet grasses from newly burnt prairie.

2 Untying the long tasseled strings that bound a small brown buckskin[2] bag, my mother spread upon a mat beside her bunches of colored beads, just as an artist arranges the paints upon his palette. On a lapboard she smoothed out a double sheet of soft white buckskin; and drawing from a beaded case that hung on the left of her wide belt a long, narrow blade, she trimmed the buckskin into shape. Often she worked upon small moccasins for her small daughter. Then I became intensely interested in her designing. With a proud, beaming face, I watched her work. In [my] imagination, I saw myself walking in a new pair of snugly fitting moccasins. I felt the envious eyes of my playmates upon the pretty red beads decorating my feet.

3 Close beside my mother I sat on a rug, with a scrap of buckskin in one hand and an awl in the other. This was the beginning of my practical observation lessons in the art of beadwork. From a skein[3] of finely twisted threads of silvery sinews my mother pulled out a single one. With an awl she pierced the buckskin, and skillfully threaded it with the white sinew. Picking up the tiny beads one by one, she strung them with the point of her thread, always twisting it carefully after every stitch.

4 It took many trials before I learned how to knot my sinew thread on the point of my finger, as I saw her do. Then the next difficulty was in keeping my thread stiffly twisted, so that I could easily string my beads upon it. My mother required of me original designs for my lessons in beading. At first I frequently ensnared many a sunny hour into working a long design. Soon I learned from self-inflicted punishment to refrain from drawing complex patterns, for I had to finish whatever I began.

5 After some experience I usually drew easy and simple crosses and squares. These were some of the set forms. My original designs were not always symmetrical nor sufficiently characteristic, two faults with which my mother had little patience. The quietness of her oversight made me feel strongly responsible and dependent upon my own judgment. She treated me as a dignified little individual as long as I was on my good behavior; and how humiliated I was when some boldness of mine drew forth a rebuke from her!

---

[1]**wigwam:** hut with an arched framework of poles covered with bark, mats, or animal hides

[2]**buckskin:** leather made from the skin of a male deer

[3]**skein:** coiled length of yarn or other thread loosely wound on a reel

6 In the choice of colors she left me to my own taste. I was pleased with an outline of yellow upon a background of dark blue, or a combination of red and myrtle-green. There was another of red with a bluish-gray that was more conventionally used. When I became a little familiar with designing and the various pleasing combinations of color, a harder lesson was given me. It was the sewing on, instead of beads, some tinted porcupine quills, moistened and flattened between the nails of the thumb and forefinger. My mother cut off the prickly ends and burned them at once in the centre fire. These sharp points were poisonous, and worked into the flesh wherever they lodged. For this reason, my mother said, I should not do much alone in quills until I was as tall as my cousin Warca-Ziwin.

7 Always after these confining lessons I was wild with surplus spirits, and found joyous relief in running loose in the open again. Many a summer afternoon a party of four or five of my playmates roamed over the hills with me. We each carried a light sharpened rod about four feet long, with which we pried up certain sweet roots. When we had eaten all the choice roots we chanced upon, we shouldered our rods and strayed off into patches of a stalky plant under whose yellow blossoms we found little crystal drops of gum. Drop by drop we gathered this nature's rock-candy, until each of us could boast of a lump the size of a small bird's egg. Soon satiated with its woody flavor, we tossed away our gum, to return again to the sweet roots.

A BRIEF HISTORY OF BEADWORK IN SOUTH DAKOTA

Date	Event
1500s	The Dakota use beads made from bones, shells, stones, and animal teeth. European traders bring glass beads to North America.
Late 1600s	The Dakota begin trading with the French in Minnesota.
1830s	The Dakota begin using glass beads in clothing, artwork, and decorations in place of Native-made beads.
1862–1865	The Dakota are expelled from their homelands in Minnesota as a result of the U.S.-Dakota War.
1900s–1920s	The Dakota create items to sell outside their community.

Source: MNopedia

From "Impressions of an Indian Childhood" by Zitkala-Sa—Public Domain

49. In paragraph 1, the phrases "cool morning breezes swept freely" and "wafting the perfume of sweet grasses" affect the tone of the excerpt by suggesting

    A. the sadness that the author feels reflecting upon her former way of life.
    B. the enthusiasm with which the author approached her work indoors.
    C. the fond feelings that the author has toward her childhood experiences.
    D. the mix of emotions that the author feels toward her work and her mother.

50. The phrase "just as an artist arranges the paints upon his palette" in paragraph 2 suggests that

    E. beadwork is a true form of art.
    F. color is a source of artistic inspiration.
    G. all artistic activities begin with a series of steps.
    H. the beadworker tries to imitate art.

51. The author's use of sequence in paragraphs 1 and 2 contributes to the development of ideas in the excerpt by

    A. listing the many steps that are involved in the process of beading in order to explain its difficulty and complexity.
    B. conveying the importance of following the steps of the beading process in a precise order to work most efficiently.
    C. emphasizing the time required to fully prepare for and execute the many large and small tasks in the activity of beading.
    D. detailing each step in preparation for beading in order to highlight the author's enthusiasm for the work.

52. The details in paragraph 3 convey a central idea of the excerpt by suggesting that

    E. the author was interested in the work because she knew her mother was making something for her.
    F. the author had difficulty learning through observation but wanted to help her mother.
    G. the author was determined to behave according to her mother's standards and sought her approval.
    H. the author had great admiration for her mother's precision and mastery of her craft.

53. Which sentence **best** summarizes the process of beading that is described in the excerpt?

   A. Take a buckskin bag full of beads and spread them out on a mat in different colors like a paint palette; take a double sheet of buckskin and smooth it out on a table; take a sinew and awl and thread the beads onto the buckskin in a desired pattern.

   B. Cut the double sheet of buckskin into a shape; take a skein of sinew and pierce the buckskin with an awl; thread the sinew with beads of many different colors in a simple or complex pattern; twist the sinew to keep it tight after every stitch into the buckskin.

   C. Arrange the beads into groups of colors on a mat; smooth out a double sheet of buckskin and cut it to shape; take a single thread of sinew; pierce the buckskin with an awl; thread the buckskin with the sinew and string it with beads, carefully twisting after every stitch.

   D. Gather beads, buckskin, sinew, and awl and place them on a mat; cut the buckskin into the desired shape; decide on a pattern for the beads and create it using the sinews and the awl; thread the beads onto the sinew in the desired pattern and twist it tight.

54. The idea that mastering moccasin design and creation requires experience is **best** illustrated in the excerpt through

   E. the information about the advanced technique of incorporating porcupine quills into a design.

   F. the descriptions of the special materials that must be used to make decorated moccasins.

   G. the descriptions of the various color combinations that make an attractive moccasin design.

   H. the example of the author successfully and independently using a sharpened rod.

55. How does the author distinguish her point of view from that of her mother?

   A. by describing their techniques for knotting sinew thread (paragraph 4)

   B. by describing their approaches to beadwork design (paragraph 5)

   C. by stating her mother's instructions on working with quills (paragraph 6)

   D. by stating her mother's ideas about activities after lessons (paragraph 7)

56. Read this sentence from paragraph 7.

> **Always after these confining lessons I was wild with surplus spirits, and found joyous relief in running loose in the open again.**

Which sentence **best** describes how this sentence fits into the overall structure of the excerpt?

E. It introduces a shift from the author's demanding relationship with her mother to her more relaxed relationships with friends.

F. It signals a change from the challenging aspects of life on the reservation to the advantages of living on the prairie.

G. It highlights a contrast between the focus and control required while working and the freedom of having fun outside.

H. It concludes the progression of events in the narrative by describing the sequence of events at the end of the author's day.

57. The table after paragraph 7 expands upon a central idea in the excerpt because it shows that

A. the craft that the author was learning was a tradition that endured through many generations and changes.

B. the author's family incorporated traditional materials into their craft as a way of resisting the influence from European traders.

C. the uniqueness of the cultural tradition that the author learned as a child was eventually recognized in Europe.

D. the author was able to incorporate color into her craftwork as a result of trade with other peoples.

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Part 2 — Mathematics

57 Questions

IMPORTANT NOTES

(1) Formulas and definitions of mathematical terms and symbols are **not** provided.

(2) Diagrams other than graphs are **not** necessarily drawn to scale. Do not assume any relationship in a diagram unless it is specifically stated or can be determined from the information given.

(3) Assume that a diagram is in one plane unless the question specifically states that it is not.

(4) Graphs are drawn to scale. Unless stated otherwise, you can assume relationships according to appearance. For example, lines on a graph that appear to be parallel can be assumed to be parallel. This is also true for concurrent lines, straight lines, collinear points, right angles, etc.

(5) Reduce (simplify) all fractions to lowest terms.

GRID-IN QUESTION NOTES

(1) For each grid-in question, write your answer at the top of the grid.

(2) Begin recording your answer in the columns on the far left.

(3) Fill in the circle under the box that matches the number or symbol you wrote. Leave the negative sign bubble blank if your answer is positive.

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Grid-In Questions

Questions 58–62

DIRECTIONS: Solve each problem. On the answer sheet, write your answer in the boxes at the top of the grid. Start on the left side of each grid. Print only one number or symbol in each box. Under each box, fill in the circle that matches the number or symbol you wrote above.

- **Do not fill in a circle under an unused box.**

- **Do not leave a box blank in the middle of an answer.**

58.
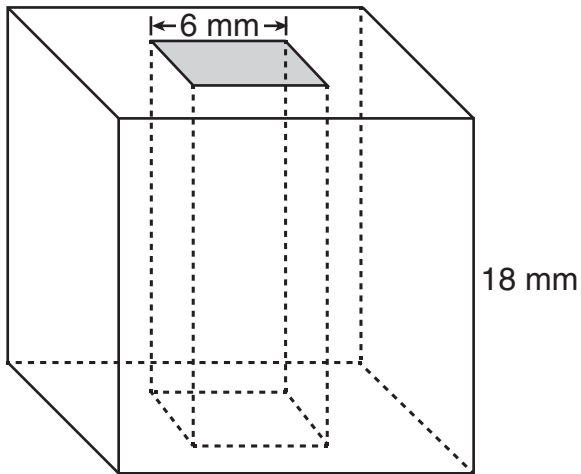
Beth makes a bead in the shape of a cube with side length 18 millimeters. She cuts a hole in the shape of a square prism out of the center of the cube so that the bead will fit on a string. The base of the square prism has a side length of 6 millimeters. After the hole is cut out, what is the volume of the bead in cubic millimeters?

59. The table shows the proportional relationship between x cups of oatmeal and y ounces of raisins in a bread recipe.

BREAD RECIPE

Cups of Oatmeal (x)	Ounces of Raisins (y)
2	1.0
3	1.5
6	3.0

What is the constant of proportionality of the number of ounces of raisins to the number of cups of oatmeal?

60. Kelly had 7.3 grams of sugar. She used 2.7 grams in her coffee. How many grams of sugar does she have left?

61. The total cost of a book is given by the expression $1.08x$, where x is the price of the book before tax. The tax rate is $m\%$. What is the value of m?

62. A row of seats in a theater contains 20 seats numbered from 101 to 120. The probability that a randomly chosen seat in this row will be numbered 104 is $x\%$. What is the value of x?

Multiple Choice Questions

Questions 63–114

DIRECTIONS: Solve each problem. Select the answer from the choices given. Mark the letter of your answer on the answer sheet. When you are solving problems, you can write in the test booklet or on the scrap paper given to you.

63. What is the prime factorization of 3,575?

   A. $5 \cdot 11 \cdot 13$

   B. $5^2 \cdot 11 \cdot 13$

   C. $5 \cdot 715$

   D. $5^2 \cdot 143$

64. If $\dfrac{x + 2y}{5} = 3y$, what is the value of x in terms of y?

   E. $\dfrac{7y}{5}$

   F. $\dfrac{13y}{5}$

   G. 13

   H. $13y$

65. What is the value of z in

$$\frac{x}{10} + \frac{y - x}{5} = \frac{z}{10}?$$

   A. 1

   B. 5

   C. y

   D. $2y - x$

66. Two sets, R and S, are described below. The sum of the elements in set R equals the sum of the elements in set S.

$$R = \{5, x, 3, 8\}$$
$$S = \{6, y, 4, 1\}$$

What is the value of $x - y$?

   E. -7

   F. -5

   G. 5

   H. 7

67. If $x = \frac{1}{4}$, what is the value of $\frac{2}{2 - x}$?

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

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

C. $1\frac{1}{7}$

D. $3\frac{1}{2}$

68. The cost of shipping a package is $12, plus $2 for each additional pound over 3 pounds. Which expression represents the total cost, in dollars, of shipping a package that weighs p pounds? Assume that $p \geq 3$.

E. $12 + 2(p + 3)$

F. $12 + 2(p - 3)$

G. $14p + 3$

H. $14p - 3$

69. Julie is at a clothing store. She wants to buy a bag for $18.75 and some T-shirts for $9.25 each. She can spend no more than $50.00. Which inequality can be used to find the number of T-shirts, x, Julie can purchase?

A. $9.25 + 18.75x \leq 50.00$

B. $9.25 + 18.75x \geq 50.00$

C. $18.75 + 9.25x \leq 50.00$

D. $18.75 + 9.25x \geq 50.00$

70. $$2x + 11 > 3x + 9$$

For what values of x is the above inequality true?

E. $x < 2$

F. $x > 2$

G. $x < 20$

H. $x > 20$

71. In a scale drawing of a triangular park, the sides measure 5 inches, 7 inches, and 8 inches. The perimeter of the actual park is 25 miles. What is the actual length of the shortest side of the park?

- **A.** 6.25 mi
- **B.** 8.75 mi
- **C.** 10 mi
- **D.** 15.625 mi

72.
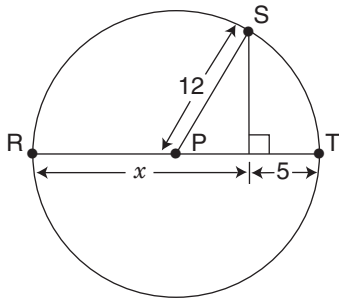
P is the center of the circle above, and R, S, and T are points on the circle. What is the value of x?

- **E.** 12
- **F.** 15
- **G.** 17
- **H.** 19

73.
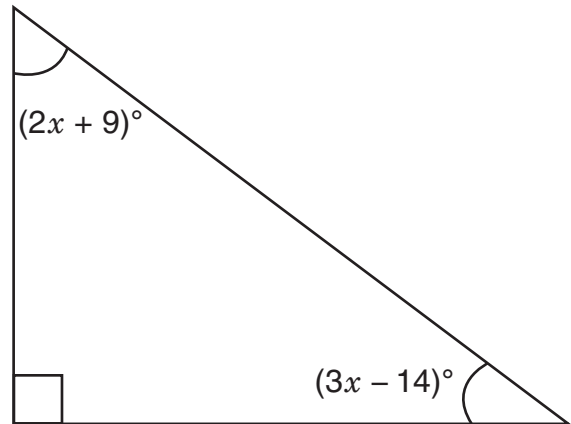
In the right triangle shown above, what is the measure of the smallest angle?

- **A.** 43°
- **B.** 44°
- **C.** 46°
- **D.** 47°

74. James must read 84 pages of a book for a class assignment. If he reads $\frac{1}{4}$ of the pages in the morning and $\frac{1}{3}$ of the **remaining** pages in the afternoon, how many pages will he still need to read?

- **E.** 35
- **F.** 42
- **G.** 45
- **H.** 56

75.

$$\frac{1}{11} + \frac{1}{22} + \frac{1}{33}$$

What is the value of the expression shown above?

A. $\frac{1}{22}$

B. $\frac{1}{11}$

C. $\frac{1}{6}$

D. $\frac{3}{22}$

76. At Midville High School, 64 students are members of either the orchestra or the choir, or both. Of these students, 38 are members of the orchestra, and 46 are members of the choir. What fraction of the total is the number of students who are members of **both** the orchestra and the choir?

E. $\frac{16}{21}$

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

G. $\frac{10}{23}$

H. $\frac{5}{16}$

77. Which of the following decimals is equivalent to $1\frac{2}{3} + 2\frac{4}{9}$?

A. $3.\overline{1}$

B. $3.\overline{6}$

C. $4.\overline{1}$

D. $4.\overline{9}$

78. The decimal 0.4 can be written as the fraction $\frac{x}{25}$. What is the value of x?

E. 0.016

F. 0.16

G. 10

H. 16

79. What is the value of $\frac{-9(-4)^2 + 36(-4) + 304}{-4}$?

A. -76

B. -4

C. 4

D. 148

80. Maxie borrowed $7.75 from her mother, $11.00 from her father, and $4.50 from her brother to purchase a video game. Her grandmother gave her $25.00 as a gift. How much money will Maxie have left or still owe if she uses the money her grandmother gave her to pay back the money she borrowed?

E. Maxie will still owe $2.25.
F. Maxie will still owe $1.75.
G. Maxie will have $1.75 left.
H. Maxie will have $2.25 left.

81. Seth grows strawberries in his garden.

- He picked $2\frac{1}{2}$ cups of strawberries on Monday.

- He picked 4 cups of strawberries on Tuesday.

- He ate $\frac{3}{4}$ cup of strawberries for breakfast each day on Wednesday, Thursday, and Friday.

How many cups of strawberries did Seth have left?

A. $3\frac{1}{2}$

B. $4\frac{1}{4}$

C. 6

D. 9

82. Which situation involves quantities that combine to equal zero?

    E. receiving $5 as a gift and then giving $5 to a friend

    F. buying a book for $10 and then buying lunch for $10

    G. getting on an elevator at the ground floor, rising 3 floors, and then rising 3 more floors

    H. starting in a cave 20 feet below the ground, climbing up 20 feet, and then climbing up 20 feet more

83.

$$\frac{\left(\dfrac{2}{3} - \dfrac{4}{5} \times \dfrac{1}{3}\right)}{\left(\dfrac{5}{3} + \dfrac{1}{4} \div \dfrac{3}{4}\right)} =$$

    A. $-\dfrac{2}{115}$

    B. $-\dfrac{1}{45}$

    C. $\dfrac{2}{9}$

    D. $\dfrac{1}{5}$

84. An athlete runs $\dfrac{1}{8}$ kilometer in $\dfrac{3}{4}$ minute. At this rate, how many kilometers would the athlete run in 1 minute?

    E. $\dfrac{3}{32}$

    F. $\dfrac{1}{6}$

    G. $1\dfrac{1}{2}$

    H. 6

85. A bus trip takes 9 hours if the mean speed is 50 miles per hour. How many hours would this trip take if the mean speed was 45 miles per hour?

    A. 8

    B. 10

    C. 12

    D. 14

86. A birdseed mixture is $\frac{2}{5}$ sunflower seeds. The cost of the sunflower seeds is $0.10 per ounce. At this rate, what is the cost of the sunflower seeds in 25 pounds of this birdseed? (Note: 1 lb = 16 oz.)

- **E.** $10.00
- **F.** $16.00
- **G.** $40.00
- **H.** $160.00

87. A robot moves forward at the rate of 9 steps every 6 seconds. If each step is x feet long, what must x be in order for the robot to travel exactly 270 feet per minute?

- **A.** 3
- **B.** 5
- **C.** 27
- **D.** 30

88. There were 36 people at Emily's party. If each person at the party drank 2 cups of juice, how many **gallons** of juice did they drink altogether?

Note: 1 gallon = 4 quarts; 1 quart = 4 cups.

- **E.** $2\frac{1}{4}$
- **F.** $4\frac{1}{2}$
- **G.** 9
- **H.** 72

89. A student reads $\frac{1}{12}$ of a book in $\frac{1}{3}$ hour. What fraction of the book can the student read in 1 hour?

- **A.** $\frac{1}{36}$
- **B.** $\frac{1}{4}$
- **C.** $\frac{5}{12}$
- **D.** $\frac{12}{3}$

90. The perimeter of square W is twice the perimeter of equilateral triangle X. What is the ratio of the length of one side of square W to the length of one side of equilateral triangle X?

E. 3:8
F. 2:3
G. 3:2
H. 2:1

91. A recipe uses $\frac{2}{3}$ cup of sugar for every $1\frac{1}{4}$ cups of flour. A cook wants to increase the recipe. How many cups of sugar are needed for each cup of flour?

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

B. $\frac{5}{6}$

C. $1\frac{7}{8}$

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

92.

READING ASSIGNMENTS

Assignment	Pages Assigned
I	3–17, inclusive
II	25–38, inclusive
III	45–60, inclusive

Over a two-week period, students are assigned a total of 250 pages to read from a science textbook. The table above shows the first three reading assignments within the larger assignment. What percentage of the 250 pages is the **total** number of pages in these first three assignments?

E. 16.8%
F. 18.0%
G. 22.8%
H. 24.0%

93. A box contains an unknown number of green marbles. An experimenter adds 100 red marbles to the box, mixes the marbles thoroughly, and then draws out 10 marbles at random. Assume that this sample is representative of the proportion in the box. If there are 2 red marbles and 8 green marbles in this sample, approximately how many green marbles are in the box?

    A. 80
    B. 300
    C. 400
    D. 500

94. A car costing $24,000 is subject to a sales tax of 8%. If Bindu made a $10,000 down payment on this car, what is the total amount she has left to pay?

    E. $14,000
    F. $15,620
    G. $15,920
    H. $25,920

95.

WINTER TEMPERATURES IN CHICAGO

Day	1	2	3	4	5	6	7
Temperature (°F)	17	7	2	4	−3	−5	1

The table above shows temperatures for a one-week period during the winter in Chicago. What is the range of temperatures shown in the table?

    A. 12
    B. 17
    C. 22
    D. 27

96.

ERRORS ON JOB TEST

Number of Applicants
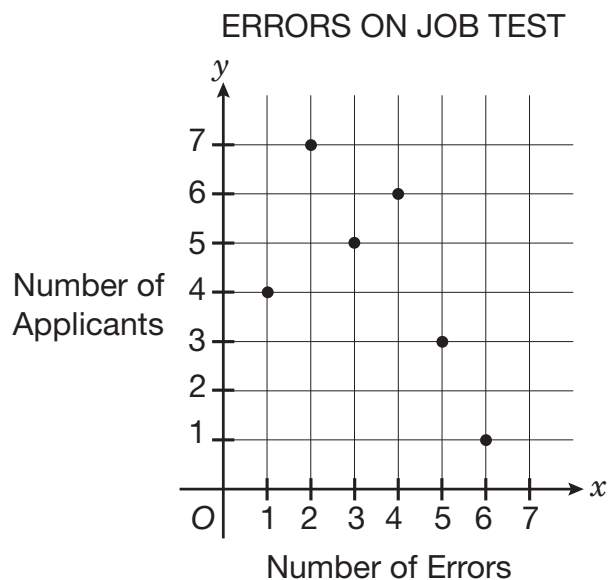
Number of Errors

A total of 26 job applicants took a computer-competency test, and the number of errors (x) was recorded for each applicant. The graph above shows how many applicants made x errors, for each value of x. How many applicants made fewer than 3 errors?

E. 6
F. 11
G. 12
H. 26

97. Last week, Emily rode the bus to school on 3 of the 5 mornings and rode the bus home on 4 of the 5 afternoons. Based on last week's events, what is the probability that Emily will ride the bus in the morning and the afternoon next Monday?

A. $\dfrac{1}{5}$

B. $\dfrac{7}{25}$

C. $\dfrac{12}{25}$

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

98. XYZ Corporation hired 6 people as summer workers. Of these 6 people, 3 will be hired as permanent employees in the fall. If 2 of the 6 people are male, how many of the possible groups of 3 people hired in the fall will include **only** 1 male?

E. 4
F. 6
G. 12
H. 24

99. At any given time, one person out of every 20 people has the common cold. Assume that the common cold can be caused by any one of 200 different viruses, each of which is equally likely to cause the cold. One of these 200 viruses is cold virus V144. What is the probability that a randomly selected person is suffering from a cold caused by virus V144?

A. $\dfrac{1}{10}$

B. $\dfrac{1}{20}$

C. $\dfrac{1}{200}$

D. $\dfrac{1}{4,000}$

100. Karl has one red spinner and one blue spinner. Each spinner is divided into 4 equal sections, numbered 1 through 4. He spins each spinner once and writes down the number that each lands on. What is the probability that the two numbers, when multiplied together, will have 4 as a product?

E. $\dfrac{1}{16}$

F. $\dfrac{3}{16}$

G. $\dfrac{4}{7}$

H. $\dfrac{7}{16}$

101. Melissa has a bag of marbles that are all the same size. The bag contains three red (R) marbles, three green (G) marbles, and two white (W) marbles. For an experiment, she will take two marbles out of the bag without looking. Which list shows the sample space for Melissa's experiment?

A. R, G, W

B. RG, RW, GW

C. R, R, R, G, G, G, W, W

D. RR, RG, RW, GG, GW, WW

102. A graph shows the relationship between the number of gallons of water, y, that has been added to a tank and the number of hours, x, that water has been added to the tank at a constant rate. What does the ordered pair (3, 24) represent?

E. Three gallons of water was added in 24 hours.

F. Three gallons of water was added per hour.

G. Twenty-four gallons of water was added in 3 hours.

H. Twenty-four gallons of water was added per hour.

103. The table shows the probabilities of a hockey team scoring different numbers of goals in a game.

HOCKEY GOAL PROBABILITIES

Number of Goals	Probability
0	0.16
1	0.21
2	0.29
3	0.21
4	0.09
5	0.04

What is the probability that the team will score three or more goals in the next game?

A. 0.13
B. 0.21
C. 0.34
D. 0.50

104. This graph shows points that represent a proportional relationship between x and y.
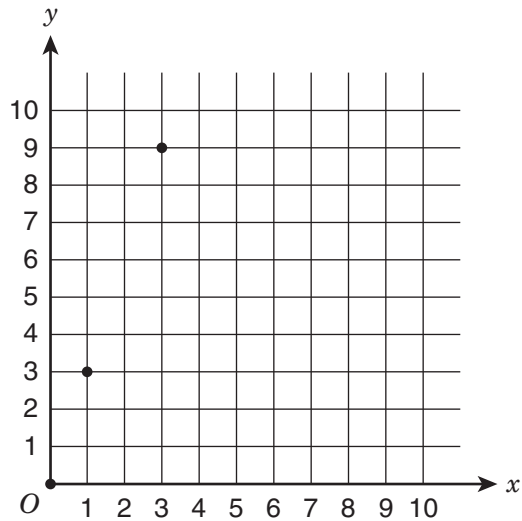
What is the constant of proportionality for this relationship?

E. 0

F. 1

G. 3

H. 9

105. The distance an eagle flies is proportional to the time the eagle spends flying. An eagle flies 90 miles in 3 hours. What is the constant of proportionality for this relationship?

A. 3

B. 30

C. 60

D. 90

106. A machine part is supposed to be 0.38 millimeters thick. The manufacturer allows a variation of −2.5% to +2.5%. Which interval shows the range of acceptable thicknesses, in millimeters, for the part?

E. 0.285–0.475

F. 0.355–0.405

G. 0.3705–0.3895

H. 0.3724–0.3876

107. A bakery charges $1.25 for each cupcake and $2.50 for a serving tray. The equation describes p, the price of c cupcakes and a serving tray, not including tax.

$$p = 2.50 + 1.25c$$

If Samantha bought some cupcakes and a serving tray for a total of $22.50, not including tax, how many cupcakes did she buy?

A. 4

B. 9

C. 16

D. 18

108. A clothing store buys shirts for a cost of m dollars each. To determine the selling price of the shirts, the manager increases the purchase cost by 55%. Which expression represents the selling price of each shirt?

E. $0.45m$

F. $0.55m$

G. $1.55m$

H. $m + 0.55$

109. A farmer has 100 apples and will eat 2 apples per day. Is there a proportional relationship between the number of apples remaining and the number of days that have passed?

A. no, because the relationship does not include 99 as a number of apples

B. no, because the ordered pair (0, 0) is not part of the relationship

C. yes, because all the values in the relationship are even

D. yes, because the number of apples is decreasing at a constant rate

110.

6 in.

2 in.

2 in.
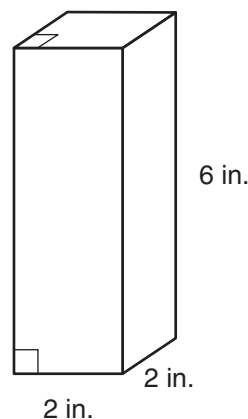
What shape will result from a horizontal slice of the figure above?

E. a square that has 2-inch sides
F. a triangle that has 2-inch sides
G. a rectangle that has a 2-inch side and a 6-inch side
H. a triangle that has one 2-inch side and two 6-inch sides

111. Anise has a piece of cloth measuring 45 inches by 75 inches. She wants to cut it into squares of equal size, without any cloth left over. What is the **greatest** possible side length, in inches, of one of those squares?

A. 3
B. 5
C. 15
D. 45

112. This table shows the number of birds that came to a bird feeder on Monday and Tuesday.

BIRDS AT BIRD FEEDER

Day	Number of Birds
Monday	30
Tuesday	24

What was the percent decrease in the number of birds from Monday to Tuesday?

E. 6%

F. 20%

G. 24%

H. 25%

113. A team is participating in a contest to collect canned goods for a food drive. The team has 53 points and must have a total of at least 100 points to win a prize. The team earns 5 points for each can of food a member collects. Which inequality can be used to find x, the number of cans of food the team needs to collect to win a prize?

A. $5 + 53x \leq 100$

B. $5 + 53x \geq 100$

C. $53 + 5x \leq 100$

D. $53 + 5x \geq 100$

114. A store manager purchases a piece of furniture for $456.00. To determine the selling price, the manager increases the purchase cost by 125%. A customer buys the furniture and pays an additional 8% sales tax. How much does the customer pay for the furniture?

E. $615.60

F. $627.48

G. $1,108.08

H. $1,846.80

THIS IS THE END OF THE TEST.
IF TIME REMAINS, YOU SHOULD CHECK YOUR ANSWERS. BE SURE THAT THERE ARE NO STRAY MARKS, PARTIALLY FILLED ANSWER CIRCLES, OR INCOMPLETE ERASURES ON YOUR ANSWER SHEET. ■

You can read explanations for each answer online here. If you are in 9th grade, you can find examples of additional types of math topics you might see on your test, here.

Answer Key for Sample Form B

1. D	14. G	27. B	40. F	53. C	66. F	79. B	92. F	105. B
2. G	15. D	28. G	41. A	54. E	67. C	80. G	93. C	106. G
3. D	16. F	29. B	42. F	55. B	68. F	81. B	94. G	107. C
4. F	17. B	30. H	43. B	56. G	69. C	82. E	95. C	108. G
5. C	18. F	31. A	44. G	57. A	70. E	83. D	96. F	109. B
6. F	19. D	32. E	45. D	58. 5184	71. A	84. F	97. C	110. E
7. D	20. H	33. D	46. F	59. 0.5	72. H	85. B	98. G	111. C
8. H	21. B	34. G	47. A	60. 4.6	73. A	86. F	99. D	112. F
9. C	22. G	35. A	48. G	61. 8	74. F	87. A	100. F	113. D
10. F	23. C	36. E	49. C	62. 5	75. C	88. F	101. D	114. G
11. A	24. E	37. D	50. E	63. B	76. H	89. B	102. G	
12. E	25. D	38. E	51. D	64. H	77. C	90. G	103. C	
13. C	26. G	39. B	52. H	65. D	78. G	91. A	104. G	

2022

NEW YORK CITY PUBLIC SCHOOLS
SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST
GRADE 8

USE A PENCIL ONLY

SIDE 1

8

1. STUDENT STATEMENT: I am a New York City resident. I am in Grade 8. This is a test for students in grade 8. I understand that if I take the test at the wrong grade level, my score will not be able to be used for placement in the specialized high schools. I am well enough to take this test and complete it. If I do not feel well, I will notify the teacher. I understand that once I break the seal of the test booklet, I may not be eligible for a make-up test.

Signature (full name - include your first and last name): _____

2. TODAY'S DATE: _____
  Month   Day   Year

3. DATE OF BIRTH: _____
  Month   Day   Year

CAREFULLY RECORD YOUR NAME, DATE OF BIRTH, INFORMATION ABOUT THE SCHOOL WHERE YOU ARE NOW ENROLLED, AND STUDENT ID NUMBER. USE A PENCIL ONLY. INCORRECT MARKS MAY DELAY THE SCORING OF YOUR ANSWER SHEET.

4. FIRST NAME (please print)

MI

LAST NAME (surname) (please print)

5. SCHOOL CURRENTLY ENROLLED

NAME OF SCHOOL

School Code

(P) Fill in for private or parochial schools only

6. DATE OF BIRTH

Month	Day	Year

JAN ① ⑪ ㉑ ⑳ ⓪ ⓪
FEB ② ⑫ ㉒ ① ①
MAR ③ ⑬ ㉓ ② ②
APR ④ ⑭ ㉔ ③ ③
MAY ⑤ ⑮ ㉕ ④ ④
JUN ⑥ ⑯ ㉖ ⑤ ⑤
JUL ⑦ ⑰ ㉗ ⑥ ⑥
AUG ⑧ ⑱ ㉘ ⑦ ⑦
SEP ⑨ ⑲ ㉙ ⑧ ⑧
OCT ⑩ ⑳ ㉚ ⑨ ⑨
NOV ㉛
DEC

7. STUDENT ID NUMBER

8. BOOKLET LETTER AND NUMBER

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NEW YORK CITY PUBLIC SCHOOLS
2022 SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST
GRADE 8

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SIDE 2

Test Booklet Letter   Test Booklet Number

Student's First Name (please print)   Student's Last Name (please print)

PART 1   ENGLISH LANGUAGE ARTS

1 Ⓐ Ⓑ Ⓒ Ⓓ	16 Ⓔ Ⓕ Ⓖ Ⓗ	31 Ⓐ Ⓑ Ⓒ Ⓓ	46 Ⓔ Ⓕ Ⓖ Ⓗ
2 Ⓔ Ⓕ Ⓖ Ⓗ	17 Ⓐ Ⓑ Ⓒ Ⓓ	32 Ⓔ Ⓕ Ⓖ Ⓗ	47 Ⓐ Ⓑ Ⓒ Ⓓ
3 Ⓐ Ⓑ Ⓒ Ⓓ	18 Ⓔ Ⓕ Ⓖ Ⓗ	33 Ⓐ Ⓑ Ⓒ Ⓓ	48 Ⓔ Ⓕ Ⓖ Ⓗ
4 Ⓔ Ⓕ Ⓖ Ⓗ	19 Ⓐ Ⓑ Ⓒ Ⓓ	34 Ⓔ Ⓕ Ⓖ Ⓗ	49 Ⓐ Ⓑ Ⓒ Ⓓ
5 Ⓐ Ⓑ Ⓒ Ⓓ	20 Ⓔ Ⓕ Ⓖ Ⓗ	35 Ⓐ Ⓑ Ⓒ Ⓓ	50 Ⓔ Ⓕ Ⓖ Ⓗ
6 Ⓔ Ⓕ Ⓖ Ⓗ	21 Ⓐ Ⓑ Ⓒ Ⓓ	36 Ⓔ Ⓕ Ⓖ Ⓗ	51 Ⓐ Ⓑ Ⓒ Ⓓ
7 Ⓐ Ⓑ Ⓒ Ⓓ	22 Ⓔ Ⓕ Ⓖ Ⓗ	37 Ⓐ Ⓑ Ⓒ Ⓓ	52 Ⓔ Ⓕ Ⓖ Ⓗ
8 Ⓔ Ⓕ Ⓖ Ⓗ	23 Ⓐ Ⓑ Ⓒ Ⓓ	38 Ⓔ Ⓕ Ⓖ Ⓗ	53 Ⓐ Ⓑ Ⓒ Ⓓ
9 Ⓐ Ⓑ Ⓒ Ⓓ	24 Ⓔ Ⓕ Ⓖ Ⓗ	39 Ⓐ Ⓑ Ⓒ Ⓓ	54 Ⓔ Ⓕ Ⓖ Ⓗ
10 Ⓔ Ⓕ Ⓖ Ⓗ	25 Ⓐ Ⓑ Ⓒ Ⓓ	40 Ⓔ Ⓕ Ⓖ Ⓗ	55 Ⓐ Ⓑ Ⓒ Ⓓ
11 Ⓐ Ⓑ Ⓒ Ⓓ	26 Ⓔ Ⓕ Ⓖ Ⓗ	41 Ⓐ Ⓑ Ⓒ Ⓓ	56 Ⓔ Ⓕ Ⓖ Ⓗ
12 Ⓔ Ⓕ Ⓖ Ⓗ	27 Ⓐ Ⓑ Ⓒ Ⓓ	42 Ⓔ Ⓕ Ⓖ Ⓗ	57 Ⓐ Ⓑ Ⓒ Ⓓ
13 Ⓐ Ⓑ Ⓒ Ⓓ	28 Ⓔ Ⓕ Ⓖ Ⓗ	43 Ⓐ Ⓑ Ⓒ Ⓓ	
14 Ⓔ Ⓕ Ⓖ Ⓗ	29 Ⓐ Ⓑ Ⓒ Ⓓ	44 Ⓔ Ⓕ Ⓖ Ⓗ	
15 Ⓐ Ⓑ Ⓒ Ⓓ	30 Ⓔ Ⓕ Ⓖ Ⓗ	45 Ⓐ Ⓑ Ⓒ Ⓓ	

PART 2   MATHEMATICS

Grid-in items: 58, 59, 60, 61, 62 (each with sign column and digits 0–9 in four columns)

63 Ⓐ Ⓑ Ⓒ Ⓓ	76 Ⓔ Ⓕ Ⓖ Ⓗ	89 Ⓐ Ⓑ Ⓒ Ⓓ	102 Ⓔ Ⓕ Ⓖ Ⓗ
64 Ⓔ Ⓕ Ⓖ Ⓗ	77 Ⓐ Ⓑ Ⓒ Ⓓ	90 Ⓔ Ⓕ Ⓖ Ⓗ	103 Ⓐ Ⓑ Ⓒ Ⓓ
65 Ⓐ Ⓑ Ⓒ Ⓓ	78 Ⓔ Ⓕ Ⓖ Ⓗ	91 Ⓐ Ⓑ Ⓒ Ⓓ	104 Ⓔ Ⓕ Ⓖ Ⓗ
66 Ⓔ Ⓕ Ⓖ Ⓗ	79 Ⓐ Ⓑ Ⓒ Ⓓ	92 Ⓔ Ⓕ Ⓖ Ⓗ	105 Ⓐ Ⓑ Ⓒ Ⓓ
67 Ⓐ Ⓑ Ⓒ Ⓓ	80 Ⓔ Ⓕ Ⓖ Ⓗ	93 Ⓐ Ⓑ Ⓒ Ⓓ	106 Ⓔ Ⓕ Ⓖ Ⓗ
68 Ⓔ Ⓕ Ⓖ Ⓗ	81 Ⓐ Ⓑ Ⓒ Ⓓ	94 Ⓔ Ⓕ Ⓖ Ⓗ	107 Ⓐ Ⓑ Ⓒ Ⓓ
69 Ⓐ Ⓑ Ⓒ Ⓓ	82 Ⓔ Ⓕ Ⓖ Ⓗ	95 Ⓐ Ⓑ Ⓒ Ⓓ	108 Ⓔ Ⓕ Ⓖ Ⓗ
70 Ⓔ Ⓕ Ⓖ Ⓗ	83 Ⓐ Ⓑ Ⓒ Ⓓ	96 Ⓔ Ⓕ Ⓖ Ⓗ	109 Ⓐ Ⓑ Ⓒ Ⓓ
71 Ⓐ Ⓑ Ⓒ Ⓓ	84 Ⓔ Ⓕ Ⓖ Ⓗ	97 Ⓐ Ⓑ Ⓒ Ⓓ	110 Ⓔ Ⓕ Ⓖ Ⓗ
72 Ⓔ Ⓕ Ⓖ Ⓗ	85 Ⓐ Ⓑ Ⓒ Ⓓ	98 Ⓔ Ⓕ Ⓖ Ⓗ	111 Ⓐ Ⓑ Ⓒ Ⓓ
73 Ⓐ Ⓑ Ⓒ Ⓓ	86 Ⓔ Ⓕ Ⓖ Ⓗ	99 Ⓐ Ⓑ Ⓒ Ⓓ	112 Ⓔ Ⓕ Ⓖ Ⓗ
74 Ⓔ Ⓕ Ⓖ Ⓗ	87 Ⓐ Ⓑ Ⓒ Ⓓ	100 Ⓔ Ⓕ Ⓖ Ⓗ	113 Ⓐ Ⓑ Ⓒ Ⓓ
75 Ⓐ Ⓑ Ⓒ Ⓓ	88 Ⓔ Ⓕ Ⓖ Ⓗ	101 Ⓐ Ⓑ Ⓒ Ⓓ	114 Ⓔ Ⓕ Ⓖ Ⓗ