2016

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

USE A PENCIL ONLY

SIDE 1
8

1. STUDENT STATEMENT: I am well enough to take this test and complete it. I understand that once I break the seal of the test booklet, I may not be eligible for a make-up test. I am a New York City resident and a Grade 8 student taking a Grade 8 test. I understand that a student who is not a New York City resident, who takes the test more than once in a given school year, or who takes the test at the wrong grade level will be disqualified from acceptance to any of the specialized high schools.

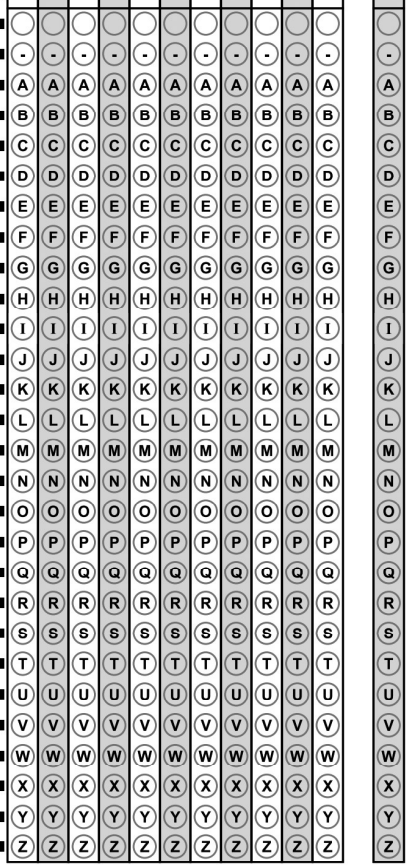
Signature (full name, first name first): _____

2. TODAY'S DATE: _____ (Month / Day / Year)

3. DATE OF BIRTH: _____ (Month / Day / Year)

CAREFULLY RECORD YOUR NAME, SCHOOL CHOICES, INFORMATION ABOUT THE SCHOOL WHERE YOU ARE NOW ENROLLED, DATE OF BIRTH, 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. CHOICES OF SPECIALIZED HIGH SCHOOLS

Indicate your school choice in order of preference.
- Fill in only one school for each choice.
- You **must** fill in a first choice school.
- Fill in only one circle in a row and only one circle in a column.

School choices indicated on the answer sheet are final.

SCHOOLS	CHOICES: 1st choice	2nd choice	3rd choice	4th choice	5th choice	6th choice	7th choice	8th choice
Bronx Science	○	○	○	○	○	○	○	○
Brooklyn Latin	○	○	○	○	○	○	○	○
Brooklyn Tech	○	○	○	○	○	○	○	○
HS Math, Sci., & Engineering	○	○	○	○	○	○	○	○
HS American Studies/Lehman	○	○	○	○	○	○	○	○
Queens Sci./York	○	○	○	○	○	○	○	○
Staten Island Tech	○	○	○	○	○	○	○	○
Stuyvesant	○	○	○	○	○	○	○	○

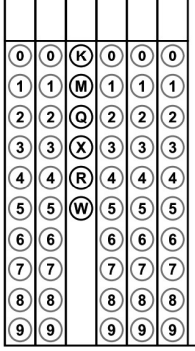
6. DATE OF BIRTH

Month	Day	Year
JAN	1 11 21	19 0 0
FEB	2 12 22	20 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. SCHOOL WHERE YOU ARE NOW ENROLLED

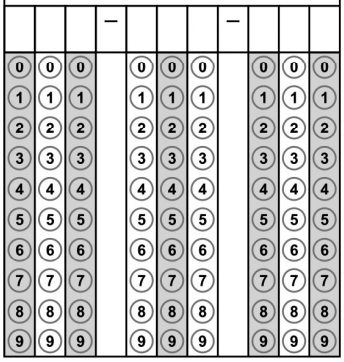
NAME OF SCHOOL _____

School Code

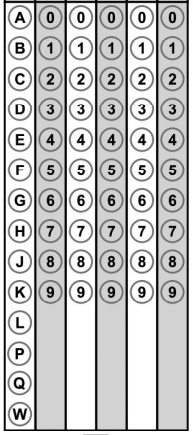


(P) Fill in for private or parochial schools only

8. STUDENT ID NUMBER



9. BOOKLET LETTER AND NUMBER



NEW YORK CITY PUBLIC SCHOOLS

USE A PENCIL ONLY

SIDE 2

2016 SPECIALIZED HIGH SCHOOLS ADMISSIONS TEST

GRADE 8

Test Booklet Letter Test Booklet Number

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

PART 1 VERBAL

SCRAMBLED PARAGRAPHS

Paragraph 1

The second sentence is	Q	R	S	T	U
The third sentence is	Q	R	S	T	U
The fourth sentence is	Q	R	S	T	U
The fifth sentence is	Q	R	S	T	U
The sixth sentence is	Q	R	S	T	U

Paragraph 2

The second sentence is	Q	R	S	T	U
The third sentence is	Q	R	S	T	U
The fourth sentence is	Q	R	S	T	U
The fifth sentence is	Q	R	S	T	U
The sixth sentence is	Q	R	S	T	U

Paragraph 3

The second sentence is	Q	R	S	T	U
The third sentence is	Q	R	S	T	U
The fourth sentence is	Q	R	S	T	U
The fifth sentence is	Q	R	S	T	U
The sixth sentence is	Q	R	S	T	U

Paragraph 4

The second sentence is	Q	R	S	T	U
The third sentence is	Q	R	S	T	U
The fourth sentence is	Q	R	S	T	U
The fifth sentence is	Q	R	S	T	U
The sixth sentence is	Q	R	S	T	U

Paragraph 5

The second sentence is	Q	R	S	T	U
The third sentence is	Q	R	S	T	U
The fourth sentence is	Q	R	S	T	U
The fifth sentence is	Q	R	S	T	U
The sixth sentence is	Q	R	S	T	U

LOGICAL REASONING

11	A	B	C	D	E
12	F	G	H	J	K
13	A	B	C	D	E
14	F	G	H	J	K
15	A	B	C	D	E
16	F	G	H	J	K
17	A	B	C	D	E
18	F	G	H	J	K
19	A	B	C	D	E
20	F	G	H	J	K

READING

21	A	B	C	D	E
22	F	G	H	J	K
23	A	B	C	D	E
24	F	G	H	J	K
25	A	B	C	D	E
26	F	G	H	J	K
27	A	B	C	D	E
28	F	G	H	J	K
29	A	B	C	D	E
30	F	G	H	J	K
31	A	B	C	D	E
32	F	G	H	J	K
33	A	B	C	D	E
34	F	G	H	J	K
35	A	B	C	D	E
36	F	G	H	J	K
37	A	B	C	D	E
38	F	G	H	J	K
39	A	B	C	D	E
40	F	G	H	J	K
41	A	B	C	D	E
42	F	G	H	J	K
43	A	B	C	D	E
44	F	G	H	J	K
45	A	B	C	D	E
46	F	G	H	J	K
47	A	B	C	D	E
48	F	G	H	J	K
49	A	B	C	D	E
50	F	G	H	J	K

PART 2 MATHEMATICS

MATHEMATICS PROBLEMS

51	A	B	C	D	E
52	F	G	H	J	K
53	A	B	C	D	E
54	F	G	H	J	K
55	A	B	C	D	E
56	F	G	H	J	K
57	A	B	C	D	E
58	F	G	H	J	K
59	A	B	C	D	E
60	F	G	H	J	K
61	A	B	C	D	E
62	F	G	H	J	K
63	A	B	C	D	E
64	F	G	H	J	K
65	A	B	C	D	E
66	F	G	H	J	K
67	A	B	C	D	E
68	F	G	H	J	K
69	A	B	C	D	E
70	F	G	H	J	K
71	A	B	C	D	E
72	F	G	H	J	K
73	A	B	C	D	E
74	F	G	H	J	K
75	A	B	C	D	E
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78	F	G	H	J	K
79	A	B	C	D	E
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83	A	B	C	D	E
84	F	G	H	J	K
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90	F	G	H	J	K
91	A	B	C	D	E
92	F	G	H	J	K
93	A	B	C	D	E
94	F	G	H	J	K
95	A	B	C	D	E
96	F	G	H	J	K
97	A	B	C	D	E
98	F	G	H	J	K
99	A	B	C	D	E
100	F	G	H	J	K

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READING

QUESTIONS 21-50

DIRECTIONS: Read each passage below and answer the questions following it. Base your answers **on information contained only in the passage.** You may reread a passage if you need to. Mark the **best** answer for each question.

On Monday evening, September 26, 1960, seventy million Americans turned on their TV sets to view the first televised political debate in a campaign for the presidency of the United States. As of that date, it was by far the largest number ever to witness a political discussion. The novelty of the event drew even those with little or no interest in politics.

The candidates, Republican Vice President Richard M. Nixon and Democratic Senator John F. Kennedy, had agreed to face each other and the nation in four one-hour sessions that the press dubbed the "Great Debates." Many expected Vice President Nixon to win the debates easily. He was ahead in the newspaper polls, he was an experienced public speaker, and he had served as vice president for nearly eight years. Senator Kennedy was less well-known and, at forty-three, was the youngest man ever to run for president. Throughout the presidential race, his opponents criticized him for his relative youth and inexperience.

By mutual agreement, the first session was limited to domestic issues within the United States. Each candidate was given eight minutes to make his opening remarks. During the remainder of the hour, the candidates took turns responding to questions posed by selected reporters. Both Kennedy and Nixon dealt with the issues calmly and carefully. Viewers who expected to see a free-for-all were disappointed. The way the two men appeared on the television screen, however, may have been as important as what they said. Kennedy looked at the camera while answering questions, appearing to speak directly to his viewers and give them straight answers. Nixon was recovering from a severe bout of influenza, and he appeared tense and tired. He looked at the reporters who asked the questions instead of at the camera, giving some viewers the impression that he avoided eye contact with his audience, and thus suggesting that he was not trustworthy. Most commentators agreed that Kennedy gained from the encounter: many viewers who had previously felt he lacked the maturity necessary to be president were won over by his charm, poise, and confident manner.

While far fewer people watched the three later sessions, much discussion ensued regarding the influence of the Great Debates on the outcome of the 1960 presidential election. Some feared that the better TV performer was bound to come across as being the better candidate. "Is this a good way to judge a person's ability to serve as president of the United States?" they asked.

Kennedy ultimately won the election, but it was by the narrowest popular vote margin in more than eighty years. Some observers concluded that, had the Great Debates been broadcast on radio and not on television, Nixon would have won.

CONTINUE ON TO THE NEXT PAGE ▶

21. Which of the following best tells what this passage is about?

- **A.** the careers of Nixon and Kennedy
- **B.** how elections have changed since 1960
- **C.** domestic issues in the Kennedy-Nixon debates
- **D.** the presidential debates of 1960
- **E.** the qualifications of Nixon and Kennedy

22. According to the passage, which of the following would have been the most likely result if the candidates had **not** debated on television in 1960?

- **F.** Kennedy would have won the election anyway.
- **G.** The election results would have been much closer.
- **H.** Nixon would have had a better chance of winning the election.
- **J.** The candidates would not have debated at all.
- **K.** Nixon would have improved his on-screen performance.

23. Which of the following did critics in 1960 think could be an undesirable consequence of presidential debates on television?

- **A.** Candidates might no longer utilize other media to get their messages across.
- **B.** By being too cautious on television, candidates might fail to debate the issues seriously.
- **C.** Appearing on television might take up too much of a candidate's time.
- **D.** Americans might be persuaded to vote for a presidential candidate because of their television performance.
- **E.** Americans who did not watch every debate might not be fully informed about the candidates' stands.

24. According to the passage, how did Kennedy benefit from the debates?

- **F.** His grasp of domestic issues was shown to be superior to Nixon's.
- **G.** The debates focused on his years of experience in the Senate.
- **H.** He appeared to have attractive personal characteristics.
- **J.** He maintained eye contact with the reporters asking the questions.
- **K.** Nixon was seen as a superficial TV performer.

25. What evidence does the author provide to support the last sentence of the passage?

- **A.** Far fewer people watched the three later debates.
- **B.** Both candidates dealt with the issues calmly and carefully.
- **C.** The candidates did not cause a free-for-all.
- **D.** The first debate session was limited to domestic issues.
- **E.** Nixon was more experienced and well-known than Kennedy.

26. According to the passage, why did people who were not normally interested in politics tune in to the first of the Great Debates?

- **F.** Vice President Nixon was a popular politician.
- **G.** Television had never before been used in this way.
- **H.** They had heard that Kennedy was young and charismatic.
- **J.** They wanted to see if the newspaper polls were correct.
- **K.** The election was expected to be very close.

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In many cultures, the ugly physical appearance of the bat has given it an unearned reputation as an evil and vicious bearer of diseases. Many people, for example, believe that the little brown bat carries rabies. In fact, it is no more likely to transmit the disease than other animals, such as dogs. Brown bats actually help to prevent disease, not spread it. The basis of their diet is the mosquito, an insect that transmits more diseases than all the bats in the world combined.

A group of bat species known as flying foxes or fruit bats serve another important purpose, as a critical link in the reproduction of many tropical trees and shrubs. In the tropical rain forests of Africa, Asia, and Australia, plants such as avocadoes, date trees, cashews, and mangoes rely in part on flying foxes for pollination. One of Africa's most valuable hardwood trees, the iroko, is entirely dependent on this type of bat for pollination. Flying foxes feed on flowers, fruit, and nectar, flying from one plant to another and pollinating the plants as they go, much as bees do in other parts of the world. Because they are sloppy eaters, flying foxes drop fruit as they go, dispersing the seeds. They can travel great distances and convey pollen and seeds far from their origins, thereby maintaining the genetic biodiversity within a plant species.

Because of the importance of bats' role in pollination and seed distribution, scientists consider them a keystone in the ecosystems of tropical rain forests. Without bats, many bat-pollinated plants—and the animals that depend on them for food and shelter—would be threatened to the point of extinction. Areas outside the rain forests would be impacted as well, since the rain forests' lush vegetation replenishes the oxygen in the global atmosphere.

Unfortunately, many people are determined to get rid of bats. Flying foxes are at particular risk. In the wild, they feed on wild fruit, but when their rain forest habitat is reduced by conversion into farmland or residential areas, they occasionally raid cultivated fruit trees, spoiling the crops. Several flying fox species have been hunted to extinction, while others are seriously endangered.

Conservation groups and government agencies in many countries are attempting to change people's attitudes toward bats. When people learn that bats pollinate the trees and crops that provide their livelihood, they are more likely to appreciate and protect the bats in their area. There are also effective, non-harmful ways to deal with troublesome bats. Orchard owners can cover their trees with netting to discourage the bats, and there are humane methods for moving bats from places where they are not wanted. For the sake of the rain forests, and for life forms everywhere that depend on them, it is urgent that people apply a new twist to an old adage, and realize that ugliness is only skin deep.

27. Which of the following best tells what this passage is about?

- **A.** why plant species in the tropical rain forest are becoming endangered
- **B.** how the misunderstood bat benefits other life forms
- **C.** why rain forests are an important world resource
- **D.** how bats spread rabies and other diseases
- **E.** how bats pollinate tropical plants

28. What does the author intend to convey by the statement "ugliness is only skin deep" (line 70)?

- **F.** Some ugly animals eventually become beautiful.
- **G.** Bats are not as ugly as most people think.
- **H.** People shouldn't think that bats are harmful simply because they are ugly.
- **J.** People who find bats ugly do not believe that bats have an important environmental role.
- **K.** Beneficial animals are often considered ugly.

CONTINUE ON TO THE NEXT PAGE ►

29. Which of the following best describes animal species that function as a "keystone" (line 35)?

A. They are a major factor in disease prevention.
B. They are a food source for other animals.
C. They pollinate every plant species.
D. They are crucial in maintaining the balance of their ecosystem.
E. They generate the oxygen in the atmosphere.

30. What would be the most immediate result if flying foxes became extinct?

F. Other animal species would take their place.
G. Tropical rain forests would become free of disease.
H. Many animals would lose a food source.
J. Many tropical plants would have difficulty with reproduction.
K. The oxygen in the atmosphere would be quickly used up.

31. Why do flying foxes sometimes eat fruit from cultivated fruit trees?

A. They prefer eating cultivated fruit to wild fruit.
B. They are better able to spread pollen from cultivated fruit trees.
C. The number of wild fruit trees has decreased.
D. Cultivated fruit trees are completely dependent on bats for pollination.
E. Declining mosquito populations can no longer feed the bats.

32. What is the most likely reason that the author mentioned the iroko tree?

F. to provide an example of a useful plant that would die out without flying foxes
G. to demonstrate that there are alternate ways to pollinate tropical plants
H. to illustrate how rain forests supply oxygen to the atmosphere
J. to show what flying foxes will do when wild fruit trees are unavailable
K. to encourage farmers to cover their trees with netting

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Anyone who has watched TV news coverage of a hurricane has seen how destructive wind energy can be. But the power of the wind can also be put to constructive use. From sailboats to old-fashioned windmills to the high-tech, modern wind machines called turbines, people have devised ways to harness wind energy for thousands of years.

The first known attempt to use wind power was the sailboat. Ancient shipbuilders understood how to use forces like lift and momentum, even if they could not explain those forces scientifically. The principles behind sailing led to the development of the windmill. The first known windmills originated in Persia, an area that is now Iran, as early as A.D. 500. They were created to help with the demanding chores of grinding grain and pumping water. By the tenth century, windmills were used throughout central Asia; they were used in China as early as the thirteenth century.

In Europe, windmills came into widespread use during the twelfth century. As in other parts of the world, they were used for milling grain and pumping water. Windmills replaced the water wheel, which was turned by the movement of running water over paddles mounted around a wheel. The windmill was more adaptable and efficient than the water wheel and quickly became popular. For example, Holland, famous for its windmills, used the machines to pump seawater away from low-lying coastal bogs. This allowed the Dutch to reclaim large areas of land from the sea. Windmills eventually became sophisticated enough for use in a broad range of work, from sawmills and drainage pumping to processing goods such as dyes, tobacco, cocoa, and spices.

In the 1700s, as steam engines gained in popularity, the use of wind machines for many types of work declined. However, windmills still played an essential role in pumping water on farms throughout the American West and Midwest. Between 1850 and 1970, over six million small windmills were installed on American farms for watering livestock and meeting other water needs. In many remote areas even today, livestock production would be impossible without the use of windmills to provide water.

Beginning in the late nineteenth century, windmills were adapted to generate electricity. During the 1930s and '40s, thin-bladed windmills provided electricity for hundreds of thousands of farms across the United States. By the 1950s, however, power lines connected almost every household in America to a central power source, such as a utility company. After that, there was little need for wind turbines until the energy crisis of the 1970s. At that time, interest in wind turbines was renewed due to rising energy costs and concern about the future availability of fossil fuels such as oil, coal, and natural gas. The last several decades have seen the development of "wind farms," clusters of wind turbines that generate electricity. Efficient, clean, and fairly inexpensive to operate, wind farms may prove to be as important in the future as earlier windmills were in the past.

33. Which of the following best tells what this passage is about?

- **A.** the destructive power of wind energy
- **B.** the ways people have harnessed wind power throughout history
- **C.** reasons for developing wind farms to generate electricity
- **D.** how windmills are used in the United States
- **E.** the use of the windmill in the present day

34. Where were the first known windmills built?

- **F.** Persia
- **G.** North America
- **H.** Europe
- **J.** China
- **K.** Holland

CONTINUE ON TO THE NEXT PAGE ▶

35. Which of the following best expresses the author's opinion regarding the future use of wind energy?

A. Wind farms will someday be the only source of electricity in the United States.
B. Wind farms will not be successful in providing large amounts of electricity.
C. A new energy source will be discovered that will diminish interest in wind farming.
D. Wind farms will become an important source of electricity in the United States.
E. Different energy sources will be developed because wind farming is too expensive.

36. The adaptation of old-fashioned water-pumping windmills into wind turbines that generate electricity illustrates

F. that modern technology is no improvement over ancient technology.
G. the inability of people to develop new solutions.
H. how wind power will eventually replace all other energy sources.
J. that water cannot be used to produce electricity.
K. the ability of people to think creatively.

37. Why were fewer American farms dependent on windmills for electrical power after the 1950s?

A. Windmills were not used for any purpose after that time.
B. The energy crisis had prompted interest in other fuel sources.
C. The energy crisis had stopped the development of wind turbines.
D. A centralized power system had connected almost all American homes.
E. Wind farms had replaced the need for individual windmills.

38. According to the passage, how did windmills aid the growth of the country of Holland?

F. Windmills helped Dutch shipbuilders use the forces of lift and momentum.
G. By pumping seawater out, the Dutch turned bogs into usable land.
H. Windmills made the country of Holland famous.
J. By pumping seawater, the Dutch flooded coastal bogs in order to improve ship travel.
K. In Holland, windmills led to the use of water wheels.

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The decade that began with the stock market crash in 1929 and ended with the declaration of war in Europe in 1939 was a turning point for art in the United States. Rejecting European trends, such as abstract art, American painters searched for a style that was distinctly American. It was a time of great social change—a society based on rural and small town life was rapidly being replaced by a society focused on city life and values. Although members of various groups are all referred to as "American Scene" painters, different groups painted their images of the United States in very different ways.

One group, sometimes called the Regionalists, included Thomas Hart Benton, Grant Wood, and John Steuart Curry, all from the Midwest. Their art was intensely patriotic and frequently glorified an older, simpler America. Their subject matter included church steeples, New England fishing villages, and midwestern cornfields. Grant Wood's most famous canvas is probably *American Gothic*, which shows a stiff and proper farm couple, the husband holding a pitchfork. The Regionalists were often muralists as well, painting local scenes on walls of state capitols and other public buildings. Enormously popular during the 1930s, Regionalist art is still treasured by many as a fond memory of times gone by.

While the Regionalists remembered the past, other American Scene artists painted the drab realities of the contemporary urban environment, testifying to its loneliness and anonymity. The Urban Realists, including Reginald Marsh, Isabel Bishop, and the Soyer brothers, were associated with the Art Students League in New York. These painters showed the high price paid by individual men and women struggling to survive the Depression. The names of some of their works illustrate the style: *Office Girls, Waiting, The Bowery.* For various reasons, their work has been largely forgotten today.

Edward Hopper was an artist who was associated with the American Scene but otherwise escaped further classification. Like the Urban Realists, he painted the tired dinginess of the urban streets during the Depression. Yet Hopper often found beauty in the midst of the city's monotony. For example, one of Hopper's best-known paintings, *Nighthawks*, shows several people sitting like robots in a brightly lit coffee shop at night, each apparently unaware of the others. Hopper was not interested in a return to the past. He presented what he saw without apology or sentimentality.

The American Scene art movement of the 1930s was characterized by realistic paintings that expressed the traditions and interests of people in the United States at that time. Because the paintings presented common images and mirrored the lives of many people, the general public readily identified with the subjects of the paintings. With the onset of World War II, a new spirit of internationalism swept through the art of the United States, and the American Scene painters became out of date. Although the movement did not last, it had reflected its own time with profound understanding.

39. According to the passage, why did ordinary people in the 1930s identify with the art of the American Scene painters?

A. The artists were primarily concerned with painting farm life.
B. People were given hope when they saw the paintings.
C. People wanted social and cultural change shown in their paintings.
D. The paintings suggested solutions to the problems of the period.
E. The paintings reflected the times in ways that were familiar to most viewers.

CONTINUE ON TO THE NEXT PAGE ▶

40. Which of the following subjects would an Urban Realist painter be most likely to represent?

F. factory workers going home from work
G. sunset on a beach
H. a self-portrait
J. a European city scene
K. an abstract painting in black and white

41. Hopper's paintings contrast with the work of the Urban Realist painters by

A. portraying the beauty in America's past.
B. showing the ugliness of a city environment.
C. illustrating the move toward an international style.
D. revealing how dull urban life can include beauty.
E. presenting the trials of working people during the Depression.

42. How does the fourth paragraph contribute to the passage?

F. It describes the end of the American Scene movement.
G. It honors Edward Hopper as a great American Scene painter.
H. It explains why Edward Hopper's work has been forgotten.
J. It contrasts American Scene with Urban Realist styles.
K. It presents an American Scene painter who focused on beauty.

43. The author used the phrase "without apology" (line 62) to explain that Hopper did not feel he needed to justify

A. how he portrayed his subjects.
B. painting scenes from the past.
C. why *Nighthawks* became popular.
D. not joining the international art movement.
E. why he was an emotional painter.

44. What is the most likely reason that Regionalist art has retained some of its popularity while Urban Realist art has not?

F. Regionalist art depicts modern life as well as life in the past, while Urban Realist art depicts only the past.
G. Regionalist art more accurately portrays the time in which it was painted than Urban Realist art does.
H. Regionalist art shows American life as people wish to remember it while Urban Realist art does not.
J. Regionalist art represents the positive side of urban life more than Urban Realist art does.
K. Regionalist art more accurately depicts how Americans overcame the effects of the Depression than Urban Realist art does.

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If you have ever watched someone fall on the ice, you've seen slipperiness at work. But have you wondered what makes ice slippery, or why skates or skis glide across ice so easily? The answer might seem obvious: ice is smooth. Yet smoothness in itself does not explain slipperiness. Imagine, for example, skating on a smooth surface of glass or sheet metal.

Surprisingly, scientists do not fully understand why ice is slippery. Past explanations of slipperiness have focused on friction and pressure. According to the friction theory, a skate blade rubs across the ice, causing friction. The friction produces heat, melting the ice and creating a slippery, microscopically thin layer of water for the skate to glide on. The friction theory, however, cannot explain why ice is slippery even when someone stands completely motionless, creating no friction.

The pressure theory claims that pressure from a skate blade melts the ice surface, creating a slippery layer of water. The water refreezes when the pressure is lifted. Science textbooks typically cite this explanation, but many scientists disagree, claiming that the pressure effect is not great enough to melt the ice. Nor can the pressure theory explain why someone wearing flat-bottomed shoes—which have a greater surface area than skate blades and thus exert less pressure per square inch—can glide across the ice or even go sprawling.

During the 1990s, another theory found acceptance: the thin top layer of ice is liquid, or "liquid-like," regardless of friction or pressure. This notion was first proposed more than 150 years ago by physicist Michael Faraday. Faraday's simple experiment illustrates this property: two ice cubes held against each other will fuse together. This happens, Faraday explained, because liquid on the cubes' surfaces froze solid when the surfaces made contact.

Faraday's hypothesis was overlooked, in part because scientists did not have the means to detect molecular structures. However, technological advances during recent decades allow scientists to measure the thin layer on the surface of the ice. For example, in 1996, a chemist at Lawrence Berkeley Laboratory shot electrons at an ice surface and recorded how they rebounded. The data suggested that the ice surface remained "liquid-like," even at temperatures far below freezing. Scientists speculate that water molecules on the ice surface are always in motion because there is nothing above them to hold them in place. The vibration creates a slippery layer of molecules. According to this interpretation of the Lawrence Berkeley Laboratory experiments, the molecules move only up and down; if they also moved side to side, they would constitute a true liquid. Thus it could be said that people are skating on wildly vibrating molecules!

The phenomenon of a slippery liquid-like surface is not limited to ice, although ice is the most common example. Lead crystals and even diamond crystals, made of carbon, also show this property under certain temperature and pressure conditions.

45. Which of the following best tells what this passage is about?

A. why ice surfaces are liquid-like
B. how ice changes from a solid to a liquid
C. answers to the question of what makes ice slippery
D. the discoveries of Michael Faraday
E. the processes of freezing and melting

CONTINUE ON TO THE NEXT PAGE ►

46. What is the most likely reason that the author mentioned lead and diamond crystals in the last paragraph?

- **F.** to point out that solids other than ice have slippery surfaces
- **G.** to suggest that ice, lead, and diamonds are composed of the same materials
- **H.** to cast doubt on Faraday's theory of slipperiness
- **J.** to suggest that scientists shoot electrons at lead and diamond surfaces
- **K.** to suggest new uses for slippery substances

47. According to Faraday, why do two ice cubes fuse when held together?

- **A.** Friction causes the ice to melt and refreeze.
- **B.** The pressure melts and refreezes the ice cubes.
- **C.** The liquid layers on their surfaces freeze.
- **D.** The vibrations of the molecules on their surfaces increase.
- **E.** Their surface areas are perfectly smooth.

48. What is the most likely reason that the author mentioned the 1996 experiment at Lawrence Berkeley Laboratory?

- **F.** to provide evidence about the surface of ice
- **G.** to illustrate the weaknesses of scientific technology
- **H.** to show how Faraday tested his theory
- **J.** to suggest that the ice surface was solid, not liquid
- **K.** to explain why ice cubes freeze together

49. According to researchers at the Lawrence Berkeley Laboratory, why is the surface of ice "liquid-like" rather than "liquid"?

- **A.** because electrons rebound from the ice surface
- **B.** because molecules on the ice surface vibrate only up and down
- **C.** because the ice surface is wet
- **D.** because the ice surface is slipperier than a liquid surface
- **E.** because the temperature on the ice surface is slightly above freezing

50. According to the passage, which of the following undermines the friction theory of slipperiness?

- **F.** a person wearing flat-bottomed shoes gliding across the ice
- **G.** two ice cubes fused together
- **H.** electrons bouncing off an ice surface
- **J.** a person trying to skate on a sheet of glass or sheet metal
- **K.** a person slipping while standing immobile on ice

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PART 2 — MATHEMATICS

Suggested Time — 75 Minutes

50 QUESTIONS

GENERAL INSTRUCTIONS

Solve each problem. Select the **best** answer from the choices given. Mark the letter of your answer on the answer sheet. You can do your figuring in the test booklet or on paper provided by the proctor. **DO NOT MAKE ANY MARKS ON YOUR ANSWER SHEET OTHER THAN FILLING IN YOUR ANSWER CHOICES.**

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 figured out from the information given.

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

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

(5) Reduce all fractions to lowest terms.

51. $\frac{4.5}{0.1} \times 0.22 =$

A. 0.99
B. 1.99
C. 9.9
D. 99
E. 990

52. If $\frac{4}{5}$ of P is 48, what is $\frac{3}{5}$ of P?

F. 12
G. 15
H. 20
J. 36
K. 60

53. If $\frac{a}{b} = 2$ and $a = 8$, what is the value of $3b + a^2$?

A. 28
B. 70
C. 76
D. 88
E. 112

54. Carlos is picking colored pencils from a large bin that contains only 480 red pencils, 240 green pencils, and 160 blue pencils. Without looking, Carlos pulls out 22 pencils. If the pencils were distributed randomly in the bin, how many pencils of each color is it most likely that he picked?

F. 8 red, 7 green, 7 blue
G. 10 red, 7 green, 5 blue
H. 10 red, 8 green, 4 blue
J. 11 red, 6 green, 5 blue
K. 12 red, 6 green, 4 blue

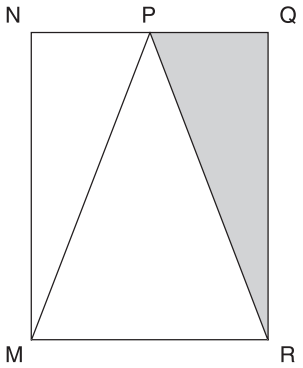
55. How many positive integers satisfy the inequality $x + 7 < 23$?

A. 15
B. 16
C. 17
D. 29
E. 30

56. $3.99 \div 1.5 =$

F. 0.266
G. 0.267
H. 2.0
J. 2.66
K. 2.67

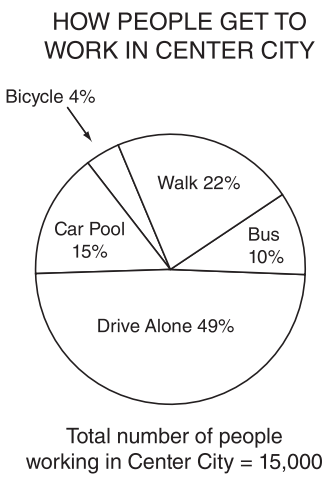
57.



In the figure above, the base of $\triangle MPR$ is a side of rectangle MNQR, and point P is the midpoint of $\overline{NQ}$. If the area of the shaded region is 24 square centimeters, what is the area of the region that is **not** shaded?

A. 24 sq cm
B. 48 sq cm
C. 64 sq cm
D. 72 sq cm
E. 96 sq cm

58.



How many more people in Center City walk to work than ride their bicycles to work?

F. 18
G. 22
H. 2,700
J. 2,800
K. 3,000

59. If x and y are positive integers such that $0.75 = \frac{x}{y}$, what is the **least** possible value for x?

A. 1
B. 3
C. 4
D. 25
E. 75

60. $|190 - 210| + |19 - 21| + x = 100$

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

F. 78
G. 88
H. 100
J. 122
K. 123

61. Ms. Grant's car gets between 20 and 22 miles per gallon, inclusive. The gasoline she uses costs between \$4.20 and \$4.50 per gallon, inclusive. What is the **greatest** amount Ms. Grant will spend on gasoline to drive her car 200 miles?

A. \$37.27
B. \$40.90
C. \$42.00
D. \$45.00
E. \$99.00

62. The set P consists of all prime numbers greater than 6 and less than 36. What is the median of the numbers in P?

F. 17
G. 17.75
H. 18
J. 18.75
K. 19

63. What is the greatest common factor of 2,205 and 3,675?

A. 147
B. 245
C. 441
D. 735
E. 1,225

CONTINUE ON TO THE NEXT PAGE ▶

64.

$$\begin{array}{r} -2 \\ 4 \\ -6 \\ 8 \\ . \\ . \\ . \\ -22 \\ +\ 24 \\ \hline \end{array}$$

If the missing terms in the problem above were filled in according to the pattern, what would be the sum of all the terms?

F. -6
G. 2
H. 6
J. 10
K. 12

65.

SONGS PLAYED DURING ONE HOUR

Number of Songs	Number of Radio Stations
14	8
15	4
16	4
17	5
18	9

The table above shows the number of songs played during a specific hour by 30 different radio stations. What is the mean number of songs played during that hour by these stations?

A. 6
B. 8
C. 16.1
D. 16.5
E. 18

66. The fuel mix for a small engine contains only 2 ingredients: gasoline and oil. If the mix requires 5 ounces of gasoline for every 6 ounces of oil, how many ounces of gasoline are needed to make 33 ounces of fuel mix?

F. 3
G. 6
H. 15
J. $27\frac{1}{2}$
K. 165

67. In the set of consecutive integers from 12 to 30, inclusive, there are 4 integers that are multiples of both 2 and 3. How many integers in the set are multiples of **neither** 2 nor 3?

A. 2
B. 5
C. 6
D. 13
E. 15

68. A pitcher contained 32 ounces of orange juice and 12 ounces of grapefruit juice. More grapefruit juice was added to the pitcher until grapefruit juice represented $\frac{1}{3}$ of the pitcher's contents. How many ounces of grapefruit juice were added?

F. 2 oz
G. 4 oz
H. 8 oz
J. 16 oz
K. 44 oz

69. A roofing contractor uses shingles at a rate of 3 bundles for each 96 square feet of roof covered. At this rate, how many bundles will he need to cover a roof that is 416 square feet?

A. 5
B. 12
C. 13
D. 14
E. 15

70. How many ways can the letters in the word RAIN be arranged horizontally so that the vowels (A and I) are always immediately next to each other (either AI or IA)?

F. 6
G. 8
H. 12
J. 16
K. 24

71.

Item	Quantity Puchased	Price Per Item
Rain Coat	1	$102.00
Slacks	2	$60.00
Shirt	2	$35.00

One state has a 6% sales tax on clothing items priced at $75 or higher, and no sales tax on clothing items priced under $75. What is the total tax on the items in the table above?

A. $6.12
B. $6.72
C. $13.32
D. $17.00
E. $203.12

72. There are 45 eighth graders and 20 seventh graders in a school club. The president of this club wants 40% of the club's members to be seventh graders. How many **more** seventh graders must join the club in order to meet the president's wishes? (Assume that the number of eighth graders remains the same.)

F. 6
G. 7
H. 8
J. 10
K. 27

73. If R, S, and T are integers and R + S and T − S are both odd numbers, which of the following must be an **even** number?

A. R + T
B. S + T
C. R
D. S
E. T

74. For what value of z is $z - \frac{1}{3}z = 12$?

F. −18
G. 4
H. 8
J. 12
K. 18

75.

Regular Price	$2.49
Discount	– $0.60
Sale Price	$1.89
6% Tax	$0.15
Total	$2.04

Nikolai bought a packet of pens. His receipt is shown above. Assume that sales tax is rounded to the nearest cent. If the 6% sales tax had been computed on the sale price instead of on the regular price, how much lower would the tax have been?

A. $0.01
B. $0.02
C. $0.03
D. $0.04
E. $0.36

76. The regular price of a 12-ounce bag of candy is $2.90. Lily has a coupon for 30% off one of these bags. What is the price per ounce (to the nearest cent) that Lily will pay if she uses the coupon?

F. $0.07
G. $0.15
H. $0.17
J. $0.22
K. $0.24

77. On a particular vehicle, the front tire makes three revolutions for every one revolution the back tire makes. How many times larger is the radius of the back tire than the radius of the front tire?

A. $\frac{1}{3}$
B. 3
C. $\frac{3}{2}\pi$
D. 3π
E. 9

78. PEOPLE PER VEHICLE AT CHECKPOINT

Number of People in the Vehicle	Percent of Vehicles
1	40%
2	35%
3	15%
4	7%
5 or more	3%

A researcher recorded the number of people in each vehicle that passed through a checkpoint. The table above shows the percent distribution for the 420 vehicles that passed the checkpoint yesterday morning. How many of the 420 vehicles contained **at least** 3 people?

F. 42
G. 63
H. 105
J. 315
K. 378

79. Jack and Roberto were assigned to guard a tower. Each was to watch for 5 hours, then rest 5 hours while the other watched. If Roberto began his first watch at 6:00 p.m., at what time will he begin his third watch?

A. 11:00 p.m.
B. 4:00 a.m.
C. 9:00 a.m.
D. 7:00 p.m.
E. 2:00 p.m.

80.

On the number line above, point E (not shown) is the midpoint of $\overline{AC}$ and point F (not shown) is the midpoint of $\overline{BD}$. What is the length of $\overline{EF}$?

F. 1 unit
G. 2 units
H. 2.5 units
J. 3 units
K. 11 units

81. A video game originally priced at $44.50 was on sale for 10% off. Julian received a 20% employee discount applied to the sale price. How much did Julian pay for the video game? (Assume that there is no tax.)

A. $31.15
B. $32.04
C. $35.60
D. $40.05
E. $43.61

82. If $r = 3q + 2$ and $q = \frac{1}{3^n}$ for $n = 1, 2,$ or 3, what is the **least** possible value of r?

F. 1

G. $2\frac{1}{9}$

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

J. 3

K. 5

83. $|(-6) - (-5) + 4| - |3 - 11| =$

A. -7
B. -5
C. -1
D. 1
E. 11

84. There are 1,000 cubic centimeters in 1 liter and 1,000 cubic millimeters in 1 milliliter. How many cubic millimeters are there in 1,000 cubic centimeters?

F. 1,000
G. 10,000
H. 100,000
J. 1,000,000
K. 1,000,000,000

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85. A radio station plays Samantha's favorite song 6 times each day at random times between 8:00 a.m. and 5:00 p.m. The song is 5 minutes long. If Samantha turns on the radio at a random time between 8:00 a.m. and 5:00 p.m., what is the probability that her favorite song will be playing at that time?

A. $\frac{1}{30}$

B. $\frac{1}{18}$

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

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

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

86. Set R contains all integers from 10 to 125, inclusive, and Set T contains all integers from 82 to 174, inclusive. How many integers are included in R, but **not** in T?

F. 23
G. 48
H. 49
J. 71
K. 72

87. Ryan must read 150 pages for school tomorrow. It took him 30 minutes to read the first 20 of the assigned pages. At this rate, how much **additional** time will it take him to finish the reading?

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

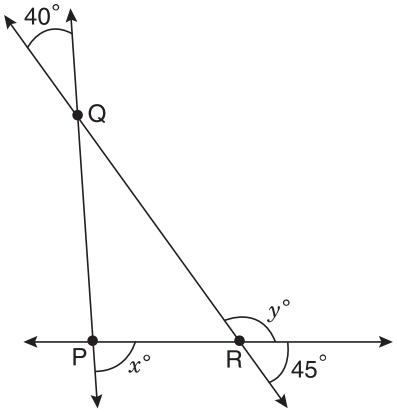
B. $2\frac{1}{6}$ hr

C. $3\frac{1}{4}$ hr

D. $3\frac{3}{4}$ hr

E. $7\frac{1}{2}$ hr

88.



The figure above shows three intersecting straight lines. What is the value of $y - x$?

F. 40
G. 50
H. 85
J. 95
K. 135

89. Joe began to increase the speed of his car at 2:00 p.m. Since that time, the speed of Joe's car has been steadily increasing by $1\frac{1}{2}$ miles per hour for each half minute that has passed. If the car is now traveling $65\frac{1}{2}$ miles per hour, for how many minutes has the car been exceeding the speed limit of 55 miles per hour?

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

B. $3\frac{1}{2}$ min

C. $4\frac{1}{2}$ min

D. 5 min

E. 7 min

CONTINUE ON TO THE NEXT PAGE ▶

90. If x, y, and z are numbers such that $xy + xz = 100$, what is the value of $\frac{x}{5}(3y + 3z) + 10$?

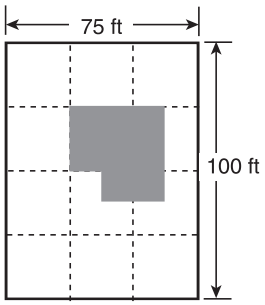
F. $60 + 2x$
G. 62
H. 70
J. 130
K. $130 + 2x$

91. Let $N = -(|-3| - |-8| + |-4|)$.

What is the value of $-|N|$?

A. -9
B. -4
C. -1
D. 1
E. 9

92.



The drawing above represents a rectangular lot containing a building, indicated by the shaded region. The dashed lines divide the lot into twelve equal-sized squares. If the unshaded portion of the lot is to be paved, about how many square feet will be paved?

F. 4,000 sq ft
G. 5,000 sq ft
H. 6,000 sq ft
J. 7,000 sq ft
K. 8,000 sq ft

93. If x can be any integer, what is the greatest possible value of the expression $1 - x^2$?

A. -1
B. 0
C. 1
D. 2
E. Infinity

94. A recent survey asked students what pets they have. Based on the results, the following statements are all true:

23 students have dogs.
20 students have cats.
3 students have both dogs and cats.
5 students have no cats or dogs.

How many students were surveyed?

F. 40
G. 42
H. 45
J. 46
K. 51

95. Ang has x dollars in his savings account, and Julia has y dollars in her savings account. Ang gives Julia $\frac{1}{3}$ of the money in his savings account, which Julia deposits into her savings account. Julia then spends $\frac{1}{4}$ of the total in her savings account. Express the amount of money Julia spent in terms of x and y.

A. $\frac{y}{4} + \frac{x}{12}$
B. $\frac{y}{4} + \frac{x}{3}$
C. $\frac{y}{4} + \frac{x}{7}$
D. $\frac{3y}{4} + \frac{x}{4}$
E. $\frac{3y}{4} + \frac{x}{3}$

96. Nam worked on a job for 10 days. On each of the last 2 days, he worked 2 hours more than the mean number of hours he worked per day during the first 8 days. If he worked 69 hours in all, how many hours did he work during the last 2 days together?

F. 8.5
G. 10.5
H. 13.0
J. 15.0
K. 17.0

97.

PRICES FOR AD SPACE

Space	Price
$\frac{1}{4}$ page	$200
$\frac{1}{2}$ page	$350
full page	$600

The table above shows prices for newspaper advertising. A store purchased quarter pages, half pages, and full pages of space in equal numbers for a total of $11,500. What is the total amount of page space the store purchased?

A. $1\frac{3}{4}$ pages

B. 10 pages

C. $16\frac{1}{2}$ pages

D. $17\frac{1}{4}$ pages

E. $17\frac{1}{2}$ pages

98. One week the price of gasoline dropped by $0.05 per gallon. Madison's car travels 27 miles each way to work, and her car travels 30 miles on each gallon of gasoline. What were her total savings, to the nearest cent, over the 5-day work week?

F. $0.23
G. $0.25
H. $0.30
J. $0.45
K. $0.50

99. A rectangular floor is 12 feet wide and 16 feet long. It must be covered with square tiles that are 8 inches on each side. Assume there is no space between adjacent tiles. If the tiles cost $8 each, how much will it cost to buy the tiles needed to cover the floor?

A. $24
B. $64
C. $192
D. $2,304
E. $3,456

100. {1, 2, 3, 4, 5, 6}

Company X wants to assign each employee a 3-digit ID number formed from digits in the set shown above. No digit may appear more than once in an ID number, and no two employees may be assigned the same ID number. What is the greatest total number of possible different ID numbers?

F. 20
G. 120
H. 180
J. 216
K. 720

THIS IS THE END OF THE TEST. IF TIME REMAINS, YOU MAY CHECK YOUR ANSWERS TO PART 2 AND PART 1. BE SURE THAT THERE ARE NO STRAY MARKS, PARTIALLY FILLED ANSWER CIRCLES, OR INCOMPLETE ERASURES ON YOUR ANSWER SHEET. ■

98. (**J**) Madison's car travels 27 miles one way to work, so it travels a total of 54 miles per day. In 5 days, it travels $5 \times 54 = 270$ miles. Her car travels 30 miles on each gallon of gas, so it uses $\frac{270}{30} = 9$ gallons of gas per week. To find the total savings, multiply the number of gallons by the savings per gallon:

9 gallons • \$0.05 = \$0.45

---

99. (**E**) Since the floor measurement is in feet and the tile measurement is in inches, change inches into feet:

$8 \text{ in.} = \frac{8}{12} = \frac{2}{3}$ ft

The floor is 12 ft wide. To find the number of tiles needed along the width of the floor, divide the width by the size of a tile:

$12 \text{ ft} \div \frac{2}{3} = 12 \bullet \frac{3}{2} = 18$ tiles

The floor is 16 ft long. Find the number of tiles needed along the length of the floor:

$16 \text{ ft} \div \frac{2}{3} = 16 \bullet \frac{3}{2} = 24$ tiles

To find the total number of tiles needed, multiply the number needed along the width by the number needed along the length:

18 • 24 = 432 tiles

To find the total cost, multiply the total tiles by the cost per tile: 432 tiles • \$8 = \$3,456

100. (**G**) Using the counting principle, the first digit has 6 possible values (1 through 6). The second digit then has 5 possible values, and the third digit has 4 possible values. So the total number of possible different ID numbers is $6 \times 5 \times 4 = 120$.

Answer Key for Sample Form A

Paragraph 1 T Q U R S	11. C	21. D	31. C	41. D	51. C	61. D	71. A	81. B	91. C
	12. K	22. G	32. F	42. G	52. J	62. H	72. J	82. G	92. H
Paragraph 2 S R U Q T	13. D	23. D	33. B	43. A	53. C	63. D	73. A	83. B	93. C
	14. G	24. H	34. F	44. H	54. K	64. K	74. K	84. J	94. H
Paragraph 3 Q S R U T	15. B	25. E	35. D	45. C	55. A	65. C	75. D	85. B	95. A
	16. H	26. H	36. K	46. F	56. J	66. H	76. H	86. K	96. K
Paragraph 4 U S T R Q	17. A	27. B	37. D	47. C	57. D	67. C	77. B	87. C	97. E
	18. G	28. H	38. G	48. F	58. H	68. G	78. H	88. G	98. J
Paragraph 5 T R U Q S	19. C	29. D	39. E	49. B	59. B	69. C	79. E	89. B	99. E
	20. K	30. J	40. F	50. K	60. F	70. H	80. J	90. H	100. G