# **ACT ENGLISH TEST 1**

#### 45 Minutes—75 Questions

**DIRECTIONS:** In the five passages that follow, certain words and phrases are underlined and numbered. In the right-hand column, you will find alternatives for the underlined part. In most cases, you are to choose the one that best expresses the idea, makes the statement appropriate for standard written English, or is worded most consistently with the style and tone of the passage as a whole. If you think the original version is best, choose "NO CHANGE." In some cases, you will find in the right-hand column a question about the underlined part. You are to choose the best answer to the question. You will also find questions about a section of the passage, or about the passage as a whole. These questions do not refer to an underlined portion of the passage, but rather are identified by a number or numbers in a box.

For each question, choose the alternative you consider best and fill in the corresponding oval on your answer document. Read each passage through once before you begin to answer the questions that accompany it. For many of the questions, you must read several sentences beyond the question to determine the answer. Be sure that you have read far enough ahead each time you chose an alternative.

# PASSAGE I

## My Puppy's First Winter Outfit

I bought for my puppy dog her first winter coat with matching boots in mid autumn. When

the first snow of the season <u>hurriedly fell</u> in early December, I was eager to clothe my beloved little canine for the first time. Much to my chagrin, however, she not only lacked interest in wearing her new gear, she actually fought me as I attempted to dress her. To make matters worse, she

had removed with success three of her four boots  $\frac{3}{3}$  before I managed to drag her to the exterior door of our apartment building.

I quickly realized that my puppy needed some training. <u>After all I could, hardly, blame</u> her 4 for instinctively choosing her own "puppy" style over the designer outfit I had chosen. For those

- **1. A.** NO CHANGE
  - **B.** on behalf of my dog
  - **C.** my puppy
  - **D.** our puppy's
- 2. The writer would like to convey her anticipation of the first snowfall of the season. Given that all the choices are true, which one best accomplishes the writer's goal?
  - **F.** NO CHANGE
  - G. created blizzard conditions
  - **H.** finally fell
  - J. came down hard
- **3. A.** NO CHANGE
  - **B.** removed
  - C. tugged off with her paws with success
  - **D.** manages successfully to remove by tugging

# **4. F.** NO CHANGE

- G. After all, I could hardly blame
- H. After all, I could hardly, blame
- J. After all, I could, hardly blame



who are wondering why she needed winter gear at all, I will note that some dogs do need extra warmth when temperatures dip below freezing. 5

Candidates for coats include the short haired and the very young. My puppy was both short haired as  $\frac{6}{6}$  well as very young. Candidates for boots include

those species that cannot tolerate contact with  $\frac{7}{7}$  chemicals commonly found in ice-melting compounds. Although my puppy had never been exposed to such chemicals, <u>I wanted to play it safe</u>.

To train her to wear the coat, I began to  $\frac{1}{9}$  proceed by dressing her in an oversized T-shirt. The size of the neck hole made the shirt much easier to slip over her head than the size of the close- $\frac{10}{10}$  close-

putting on and wearing the shirt. We then began to practice with the coat. Each time she let me put it

- **5.** The writer is considering deleting the phrase "when temperatures dip below freezing" from the preceding sentence. Should the phrase be kept or deleted?
  - **A.** Kept, because it specifies when some dogs need extra warmth.
  - **B.** Kept, because the temperature at which water freezes is constant throughout the world.
  - **C.** Deleted, because the temperature at which water freezes is not as important.
  - **D.** Deleted, because this level of detail is not consistent with the essay's description of the puppy's designer outfit.
- 6. F. NO CHANGE
  - G. short haired in addition to being very young
  - H. short in hair and young in terms of age
  - **J.** OMIT the underlined portion.
- 7. A. NO CHANGE
  - **B.** them that
  - C. those species which
  - **D.** those species who
- **8.** Which of the following alternatives to the underlined portion would NOT be acceptable?
  - **F.** I wanted to be cautious
  - G. I did not want to experiment
  - **H.** I wanted her to play safe
  - J. I chose not to experiment
- 9. A. NO CHANGE
  - **B.** began by
  - C. proceed with
  - **D.** OMIT the underlined portion.
- 10. F. NO CHANGE
  - **G.** smaller sizes of the
  - **H.** size of the neck hole of
  - **J.** OMIT the underlined portion.
- **11.** Which of the following alternatives to the underlined portion would NOT be acceptable?
  - A. Subsequently, we
  - **B.** Having conquered that challenge, we
  - C. Nevertheless, we
  - **D.** As a next step, we



on without a struggle, I gave her a treat and praised

her for her good behavior. 12

<u>To train her to wear the boots</u>, I first carried 13her to an open field that I knew was free of ice-

melting compounds. After a walk around the snowy <sup>14</sup> field until she grew tired, I slipped the boots on her, gave her a treat, and walked her home using the sidewalks. My tactic was to capitalize on my tired puppy's desire to get to home as soon as likely. <sup>15</sup> The treat merely acted as a reinforcement. **12.** At this point, the writer is considering adding the following true statement:

My puppy and I really bonded during this training period, which lasted a few weeks.

Should the writer add this sentence here?

- **F.** Yes, because it highlights the importance of consistency when training a dog.
- **G.** Yes, because it is necessary to understanding the essay as a whole.
- **H.** No, because it does not provide information that is essential to the essay as a whole.
- **J.** No, because it provides information that is included elsewhere in the essay.
- **13.** Given that all the choices are true, which one maintains the style and tone of the essay?
  - A. NO CHANGE
  - **B.** Objective Number Two: To train her to wear boots
  - C. In full accord with good training practices
  - **D.** Anyway, when it came to boots
- 14. F. NO CHANGE
  - **G.** After walking
  - H. During a walk
  - J. Before our walk
- 15. A. NO CHANGE
  - **B.** to go home
  - C. to wander home
  - **D.** OMIT the underlined portion.



# **PASSAGE II**

## Nigersaurus Taqueti

According to paleontologists, a dinosaur with <u>unusual jaws design</u> lived more than 100 million years ago in the region currently known as the Sahara Desert. The skeletal remains of Nigersaurus, <u>it is the creature</u> that flabbergasted <sup>17</sup> scientists for decades, recently went on display at the headquarters of the National Geographic Society. Based on recent discoveries, members of the Society now believe that the unique jaw design of Nigersaurus allowed it to suck up food <u>like a</u> <sup>18</sup> <u>vacuum cleaner would suck</u> up dirt. No other <sup>18</sup> dinosaur species is known to have possessed such an ability.

 $\underline{\text{Because}}_{20}$  evidence of Nigersaurus was first discovered decades earlier, scientists have only

recently been able to reconstruct the creatures skull  $\frac{21}{21}$  and skeleton. They now believe the thirty-foot-long reptile had a feather-light skull that it held close to

## 16. F. NO CHANGE

- G. an unusual jaw design
- H. unusual jaw's design
- J. a not usual designed jaw
- 17. A. NO CHANGE
  - **B.** they are the creatures
  - **C.** a creature
  - **D.** OMIT the underlined portion.

# 18. F. NO CHANGE

- G. as vacuums clean
- H. much like the vacuum of cleaners that suck
- J. like a vacuum cleaner sucks
- **19.** The writer is considering deleting the preceding sentence. Should the sentence be kept or deleted?
  - **A.** Kept, because it emphasizes a unique characteristic of Nigersaurus.
  - **B.** Kept, because it establishes the author as an expert in the field of paleontology.
  - **C.** Deleted, because the essay is about Niger-saurus, not dinosaurs in general.
  - **D.** Deleted, because the statement lacks scientific rigor.
- 20. F. NO CHANGE.
  - G. Since
  - H. While
  - **J.** OMIT the underlined portion.
- 21. A. NO CHANGE
  - **B.** it's
  - C. its'
  - **D.** the creature's



the ground to graze like a cow. Unlike a cow 22however the dinosaur clipped vegetation using more 22than fifty columns of teeth that were lined up tightly along the front edge of its jaw. Instead of then swallowing its meal, the dinosaur literally vacuumed up the food <u>on which it was grazing</u>.

Using CT scans, researchers were able to study the inside of the animal's <u>skull; where the</u>  $^{24}$ orientation of canals disclosed the habitual low pose

of the <u>head, it is a pose</u> common among dinosaurs  $\frac{25}{25}$ that grazed. Additionally, researchers discovered that Nigersaurus had a spine that consisted more of

air than bone. 26

<u>The beginning remains of what is now</u> <sup>27</sup> <u>formally</u> known as "Nigersaurus Taqueti" were <sup>27</sup> <sup>27</sup>

- 22. F. NO CHANGE
  - **G.** However unlike a cow
  - **H.** Unlike a cow, however,
  - J. Moreover, unlike a cow,
- **23.** Which of the following alternatives to the underlined portion would be LEAST acceptable?
  - A. on which it grazed
  - **B.** it grazed on
  - C. it grazed
  - **D.** grazed
- 24. F. NO CHANGE
  - G. skull—but
  - H. skull. The
  - **J.** OMIT the underlined portion.
- **25. A.** NO CHANGE
  - **B.** head, a pose
  - **C.** head, it's a pose
  - **D.** OMIT the underlined portion.
- **26.** If the writer were to delete the last sentence of the paragraph, the paragraph would primarily lose:
  - **F.** Information that highlights the extraordinary versatility of CT scans.
  - **G.** Details that are informative, but inconsistent with the tone and style of the paragraph.
  - **H.** Details that directly link the paragraph to the final paragraph of the essay.
  - **J.** Information that is informative and consistent with the tone of the paragraph.
- 27. A. NO CHANGE
  - **B.** Remains of what is now formally first
  - **C.** The first remains of what is now formally
  - D. First, the remains were formally



<u>picked up</u> in Niger in the 1950s by a group of  $_{28}^{28}$ French paleontologists led by Philippe Taquet, but the species was not named at that time. The National Geographic Society, which named the

species decades later, <u>honoring</u> the early work of  $\frac{29}{29}$  the French scientists by including in the name of the species both the name of the nation where the first remains were discovered and the name of the scientist who led the initial work efforts. 30

- **28.** The writer would like to indicate the physically demanding nature of the work that led to the discovery of the remains. Which of the following best accomplishes the writer's goal?
  - F. NO CHANGE
  - G. unearthed
  - **H.** spotted
  - J. stumbled upon
- **29. A.** NO CHANGE
  - **B.** in honor of
  - C. honored
  - **D.** would honor
- **30.** The writer is considering deleting the following clause from the preceding sentence:

both the name of the nation where the first remains were discovered and

Should this clause be kept or deleted?

- **F.** Kept, because it is essential to the structure of the sentence.
- **G.** Kept, because it is essential in maintaining the descriptive tone of the essay.
- **H.** Deleted, because it is not essential to the primary focus of the sentence.
- **J.** Deleted, because it adds information that is unrelated to the main focus of the essay.

# PASSAGE III

## **Back to School**

For some adults who want to change careers, going back to school is an undercover mission. During the day, they work traditional jobs in indus-

tries that include retail, finance, and construction.

During evening hours however; they attend classes

31

- **31.** A. NO CHANGE
  - **B.** During evening hours, however, they
  - C. During evening hours, however; they
  - **D.** Throughout evenings however, adults



and complete assignments, they are careful to keep  $\frac{32}{32}$  their student lives a secret from employers and co-workers.

Since there may be many reasons that compel such non-traditional students to keep their scholastic activities hush-hush, most adult students cite employer backlash as the primary one. 34 L. Rodriguez of Cleveland, Ohio, for example, told reporters that she felt certain that her employment

 $\frac{\text{was}}{35}$  terminated if her boss found out she was attending classes in order to make a career change possible. Others, like M. Peters of San Jose, California, fear that while they may not get "fired" for taking evening classes, <u>there</u> short-term career  $\frac{36}{36}$  opportunities would certainly be limited. "An

employer has no reason to promote or further train an employee who is actively working toward a

- **32. F.** NO CHANGE
  - G. careful
  - **H.** they carefully
  - **J.** OMIT the underlined portion.
- 33. A. NO CHANGE
  - **B.** Because
  - C. However,
  - **D.** While
- **34.** Upon reviewing the preceding sentence, the writer is interested in making it more concise. Deleting which of the following words or phrases would NOT be acceptable?
  - **F.** that compel
  - G. adult
  - **H.** adult students
  - J. as the primary one
- 35. A. NO CHANGE
  - **B.** will be
  - **C.** would be
  - **D.** had been
- 36. F. NO CHANGE
  - G. they're
  - H. those
  - J. their
- **37.** Which of the following alternatives to the underlined portion would be LEAST acceptable?
  - A. directive
  - **B.** cause
  - C. incentive
  - **D.** inducement

career change," said Peters. "To be honest, I completely understand the employer's perspective in this situation. It doesn't make good business sense to invest in an employee who is not fully committed to the company." 38

So why are so many risking a backlash? <sup>39</sup> Many cite the desire to "be" a boss rather than to "have" one. T. Parish of Louisville, Kentucky, told

reporters that he <u>had grown tired of</u> working hard to  $\frac{40}{40}$ 

build incredible wealth for his employer. He hopes for the day when his work efforts will benefit his 41own annual income and financial future more directly. "I am currently on track to earn the degree

- **38.** After reviewing the second paragraph, the writer is considering deleting the preceding sentence. Should the writer delete the sentence?
  - **F.** Yes, because it introduces a new theme that is only mildly related to the main topic of the essay.
  - **G.** Yes, because it differs markedly in tone from the rest of the quote.
  - **H.** No, because it successfully establishes the credibility of M. Peters.
  - **J.** No, because it supports the position of M. Peters.
- **39.** Given that all the choices are true, which one would most effectively introduce the main idea of this paragraph?
  - A. NO CHANGE
  - B. Why should you risk backlash?
  - **C.** Empirical evidence shows that many adults work during the day and attend classes at night.
  - **D.** So why are some adults willing to go back to school and risk employer backlash?
- 40. F. NO CHANGE
  - **G.** grows tired
  - H. tires,
  - J. had grown tired in
- **41. A**. NO CHANGE
  - **B.** (Do NOT begin new paragraph) He hopes, for the day when,
  - **C.** (Begin new paragraph) He hopes for the day when
  - **D.** (Begin new paragraph) Parish is hoping for when



I will need to start a successful business of my own one day," said Parish, when asked why he was willing to risk employer backlash to attend classes, study, and complete assignments  $\frac{\text{during much of his}}{42}$  $\frac{\text{free time.}}{42}$ 

Others interviewed were simply tired of working <u>around</u> industries they found boring. They had gone back to school to earn credentials in fields that promised to be more stimulating. In other words, they wanted to bring both passion and enthusiasm to <u>they're work; a worthwhile</u> goal indeed.

- **42.** All of the following would be acceptable replacements for the underlined portion EXCEPT:
  - **F.** during after-work hours
  - G. later in life
  - H. on evenings and weekends
  - J. after work

# **43.** A. NO CHANGE

- **B.** with
- C. in
- **D.** toward

# 44. F. NO CHANGE

- G. there work, a worthwhile
- **H.** their works; a worthwhile
- **J.** their work, a worthwhile

Question 45 asks about the preceding passage as a whole.

- **45.** Suppose the writer's goal had been to write a brief persuasive essay that strongly urged working adults to go back to school. Does this essay fulfill that goal?
  - **A.** Yes, because the essay focuses primarily on the benefits of self-employment.
  - **B.** Yes, because the essay suggests that evening classes are easy.
  - **C.** No, because the essay merely describes a few of the issues related to adult education.
  - **D.** No, because the essay lacks statistical data to support the assertions made.



#### Passage IV

#### **Surnames in America**

# [1]

According to a report <u>soon</u> published by the United States Census Bureau, Smith remains the most common surname in America. For the first time in history, however, two Hispanic surnames— Garcia and Rodriguez—<u>are being</u> among the top 10  $\frac{47}{47}$ 

most common surnames in the <u>nation, and</u> Martinez <sup>48</sup> nearly edged out Wilson for 10th place.

# [2]

Compiling surname rankings is a cumbersome task, according to a Census Bureau spokesperson, because of confidentiality and accuracy issues. Consequently, the recently published  $\frac{49}{49}$ 

report is only the second of <u>the</u> kind. While the record is somewhat imprecise, several demographers nevertheless contend that the new census

#### 46. F. NO CHANGE

- **G.** consequently
- H. recently
- J. secretly
- 47. A. NO CHANGE
  - **B.** are
  - C. being
  - **D.** OMIT the underlined portion.
- **48. F.** NO CHANGE
  - G. nation, since
  - **H.** nation since
  - J. nation, when
- **49.** Which of the following alternatives to the underlined portion would NOT be acceptable?
  - A. Thus,
  - **B.** Thus, it is not surprising that
  - C. Therefore,
  - **D.** Whereby,
- 50. F. NO CHANGE
  - **G.** its
  - H. it's
  - **J.** OMIT the underlined portion.

report marks the first time in the United State's

<u>history</u> that any non-Anglo name was among the  $\frac{51}{51}$ 

51

ten most common in the nation. 52

[3]

A review of related Census Bureau data <u>reveal</u> that the number of Hispanics living in the United States grew 58 percent during the 1990s to nearly 13 percent of the total U.S. population. Cracking the list of top 10 surnames provides evidence of just <u>how pervasive</u> the Latino migration has permeated American culture. A board member of a Miami-based Spanish-American organization said the milestone gives the Hispanic community <u>new standing within</u> the social structure of the <u>55</u> country. "People of Hispanic descent who hardly speak Spanish are now more eager to embrace their Hispanic heritage," he <u>said</u>. "Today, kids identify more with their roots than ever before."

- **51. A.** NO CHANGE
  - **B.** United States histories
  - C. history, of the United States,
  - **D.** the history of the United States
- **52.** At this point, the writer is considering adding the following statement:

While there are many surnames on the list, the top twenty-five account for nearly forty percent of the population.

Should the writer make this addition here?

- **F.** Yes, because it provides further evidence that Anglo surnames are losing popularity.
- **G.** Yes, because it supports the assertion that the record lacks certainty.
- **H.** No, because it provides information that is not relevant to the focus of the paragraph.
- **J.** No, because the popularity of a given name can easily change with time.

# **53. A.** NO CHANGE

- **B.** reveals
- C. argues
- **D.** supports

# 54. F. NO CHANGE

- G. how pervasively
- H. as pervasive
- J. how, pervasively,
- **55. A.** NO CHANGE
  - **B.** new standards at
  - C. elevation regarding
  - **D.** OMIT the underlined portion.
- **56.** Which choice would most effectively convey the speaker's pride in making the statements quoted in the essay?
  - F. NO CHANGE
  - G. said beamingly
  - H. laughed
  - J. reported

The <u>late</u> surname count also signals the growing number of Asians in America. The surname Lee ranked twenty-second, with the number of Lees <u>about equal divided among</u> whites and 58Asians. (Lee is so common in both China and Korea that, in all its variations, it reigns as the top surname in the world.) <u>Subsequently</u>, the census found six 59million surnames in the United States. Among those, 151,000 were shared by a hundred or more Americans.

# 57. A. NO CHANGE

- **B.** later
- C. latter
- **D.** latest
- 58. F. NO CHANGE
  - G. about equally divided among
  - H. about equally divided between
  - J. equally divided about

# 59. A. NO CHANGE

- **B.** Summarily
- **C.** Initially
- **D.** Altogether

Question 60 asks about the preceding passage as a whole.

**60.** Upon reviewing this essay and finding that some information had been left out, the writer composes the following sentence incorporating that information:

It is no wonder that celebrations of Hispanic culture have become more popular among teens in recent years.

This sentence would most logically be placed after the last sentence in Paragraph:

- **F.** 1.
- **G.** 2.
- **H.** 3.
- **J.** 4.

Passage V

## Winter Vegetables

Every year, as winter gets near, fresh  $\frac{61}{61}$ 

vegetables become more limited—and expensive in much of the United States. This annual trend

## 61. A. NO CHANGE

- **B.** is nearing
- C. approaches
- **D.** approached



forces many Americans to turn to canned or frozen options during the cold winter months.

#### In contrast with canned vegetables, which 62

tend to lose <u>alot</u> of nutrients during the preservation process, frozen produce is extremely healthful. In fact, frozen vegetables are often more healthful than not only canned produce, <u>and also</u> the "fresh" produce that is sold in supermarkets during the winter months. How, you may wonder, can it be that frozen vegetables contain more healthful nutrients than their fresh counterparts just a few aisles away? <u>65</u> According to researchers,

unlike vegetables destined to be sold in freshproduce aisles, vegetables chosen for freezing tend to be harvested at the peak of ripeness, a time where they are most nutrient-packed.  $\frac{66}{66}$ 

[1] <u>Initially</u>, in processing frozen vegetables  $_{67}^{67}$  involves blanching them in hot water or steaming

# 62. F. NO CHANGE

- G. In contrast, with canned vegetables, which
- H. In contrast, canned vegetables, which
- J. In contrast, canned vegetables
- 63. A. NO CHANGE
  - **B.** a lot
  - C. allot
  - **D.** lot's
- 64. F. NO CHANGE
  - **G.** but also
  - **H.** and when
  - **J.** OMIT the underlined portion.
- **65.** The writer is considering deleting the phrase "just a few aisles away" from the preceding sentence. Should the writer delete the phrase?
  - **A.** Yes, because it adds detail that is not essential to understanding the focus of the sentence.
  - **B.** Yes, because it is not consistent with the style and tone of the essay as a whole.
  - **C.** No, because it adds detail that is essential to the meaning of the sentence.
  - **D.** No, because it heightens the drama introduced at the beginning of the paragraph.
- 66. F. NO CHANGE
  - **G.** where it is
  - **H.** when they are
  - **J.** when it is
- 67. A. NO CHANGE
  - **B.** First,
  - C. The first step
  - **D.** Progress



them. [2]  $\underline{\text{Doing so}}_{68}$  kills bacteria and retards the action of food-degrading enzymes. [3] While this step does cause some water-soluble nutrients to break down or leach out, the subsequent flash-freeze step preserves the vegetables in a relatively high nutrient-rich state. [4] This process ensures that their rich nutritional characteristics remain constant when they are frozen to the time they are  $\frac{69}{69}$ 

prepared by consumers. 70

<u>Likewise</u>, vegetables destined to be shipped  $^{71}$  to fresh-produce aisles around the country are

typically picked before <u>they are ripe</u>; it gives them <sup>72</sup> less time to develop a full spectrum of vitamins and minerals. While outward signs of ripening may still occur <u>in a vegetable</u>, such fresh vegetables will <sup>73</sup> never achieve their peak nutritive values.

- **68.** All of the following would be acceptable replacements for the underlined portion EXCEPT:
  - F. Both
  - G. This safeguard
  - H. Either measure
  - J. Doing either
- 69. A. NO CHANGE
  - **B.** from the time
  - C. in the time
  - **D.** for when
- **70.** Upon reviewing this paragraph and realizing that some information has been left out, the writer composes the following sentence:

The vegetables remain frozen during their trip to the supermarket and their time in the store.

This sentence should most logically be placed after Sentence:

- **F.** 1.
- **G.** 2.
- **H.** 3.
- **J.** 4.
- **71. A.** NO CHANGE
  - **B.** In contrast
  - C. Hence
  - **D.** Furthermore
- 72. F. NO CHANGE
  - **G.** they are ripe, giving them
  - **H.** ripe; it gives them
  - J. ripe, having
- 73. A. NO CHANGE
  - **B.** with a vegetable
  - **C.** for a vegetable
  - **D.** OMIT the underlined portion.



Furthermore, unlike frozen vegetables, fresh vegetables are exposed to heat and light during the often long haul from farm to supermarket. Such exposure further degrades essential nutrients, making frozen vegetables the better option for 74<u>consumers</u> during the cold winter months.

74

- **74.** Which choice would best tie the conclusion of this essay to its opening sentence?
  - F. NO CHANGE
  - **G.** choice for domestic consumers
  - **H.** choice for those living in the States
  - J. option for Americans

Question 75 asks about the preceding passage as a whole.

- **75.** Suppose the writer had intended to write an essay that explained why frozen vegetables are nutritionally superior to canned vegetables during cold winter months. Would this essay fulfill the writer's intent?
  - **A.** Yes, because the essay states that the nutrient value of canned vegetables is consistently low throughout the year.
  - **B.** Yes, because the essay states that if frozen is better than fresh, frozen is clearly better than canned.
  - **C.** No, because the essay focuses primarily on the difference between frozen and fresh vegetables.
  - **D.** No, because the essay does not fully explain the ripening process.

**END OF TEST** 



**DIRECTIONS:** Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer sheet.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

- Linda purchased 1<sup>1</sup>/<sub>2</sub> pounds of potatoes on Friday and 2<sup>1</sup>/<sub>3</sub> pounds of potatoes on Saturday. What was the total weight, in pounds, of potatoes purchased by Linda in the two-day period?
  - **A.** 3%
  - **B.** 3⅔
  - **C.** 3<sup>1</sup>/<sub>3</sub>
  - **D.** 3<sup>2</sup>/<sub>3</sub>
  - **E.** 3%
- **2.**  $2x^2 \cdot 2x^3y \cdot 3x^2y$  is equivalent to:
  - **F.**  $7x^7y^2$
  - **G.**  $7x^{12}y^2$
  - **H.**  $12x^7y^2$
  - **J.**  $12x^{12}y$
  - **K.**  $12x^{12}y^2$
- **3.** There are a total 12,715 seats in an arena. Of the total, 7,512 seats are currently occupied by spectators. How many seats, to the nearest percent, are currently occupied?
  - **A.** 12
  - **B.** 52
  - **C.** 59
  - **D.** 61
  - **E.** 75
- 4. A gardener wants to use rope to section off a rectangular plot of land to grow vegetables. The plot measures 11 feet by 15 feet. Assuming no waste and that no extra rope is required to tie the ends, what is the minimum number of feet of rope the gardener will need to section off the plot of land?
  - **F.** 26
  - **G.** 52
  - **H.** 104
  - **J.** 139
  - **K.** 165

but some of the problems may be best done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed:

- 1. Illustrative figures are NOT necessarily drawn to scale.
- 2. Geometric figures lie in a plane.
- 3. The word *line* indicates a straight line.
- 4. The word average indicates arithmetic mean.

## **DO FIGURING HERE**

- **5.** In the first 4 of 5 consecutive days, Martha delivered 144, 152, 139, and 171 newspapers. How many newspapers did Martha deliver on the fifth day, if the average number of newspapers she delivered per day during the five-day period was 155?
  - **A.** 154
  - **B.** 162
  - **C.** 169
  - **D.** 171
  - **E.** Given the number of newspapers delivered by Martha on the first four days, she cannot average 155 per day for the five-day period.
- 6. Mr. Lee regularly spends a total \$145 commuting to work by train Monday through Friday. On Wednesday of a given five-day week, however, Mr. Lee decides to commute to work by car, instead of by train. If the cost of commuting by car is \$7, how much money does Mr. Lee save commuting to work that week? (Assume the regular train fare is the same each day of the week.)
  - **F.** \$ 7
  - **G.** \$ 12
  - **H.** \$ 22
  - **J.** \$138
  - **K.** \$143
- 7. If x is a real number such that  $x^3 = 125$ , then  $x^2 \sqrt{5x} = ?$ 
  - **A.** 0
  - **B.** 5
  - **C.** 10
  - **D.** 20
  - **E.** 25
- 8. The expression a[(b-c) + d] is equivalent to:
  - **F.** ab ac + ad
  - **G.** ab ac ad
  - **H.** b-c+ad
  - **J.** ab + ac + ad**K.** ab + ac - ad



- **A.**  $-\frac{10}{3}$  **B.**  $-\frac{10}{13}$  **C.**  $\frac{3}{10}$  **D.**  $\frac{10}{13}$ **E.**  $\frac{10}{3}$
- **10.** If a coin is randomly chosen from a bag that contains exactly 4 pennies, 3 nickels, and 8 dimes, what is the probability that the coin will NOT be a nickel?

F.  $\frac{1}{5}$ G.  $\frac{1}{4}$ H.  $\frac{3}{4}$ J.  $\frac{4}{5}$ K.  $\frac{5}{4}$ 

**11.** If the difference between the consecutive numbers in the sequence below is the same, which two numbers should be placed in the blanks?

19, \_\_\_\_, \_\_\_\_, 37

- **A.** 25, 31
- **B.** 22, 25
- **C.** 24, 32
- **D.** 26, 33
- **E.** 28, 36
- 12. A spherical rubber ball has a diameter of  $2\frac{1}{3}$  inches. If the formula for the volume of a sphere with radius *r* is  $V = \frac{4}{3}\pi r^3$ , what is the volume of the ball to the nearest cubic inch?
  - **F.** 3
  - **G.** 7
  - **H.** 9
  - **J.** 10 **K.** 21



**13.** In the table below, the sums of the integers in each row, column, and diagonal are equal. Which of the following integers accurately expresses the value of *x*?

2	9	x
-1	3	7
8	- 3	4

- **A.** 2
- **B.** 1 **C.** 0
- **C.** 0 **D.** -1
- **D.** -1**E.** -2
- E. 2
- 14. The matrix below summarizes the number of students that tried out for various sports teams Central High School.

	soccer	lacrosse	track	tennis
[	60	40	46	30 ]

The following matrix represents the percentage of students that were ultimately chosen to participate in each of the four sports.

soccer	30
lacrosse	40
track	50
tennis	_ 40 _

Given the two matrices, what is the total number of students accepted to participate on the four sports teams at Central High School?

- **F.** 47
- **G.** 50
- **H.** 62
- **J.** 69
- **K.** 72
- **15.** A manufacturer needs 57 pounds of grapes to make 24 cartons of raisins. How many pounds of grapes would the manufacturer need to make 16 cartons of raisins?
  - **A.** 28
  - **B.** 33
  - **C.** 38
  - **D.** 40
  - **E.** 41





Point A, not shown, is in one of the four quadrants of the *xy*-coordinate plane above. If the *x* and *y* coordinates of point A are both negative, in which quadrant must A be located?

- **F.** Quadrant I
- G. Quadrant II
- H. Quadrant III
- J. Quadrant IV
- K. Quadrants II or IV
- 17. Which of the following is a solution of the equation  $x^2 16x = 0$ ?
  - A. 4
  - **B.** 4
  - **C.** 12
  - **D.** 16
  - **E.** 20
- **18.** A sandwich shop has 2 types of bread, 3 types of cheese, and 5 types of meat. How many different sandwiches can be made using one type of bread, one type of cheese, and one type of meat?
  - **F.** 10
  - **G.** 16
  - **H.** 20
  - **J.** 26
  - **K.** 30
- **19.** Given  $A = \frac{3}{4}B + 0.23$  and A = 0.65, what is the value of B?
  - **A.** 0.30
  - **B.** 0.48
  - **C.** 0.56
  - **D.** 0.67
  - **E.** 0.76





#### Use the information that follows to answer questions 20-21.

The following chart represents the current enrollment in three art classes at a community college.

Course Title	Day	Time	Enrollment
Basic Drawing	Mon	9 am	21
	Wed	9 am	26
	Fri	9 am	22
Watercolors	Mon	11 am	28
	Wed	9 am	24
Art History	Fri	11 am	27

- **20.** What is the average number of students enrolled per day in the Basic Drawing class?
  - **F.** 23
  - **G.** 24
  - **H.** 25
  - **J.** 26
  - **K.** 69
- **21.** Room 12 of the community college can be occupied by a maximum 30 students. All but one of the art classes meets in Room 12. Such class cannot meet in Room 12 due to a scheduling conflict. On which day and at what time does the conflict occur?
  - A. Monday at 9 am
  - **B.** Friday at 9 am
  - **C.** Monday at 11 am
  - **D.** Wednesday at 9 am
  - **E.** Friday at 11 am
- **22.** If a rectangular plot measures 36 feet by 15 feet, what is the length, in feet, of the diagonal of the plot?
  - **F.** 39
  - **G.** 47
  - **H.** 51
  - **J.** 126
  - **K.** 540





- **24.** Which of the following is the slope-intercept form of 9x + y 3 = 0?
  - **F.** y = -9x 3 **G.** y = -9x + 3 **H.** y = 9x - 3 **J.** y = 3x - 9**K.** y = 3x + 9
- **25.** For all positive integers a, b, and c, which of the following expressions equals  $\frac{a}{c}$ ?
  - A.  $\frac{a \cdot b}{b \cdot c}$
  - **B.**  $\frac{a \cdot a}{}$
  - **D.** <u>c c</u>
  - C.  $\frac{a \cdot c}{c \cdot a}$
  - **D.**  $\frac{a-b}{c-b}$ **E.**  $\frac{a+b}{c+b}$
- **26.** Right triangle XYZ below has a hypotenuse that is 12 inches long. If  $sin Z = \frac{3}{4}$ , how long is  $\overline{XY}$ , in inches?





- **27.** Line AB intersects circle C at points A and B, as shown, and is 12 cm long. If line AB is 2 cm from the center of the circle C, what is the radius of circle C to the nearest tenth of a centimeter?
  - A. 7.5 B. 6.3 C. 5.2
  - **D.** 4.0
  - **E.** 3.4
- **28.** Points Q, R, S, and T lie on  $\overline{\text{QT}}$  as shown below. Given that  $\overline{\text{QT}}$  is 20 units long,  $\overline{\text{QS}}$  is 18 units long, and  $\overline{\text{RT}}$  is 9 units long, what is the unit length of  $\overline{\text{RS}}$ ?

Q			R	S	¬ Т
	F. G. H. J. K.	7 8 10 11 It cannot be determined given.	based on the inform	ation	

- **29.** Lines y = 3x + 5 and y = 4x + 2 intersect on a standard (x, y) coordinate plane. What is the *x*-coordinate of the point where the two lines intersect?
  - **A.** 0
  - **B.** 2
  - **C.** 3
  - **D.** 5
  - **E.** 8
- **30.** An aquarium in the shape of a rectangular box can hold 180 gallons of water when completely filled. Given that the width of the aquarium is 3 feet and its length is 7 feet, what is the minimum depth, in feet, of the aquarium? (Assume that 1 cubic foot of water is equal to 3 gallons of water.)
  - **F.** 2.54
  - **G.** 2.61
  - **H.** 2.72
  - **J.** 2.86
  - **K.** 3.12



**31.** The chart below displays information regarding the number and type of pizza delivered on a given day by a pizzeria.

Type of Pizza	Number Delivered
Pepperoni	$\bigcirc$ (
Cheese	$\bigcirc \bigcirc \bigcirc \bigcirc$
Mushroom	$\bigcirc$
Sausage	

 $\bigcirc$  = 10 Pizzas

According to the chart, what fraction of the pizzas delivered were mushroom?

**A.**  $\frac{1}{12}$  **B.**  $\frac{1}{10}$  **C.**  $\frac{1}{6}$  **D.**  $\frac{1}{3}$ **E.**  $\frac{1}{2}$ 

**32.** If 2a = 2b + 4, then  $(b - a)^3 = ?$ 

**F.** -8 **G.** -4 **H.** -2 **J.** 8 **K.** 16

**33.** For all real numbers R and S, if R = 2S + 10, then S = ?

**A.**  $\frac{R}{2} - 10$  **B.**  $\frac{R}{2} + 10$  **C.**  $\frac{R}{2} - 20$  **D.**  $\frac{R + 10}{2}$ **E.**  $\frac{R - 10}{2}$ 



- **34.** A 12-foot ladder is leaning against the wall of a building. If the bottom of the ladder touches the ground 5 feet from the base of the building, approximately how far is the top of the ladder from the base of the building?
  - **F.** 9
  - **G.** 11
  - **H.** 12
  - **J.** 13
  - **K.** 15
- **35.** Given the diagram as labeled below, what is the area, in square units, of parallelogram ABCD?



- **36.** The ratio of the lengths of the sides of a triangle is 6:8:9. The longest side of a second, similar triangle is 12 cm in length. What is the length, in centimeters, of the shortest side of the second triangle?
  - **F.** 6
  - **G.** 8
  - **H.** 9
  - **J.** 10
  - **K.** The length cannot be determined based on the information given.
- **37.** The larger of two numbers exceeds 3 times the smaller number by 6. The sum of 3 times the larger number and twice the smaller number is 62. Which equation correctly identifies x as the smaller number?
  - **A.** 3(3x + 6) + 2x = 62 **B.** 3(3x - 6) + 2x = 62 **C.** 3(3x + 6) + 3x = 62**D.** 2(3x + 6) + 2x = 62
  - **E.** (3x+6) + 3x = 62



**38.** In the figure below, all angles shown are right angles and the line segment lengths are given in centimeters. What is the perimeter of the figure, in centimeters?



**39.** The circle inscribed in the square below has a radius of 6 ft. What is the area of the square?



- **40.** Points R and S are located in a standard (*x*, *y*) coordinate plane. If R has coordinates (7, 2) and S has coordinates (5, 8), what are the coordinates of the midpoint between R and S?
  - **F.** (2, 6)
  - **G.** (2, –6)
  - **H.** (6, 5)
  - **J.** (6, 6)
  - **K.** (12, 10)
- **41.** For all positive integers *a*, *b*, and *c*, find the expression that is equivalent to:

$$\frac{2a^{3}b^{-2}c}{3^{-2}a^{2}c^{-3}}$$

- **A.**  $(2ac^3) \div (9b^2)$
- **B.**  $(2ac^4) \div (9b^2)$
- **C.**  $(18ac) \div (b^2)$
- **D.**  $(18ac^4) \div (b^2)$ **E.**  $(18a^5c^2) \div (b^2)$



**42.** In the figure below, BCED is a trapezoid and points A, B, and C are collinear. If the measure of angle ABD is 110° and the measure of angle DEB is 30°, what is the measure of angle DBE?



**43.** Of the total 365 cookies baked one day,  $\frac{3}{5}$  were chocolate chip. If  $\frac{1}{3}$  of the chocolate chip cookies also had walnuts, how many chocolate chip cookies with walnuts were baked?

- **A.** 65
- **B.** 70
- C. 73D. 82
- **E.** 90

44. A square has two diagonals and shown below.



How many diagonals does the hexagon below have?



- **F.** 0 **G.** 3
- **H.** 6**J.** 7
- **K.** 9
- **N**. 9

**45.** If 135% of a number is 540, what is 65% of the number?

- **A.** 260
- **B.** 280
- **C.** 300
- **D.** 320
- **E.** 400



- **46.** Which of the following complex numbers is equivalent to  $\frac{1}{1-i} \cdot \frac{1+i}{1+i}$ , where  $i^2 = -1$ ?
  - **F.** 2 + *i*
  - **G.** 1 + *i*
  - **H.** 1 *i*
  - **J.** (1+i)/2
  - **K.** (1-i)/2
- **47.** In a standard (x, y) coordinate plane, what is the distance between the points (1, 0) and (0, 4)?
  - A.  $\sqrt{19}$
  - **B.**  $\sqrt{17}$
  - **C.** 16
  - D. 5
  - E. 4
- 48. If the ratio of the radii of two circles is 3:5, what is the ratio of area of the smaller circle to the area of the larger circle?
  - 3:5 F.
  - **G.** 6:10
  - **H.** 9:25
  - **J.** 18:50
  - K. It cannot be determined based on the information given.
- **49.** A circle in the standard (x, y) coordinate plane is tangent to the x-axis at the point (3, 0) and to the y-axis at the point (0, 3). Which of the following is an equation of the circle?
  - **A.**  $x^2 y^2 = 9$ **B.**  $x^2 + y^2 = 9$ **C.**  $(x-3)^2 - (y-3)^2 = 9$  **D.**  $(x+3)^2 + (y+3)^2 = 9$  **E.**  $(x-3)^2 + (y-3)^2 = 9$

**50.** If 
$$\tan \theta = \frac{3}{4}$$
 and  $\pi < \theta < \frac{3}{2}\pi$ , then  $\sin \theta$ ?

**F.** 
$$-\frac{3}{5}$$
  
**G.**  $-\frac{3}{4}$   
**H.**  $-\frac{5}{4}$   
**J.**  $\frac{3}{5}$   
**K.**  $\frac{5}{3}$ 



**51.** Mary drew a circle graph (not shown) that included all of the various types of flowers in her garden. The garden included the following:

20% tulips; 25% daisies; 15% roses; and 10% pansies.

The last sector of her graph included the remaining flowers that were not tulips, daisies, roses, or pansies. What is the <u>degree</u> measure of the last sector of the circle graph?

- **A.** 30°
- **B.** 35°
- **C.** 54°
- **D.** 108°
- **E.** 150°
- **52.** The chart below shows the relationship between rows and blocks. What is the total number of blocks in row n, in terms of n?

Row Number	1	2	3	4	 п
Total Number of Blocks in Row	4	6	8	10	 ?

- **F.** 2n 2
- **G.** 2*n* + 2
- **H.**  $2n_{2}$
- $\mathbf{J.} \quad n^2$
- **K.** *n*
- **53.** Out of 30 girls, 16 participated in tennis and 12 participated in soccer during the academic year. Given this information, what is the minimum number of girls who play both tennis and soccer?
  - **A.** 0
  - **B.** 2
  - **C.** 4
  - **D.** 7
  - **E.** 12



- 54. Which of the following is the set of all real numbers *x*, such that 2x + 2 > 2x + 4?
  - **F.** The set containing all real numbers.
  - **G.** The set containing all positive real numbers.
  - H. The set containing all negative real numbers.
  - **J.** The set containing only zero.
  - K. The empty set.
- **55.** The figure below is an octagon with 8 equal interior angles. What is the measurement of one of the interior angles?



- **56.** If x = t + 7 and y = 2 3t, which of the following properly expresses *y* in terms of *x*?
  - **F.** y = 23 3x **G.** y = 23 + 3x **H.** y = -23 - 3x **J.** y = -19 - 3x**K.** y = 19 + 3x
- **57.** Which system of inequalities is represented by the shaded region below?



- **A.**  $y \le 4x$  and  $y \ge 2$
- **B.**  $y \le 4x$  and  $x \le 2$
- **C.**  $y \le 2x$  and  $y \ge 2$
- **D.**  $y \le 2x$  and  $x \le 4$
- **E.**  $y \le 2x$  and  $x \le 2$



**58.** In the standard (x, y) coordinate plane, which of the following is the graph  $y = (x + 2)^2 - 3$ ?





- **59.** If the diagonal of a square is 6 inches long, what is the area of square?
  - **A.** 6 **B.**  $3\sqrt{2}$
  - **C.** 18
  - **D.** 24
  - **E.**  $36\sqrt{2}$

**60.** If  $f(x) = 2x^2 - 3$ , then f(x + a) = ?

- F.  $2x^2 + 2ax + 2a^2 3$ G.  $2x^2 + 4ax + 2a^2 3$ H.  $2x^2 4ax + 2a^2 3$ J.  $4x^2 + 8ax + 4a^2 3$ K.  $4x^2 + 4ax + 4a^2 3$

**END OF TEST** 



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

# Passage I

Line

5

**Prose Fiction:** The following passage is adapted from the short story "The Outlaws" by Selma Lagerlof.

A peasant who had murdered a monk took to the woods in flight. He was quickly made an outlaw by the villagers with whom he had lived. To his surprise, he found before him in the wilderness another outlaw, a fisherman from the outermost islands who had been accused of stealing a herring net. The two joined together, lived in a cave, set snares, sharpened darts, baked bread on a granite rock, and guarded one another's lives. The peasant never left the woods. The fisherman, who had not committed such an abominable crime,

- 10 who had not committed such an abominable crime, however, sometimes loaded game on his shoulders and stole down the mountain to be among men. There, he managed to acquire, in exchange for ring-neck pheasants, for long-eared hares, and for fine-limbed red 15 deer, milk and butter, arrowheads, and clothes. These
- items helped the outlaws sustain life in the wilderness.

The cave where they lived was dug in the side of a hill. Broad stones and thorny sloe-bushes hid the entrance from virtually every vantage point. Above the 20 center of the cave grew a thick, mature pine tree. At its roots the outlaws had born a vent-hole for the cave using crude implements. The rising smoke from small fires within filtered through the vent and then through the tree's thick branches where it seemed to vanish into 25 space. The men used to go to and from their dwelling place, wading in the mountain stream, which ran down the hill. No one looked for their tracks under the merry,

At first they were hunted like wild beasts. The 30 peasants gathered as if for a chase of bear or wolf. The wood was permeated by men with bows, arrows, and other weapons. Men wielding spears went through it, leaving no dark crevice or busy thicket unexplored. While the noisy battue hunted through the wood, the

35 outlaws lay in their dark hole, listening breathlessly, panting with terror. The fisherman held out a whole day, but he who had murdered was driven by unbearable fear out into the open where he could see his enemy. He was quickly spotted and chased, but it seemed to him seven

40 times better than to lie still in helpless inactivity.

bubbling water.

# 

He fled from his pursuers, slid down precipices, sprang over streams, and climbed up perpendicular mountain walls. All latent strength and dexterity in him was called forth by the frenzy of danger. His body 45 became elastic like a steel spring; his foot made no false step; his fingers never lost their hold; eye and ear were twice as sharp as usual. He understood what the leaves whispered and the rocks warned. When he had climbed up a precipice, he turned toward his pursuers, sending

50 them gibes in biting rhyme. When the whistling darts whizzed by him, he caught them, swift as lighting, and hurled them down on his enemies. As he forced his way through whipping branches, something within him sang a song of triumph.

55 The bald mountain ridge ran through the wood and alone on its summit stood a lofty fir. The red-brown trunk was bare, but in the branching top rocked an eagle's nest. The fugitive was now so audacious that he climbed up to the perch, while his pursuers looked for

- 60 him on the wooded slopes. There he sat muffling the panicked cries of the young eaglets, while the hunt passed by far below him. Panicked and alarmed, the male and female eagles swooped down upon the invader. They fluttered before his face, striking with their beaks
- 65 at his eyes, beating him with their wings, and tearing with their claws superficial wounds in his weatherbeaten skin. Laughing, he fought with them. Standing upright in the shaking nest, he cut at them with his sharp knife and forgot in the pleasure of the play the danger
- and his pursuers in the wood below. When he found time to look for them, they had already gone by to some other part of the forest. No one had thought to look for the prey on the bald mountain ridge. No one had raised an eye to the clouds to see him practicing boyish tricks
  and sleepwalking feats while his life was in the greatest
  - danger.

The peasant trembled when he found that he was safe. With shaking hands, he caught at a support. Giddy with relief, he measured the height to which he had climbed. He then moaned with the fear of falling. Afraid of the birds, afraid of being seen, afraid of everything, he eventually slid down the trunk. He laid himself forward over the rocks until the underbrush covered him. There he hid himself under the young pine

- 85 tree's tangled branches. Weak and powerless, he sank down on the moss. A single man could have captured him as he recovered from the reality of what had After what seemed like an hour, he transpired. stumbled back to the cave to find his companion no 90 worse off, still motionless with fear.
- **1.** The passage primarily provides a vivid description of:
  - **A.** a fisherman's life in the woods with his friends.
  - **B.** how an outlaw evaded members of a search effort in the woods.
  - C. why caves are not always the best places to hide in the woods.
  - **D.** how mating adult eagles instinctually protect their young.
- 2. In terms of developing the story, the first two paragraphs primarily:
  - **F.** introduce the main characters and set the scene.
  - **G.** introduce the main characters and foreshadow their demise.
  - H. create a dilemma that is resolved later in the passage.
  - J. establish a tone of informality and humor.
- **3.** The passage is narrated from the perspective of:
  - **A.** the outlaw who had murdered the monk.
  - **B.** the villagers who were searching for the outlaw.
  - **C.** a third party with intimate knowledge of all details.
  - **D.** a third party with limited knowledge of details and events.
- 4. It can most reasonably be inferred from the first paragraph that the outlaws "guarded one another's lives" (lines 8-9) from:
  - **F.** eagles that nested high in trees.
  - G. other humans who might spot them.
  - H. wild beasts, like bears or wolves.
  - J. other outlaws living in the woods.

- 5. The word "busy" in line 33 suggests that the thicket was.
  - A. impenetrable
  - **B.** dense
  - **C.** thorny
  - **D.** poisonous
- 6. According to the fourth paragraph (lines 46-54), when fleeing his pursuers, the outlaw's body and mind responded:
  - **F.** with unusual lethargy.
  - **G.** incredibly well.
  - **H.** as if enervated.
  - **J.** somewhat better.
- 7. Based on the description in the fifth paragraph, during his fight with the eagles, the outlaw did all of the following EXCEPT:
  - A. stand upright in the shaky nest.
  - **B.** incur minor scratches.
  - **C.** brandish a sharp knife.
  - **D.** gaze down upon his human pursuers.
- 8. The events described in paragraphs 4-6 took place:
  - **F.** in a fictional world.
  - **G.** in the peasant's imagination.
  - H. shortly after the monk was murdered.
  - J. years after the monk was murdered.
- 9. As used in line 78, the word "support" most likely refers to:
  - A. a stake.
  - **B.** a nest.
  - C. a branch.
  - **D.** an eaglet.
- **10.** The narrator's attitude toward the outlaw can best be described as:
  - **F.** disapproving
  - G. detached
  - **H.** approving
  - J. enthusiastic



# **Passage II**

**Social Science:** The following passage discusses several aspects of Pilates, an exercise program developed by Joseph Pilates in 1923.

Pilates is a physical fitness program that began sweeping the nation during the mid 1990s, changing the notion of a "workout" for many. That's right; for many *Line* exercise enthusiasts, long gone are the days of mono-5 tonous treadmills and stationary bikes. Long gone too are the days of pushups, sit-ups, and other traditional forms of strength training. Even once fashionable tae bo and body-pump group classes have lost their appeal to

10 the Pilates movement.

Developed in the early twentieth century by German-born Joseph Pilates, the fitness program that bears his name currently boasts more than 11 million regular participants and 14,000 instructors throughout

the masses within the last decade, perhaps as a result of

15 the United States. Amazingly, the numbers continue to grow. So why—you may ask—has Pilates become and remained so popular?

Marketing experts claim that Pilates has remained the exercise rage because it has been espoused 20 and promoted by so many celebrities. "Just walk through the DVD sections of fitness or entertainment product retailers and you will be overwhelmed with images, testimonials, and other endorsements from celebrities like Madonna, Martha Stewart, and Tiger

25 Woods," says one marketing executive. "Celebrities attract adult admirers to Pilates the way a character like SpongeBob SquarePants attracts children to specific brands of cereal or liquid soap."

One psychologist explained the phenomena by 30 pointing out that humans are social creatures who are willing to go to extremes to be accepted by not only family, friends, and co-workers, but also by members of their communities at large. "Celebrities are the members of a society who are accepted and admired by the

- 35 masses. Whether celebrities are actually happy is irrelevant. What is critical is that celebrities are perceived as happy and admired. This perception causes, often unconsciously, everyday people like you and me to seek the same happiness and admiration. So
- 40 how do we go about doing so? We emulate celebrities: If they wear Armani sunglasses, we wear Armani sunglasses; if they practice Pilates, we practice Pilates."

Huntington | ACT

In contrast, fitness experts argue that the physical benefits of Pilates keep adults coming back for

45 more. Joseph Pilates himself classified his fitness program as a form of "contrology," because he believed his method of exercise helped the dedicated participant learn how to use his mind to control his body. This benefit alone, touted Pilates, made his program superior 50 to all others.

The goal of Pilates is not a "washboard stomach" or bulging biceps. Pilates focuses on strengthening the core postural muscles (i.e., the ones that help keep the human body balanced and that are essential to providing 55 support for the spine). "Once you've begun to experience the physical benefits of strong and controlled deep back and torso muscles," asserted one renowned exercise physiologist, "the benefits of other workouts pale in comparison."

60 Some adherents admit that they have stuck with Pilates for social reasons. "Pilates classes are a great way to meet people," claimed a young adult who regularly attends a group class near his home in Southern California. "I have become friends with quite a few of 65 my Pilates classmates," he added. "We share a healthy

lunch after class whenever possible. We even socialize, at times, on weekends and holidays."

Sociologists explain this trend by noting that social networking in America has evolved over time. 70 "Years ago, adults would network at places like bars and night clubs," asserted one sociologist. "Today, there are essentially two new social networking options for adults: online chat rooms and fitness centers."

Other adult participants contend that Pilates 75 offers them a great opportunity to exercise with their children. "Many of my adult students attend class with their children," stated one instructor. "They see Pilates class as the perfect way to exercise and spend time with their children."

80 "Social benefits notwithstanding," commented one fitness center owner, "our Pilates classes help parents teach their children about the importance of regular exercise in leading a healthy and fulfilling life. Many parents in today's society fail to instill in their 85 children the importance of an exercise program that is both fun and safe for growing bodies."

#### GO ON TO THE NEXT PAGE.

35

- **11.** According to the passage, adults participate in Pilates classes for all of the following reasons EXCEPT:
  - **A.** to spend time with their children.
  - **B.** to emulate celebrities.
  - C. to increase core postural muscle strength.
  - **D.** to achieve a more balanced diet.
- **12.** The main function of the second paragraph (lines 11-17) in relation to the passage as a whole is to:
  - **F.** provide some background information and pose a question that the author attempts to answer in the remainder of the passage.
  - **G.** cite an authority and pose a rhetorical question that is never fully answered by the author in the remainder of the passage.
  - **H.** introduce statistics that are immediately undermined by the rhetorical question that follows.
  - **J.** support a claim made in the first paragraph and anticipate a possible objection to the question posed.
- **13.** The author includes the quote that refers to "SpongeBob SquarePants" (lines 25-28) in order to help the reader:
  - A. remember a simpler time of life.
  - **B.** understand adult attraction to celebrities.
  - **C.** introduce a humorous tone to the passage.
  - **D.** highlight marketing brilliance.
- **14.** It is reasonable to infer that the psychologist quoted in paragraph four (lines 29-42):
  - **F.** disapproves of people who admire celebrities.
  - G. may admire certain celebrities herself.
  - H. is happy being a psychologist.
  - J. wears Armani sunglasses and practice Pilates.
- **15.** The term *contrology* (line 46) is most likely in quotation marks in order to indicate that the word:
  - **A.** is being used ironically.
  - **B.** was coined by Joseph Pilates.
  - **C.** was used widely in Germany.
  - **D.** is rooted in mythology.

- **16.** The phrase *stuck with* (line 60) suggests that without the social aspects of Pilates class:
  - **F.** some children would lose interest.
  - G. some adults would not socialize.
  - H. some instructors would be less demanding.
  - J. some adults would stop participating.
- **17.** According to the statements made by the sociologist in paragraph 8 (lines 68-73):
  - A. adults no longer network socially at bars or night clubs.
  - **B.** online chat rooms are extremely popular among adults.
  - **C.** fitness centers are places where people can interact socially.
  - **D.** fitness centers no longer focus on the physical wellbeing of members.
- **18.** Based on the passage, which of the following statements is most likely true?
  - **F.** An exercise program designed to strengthen core postural muscles is entirely safe for everyone.
  - **G.** Social networking has become more and more popular over time.
  - **H.** An exercise program designed to strengthen core postural muscles is generally safe for children.
  - **J.** Celebrities enjoy the social benefits of Pilates more that everyday people.
- **19.** As it is used in line 83, the word *fulfilling* means:
  - A. busy
  - **B.** satisfying
  - C. active
  - **D.** relaxing
- **20.** According to the passage, which statement best summarizes the answer to the question posed in lines 16-17?
  - **F.** Membership in Pilates classes continues to grow over time.
  - **G.** There are many reasons to explain why people practice Pilates.
  - H. Pilates helps people lead healthy lives.
  - **J.** Marketing experts use celebrities and social networks to promote Pilates.

# Passage III

Humanities: The following passage is adapted from "Decline of the Drama" written by Stephen Leacock in 1921

Traveling home the other night on the subway, I overheard a man say, "Woefully, the drama today is nothing more than a bunch of talk. It has become inferior to virtually all other forms of live entertainment." These Line 5 remarks got me thinking, and I'm glad they did. Not only has it been a while since I've pondered the state of the drama, but in my role as a weekend newspaper columnist, I'm actually required to think about topics of interest at least once a week.

- Somewhat of a dramatic actor back in my 10 twenties, I am saddened by the notion that the drama has declined in both quality and popularity. While I only appeared in amateur productions, I played some particularly interesting parts nonetheless. I was once a
- 15 fairy in A Midsummer Night's Dream and an angel in A Golden Summer. I have had other parts too in productions like Bells Ring from Behind. (I rang the bells.) I have been a groan and a sigh, and I was once the vision in A Vision Passes before the Sleeper.
- So when I write of acting and of the spirit of the 20 drama in its heyday, I speak of what I know, not merely of what I have been told.

Through drama I have been brought into contact-very often into quite intimate personal 25 contact-with some of Broadway's greatest actors. I will never forget Forbes Robertson: he owes me 50 cents. And as for Martin Harvey-I simply cannot call him Sir John, we are such dear old friends-he never comes to New York without at once calling me for my

- 30 services. No doubt everyone knows that splendid play in which he once appeared, The Breed of the Treshams. There was a torture scene therein, a most gruesome thing. Harvey, as the hero, had to be tortured before he made his triumph, not on the stage itself, but just off the
- stage in a little room. Audience members were 35 dismayed as he howled in agony. Well, it was I who tortured him. Indeed, Harvey and I were at one time so used to working together that he would not accept cruel and unusual offstage punishment from anyone but me.
- So naturally I am a keen friend and student of 40 the drama, and I hate to think of it going all to pieces.

Huntington | ACT

The real trouble with the drama is that it has become a mere mass of conversation and reflection. I

agree with the man on the subway. All the action is 45 gone. There is nothing left but thought, and who wants to pay money to think?

Now, when I was at the apogee of my acting career (I think that's the right word—it may be apology—I'm not sure), things were very different. Both audiences and

- 50 actors back then wanted action-striking, climatic, catastrophic action. Furthermore, directors always made darn sure that such high-impact action happened in a place that was interesting, not simply in an ordinary room with ordinary furniture. The scene was always set
- 55 in place like a lighthouse during a thunderstorm or a mad house under a full moon.

I remember in the case of the first play I ever wrote (Yes, I wrote plays too!), the manager to whom I submitted the script asked me at once, "Where is the action laid?" "It is laid," I answered, "in the main sewer 60 of a great city shortly before a flood." "Good, good," he said, "keep it there."

Of all the settings used on Broadway, the lighthouse was always the best. There is something about a lighthouse that you can't get in a living room or a 65 kitchen. What it is exactly, I'm not sure, but I know there's a difference. I thoroughly enjoyed every lighthouse play in which I had a role. For some unknown reason, the lighthouse inspired me to throw 70 myself deep into my acting.

Yes, there was certainly something about a lighthouse-the way you'd see it from a distance in scene one, its lantern shining out over the black waters, suggesting security, fidelity, and faithfulness. Then in 75 scene two, the stage was set dim and the audience was privileged to see only the silhouette of the lonely night "See," he cried as he stood, "there is watchman. lightning in yon sky." (I was the lightning and his line was my cue.) "God help all the poor souls at sea tonight!" Then a woman would appear and cry out, 80 "Look! Look! There is a boat adrift upon the reef!" (As she spoke, I had to rush around and make the boat in the distance go up and down. Then there was more lightning.)

The fishermen in those plays used to get fearfully 85 excited during the boat scenes. I remember well the bursts of commotion that were well coordinated with momentary pulses of white light that illuminated panicked fishermen in wet oilskins on a slick wooden 90 deck. For me, and many others, that was acting and that was drama. It saddens me to think that there isn't a single flash of lightning on all of Broadway this season.

- **21.** Which of the following best describes the structure of the passage?
  - **A.** A dialogue between two people in which both express their opinions on the decline of the drama
  - **B.** An account of the writer's perspective regarding the decline of the drama based primarily on the writer's first-hand experiences
  - **C.** A detailed rebuttal by the writer of the opinion expressed by the man on the subway regarding the decline of the drama
  - **D.** A one-sided account of the man on the subway's views regarding the decline of the drama
- **22.** Based on the passage, which of the following statements best describes the writer's career as a dramatic actor?
  - **F.** The writer played leading roles in many dramas.
  - **G.** The writer achieved greater success as a playwright than as an actor.
  - **H.** The writer played minor, often offstage, roles in dramatic performances.
  - **J.** The writer was well known by people like the man in the subway.
- **23.** The passage suggests that the writer believes that audiences attend dramatic performances in order to:
  - A. watch shows that are packed with action and drama.
  - **B.** think about society's thorniest issues in the comfort of a theater.
  - **C.** escape momentarily the harsh realities of their time.
  - **D.** support theater groups like the one associated with the writer.
- **24.** Which of the following statements about the drama is best supported by the passage?
  - **F.** Back in the 1920s, it was a popular form of live entertainment among theatergoers.
  - **G.** At the time the passage was written, it was less popular with audiences than it had once been.
  - **H.** It would regain lost popularity if only more performances opened with lighthouse scenes.
  - **J.** At the time the passage was written, the subject matter of dramas no longer inspired actors.

- **25.** The *parts* referred to in line 14 were probably most "interesting" to:
  - A. the man on the subway and his companion.
  - **B.** most theatergoers.
  - **C.** the writer of the passage.
  - **D.** the authors that included the parts in their scripts.
- **26.** The insertion of the parenthetical in lines 48-49 can best be described as the author's attempt at:
  - **F.** irony.
  - G. deception.
  - H. pageantry.
  - J. humor.
- **27.** Which of the following is the best example of the kind of *action* described in lines 49-54?
  - A. A woman cooking dinner for her family.
  - **B.** A man cooking dinner for his family.
  - C. A sailor falling overboard into a stormy sea.
  - **D.** A detective contemplating the consequences of her work.
- **28.** According to the passage, the manager referred to in line 58 would most likely have objected to a drama that was set:
  - **F.** on a boat near the bottom of a waterfall.
  - G. in a lighthouse on a stormy night.
  - **H.** in the kitchen of a house on a spring day.
  - J. behind the scenes at a three-ring circus.
- **29.** The passage as a whole suggests that most dramas being performed at the time the passage was written were:
  - A. laden with profound reflections.
  - **B.** formulaic and predictable.
  - **C.** too short to justify ticket prices.
  - **D.** lacking in dialogue.
- **30.** According to the passage, the writer's views of dramas past and present, respectively, can best be described as:
  - **F.** indifferent and enthusiastic.
  - G. concerned and analytic.
  - **H.** approving and critical.
  - J. reminiscent and supportive.

# Passage IV

Natural Science: The following passage is adapted from "Relativity: The Special and General Theory" by Albert Einstein.

Apart from the difficulty associated with uniform particle motion, there is a second fundamental difficulty with classical celestial mechanics. This second *Line* difficulty was first discussed in detail by the astronomer 5 Seeliger. In his published works, Seeliger encouraged

readers to consider the universe as a whole. He then

If we were to think about the universe for a moment as Seeliger requested, we might quickly come to

challenged them to describe such universe in words.

- 10 the conclusion that, with regard to space, the universe is infinite. In other words, we might say that the universe goes on forever without limit. If we were then asked to comment on the stars existing within the universe, we might add that there are stars everywhere and, although
- 15 the density of matter is variable in detail, it is nevertheless on the average everywhere the same. In other words, we might say that no matter how far we might travel through space, we would expect to find everywhere, stars of approximately the same kind and
- 20 density.

This view, however, is not in harmony with the classical celestial theory of the physicist Newton, which requires that the universe have a center. This center, Newton theorized, would be identifiable as a center

- 25 because it is there that the density of stars would be greatest. Accordingly, if we were to proceed outwards through space from this center of the universe, we would observe an ever-diminishing density of stars until finally, at some great distance from the center, we would enter
- 30 an infinite region of emptiness. According to Newton, the stellar universe was properly understood as a finite island in the infinite ocean of space.

Unfortunately, Newton's conception of the universe is not very satisfactory because it leads to the 35 conclusion that the light emitted by stars, especially those stars farthest from the center, is perpetually passing out into infinite space, never to return and never again to come into contact with other objects of nature. Such a finite material universe would be destined to become

40 gradually but systematically impoverished.

In order to escape this dilemma, Seeliger suggested a modification of Newton's theory. He made the assumption that the mean (average) density of matter of the universe is constant everywhere, even to infinity.

45 Seeliger, thus, freed us from the distasteful conception that the material universe ought to possess something in the nature of a center.

Unfortunately, Seeliger purchased our emancipation from the aforementioned fundamental difficulty

- 50 at the cost of a modification of Newton's law that has neither an empirical nor a theoretical foundation. In fact, we could dream up innumerable laws that would serve the same purpose without ever being able to offer a persuasive reason why one of them should be preferred
- 55 to the others. This is the case because each one of our laws would lack, as does the theory of Newton itself, a rigorous theoretical foundation.

Unsatisfied with the level of theoretical rigor associated with the work of Seeliger and Newton, we should turn our attention to non-Euclidean geometry, 60 which has led to the recognition that we can cast doubt on the infiniteness of our universe without coming into conflict with our experiences or the laws of thought. While the physicist Helmholtz has already used non-65 Euclidean geometry to describe the universe in detail, we

will briefly highlight its usefulness.

Start by imagining an existence in twodimensional space: flat beings, with flat things, free to move about within their two-dimensional world. For

- them, nothing exists outside of the plane-that which 70 they observe to happen to themselves and to their flat implements is the all-inclusive reality of their plane. In contrast to ours, their universe is limited to only two dimensions; like ours, however, theirs extends infinitely.
- In their universe there is room for a grid composed of an 75 infinite number of identical squares.

Let us now consider a second two-dimensional existence, but this time on a spherical surface instead of on a plane. The flat beings fit exactly on the curved 80 surface and they are unable to leave it. Their whole universe of observation extends exclusively over the surface of the sphere. Are these beings able to travel infinitely in one direction (from their perspective, of course)? Yes. Is their universe, thus, infinite? No, it is

- 85 limited by the surface area of their spherical world. The great charm resulting from this consideration lies in the recognition of the fact that, while the universe of these beings is finite, it nonetheless has no limits. Thus, we must remain open to the idea that our own universe is
- 90 both finite and boundless.



- **31.** Which of the following statements most accurately summarizes the author's opinion of the celestial theories of Seeliger and Newton?
  - **A.** Alone each is insufficient, but together they are satisfactory.
  - **B.** They are both based on non-Euclidean geometry.
  - C. They are materially similar.
  - **D.** They both lack rigorous theoretical support.
- **32.** Based on the passage, with which of the following conclusions about our universe would the author most likely agree?
  - **F.** While it is limitless, it may be boundless.
  - **G.** While it has a center, it may be a small one.
  - **H.** It may be both finite and without limits.
  - J. It may be finite, but it is ever-expanding.
- **33.** According to the passage, Seeliger believed that:
  - A. the universe is infinite and without limits.
  - **B.** the universe has a center.
  - **C.** space travel would one day be possible.
  - **D.** the density of stars is highest near the center.
- **34.** The author uses the fourth paragraph (lines 33-40) primarily to:
  - **F.** introduce a new theory.
  - **G.** explain why a theory is unsatisfactory.
  - H. argue against the conservation of matter.
  - **J.** explain why non-Euclidean geometry is important.
- **35.** Which of the following questions does the passage NOT answer?
  - **A.** Did Helmholtz attempt to describe the universe in detail?
  - **B.** Why is it problematic for the universe to become impoverished?
  - **C.** Did Newton's theory require that the universe have a center?
  - **D.** Why did Seeliger modify Newton's theory?
- **36.** According to the passage, the flat two-dimensional world differs from the spherical two-dimensional world in that:
  - **F.** the former is finite, while the latter is infinite.
  - G. the former has no limits, but the latter does.
  - **H.** the former is infinite, while the latter is finite.
  - J. the former is boundless, but the latter is not.

- **37.** When the author refers to the idea of the universe having a center as a "distasteful conception" (line 45), he is most likely expressing his distaste for:
  - A. the astronomer Seeliger and his theories.
  - **B.** the notion that our universe is irretrievably losing matter to infinite space.
  - **C.** the physicist Newton and his classical celestial theory.
  - **D.** a theory that lacks a Euclidean basis and empirical data.
- **38.** The main function of the sentence in lines 51-55, in terms of the sixth paragraph (lines 48-57) as a whole, is to:
  - **F.** give the reader a sense of proportion to better understand the vastness of the universe.
  - **G.** create a context that helps the reader understand the lack of theoretical rigor behind Seeliger's modification of Newton's theory.
  - **H.** divert the reader's attention from the celestial mechanics theories of Newton and Helmholtz.
  - **J.** formulate a hypothetical situation that allows the reader to compare the theoretical rigor introduced at the beginning of the paragraph.
- **39.** The author italicized the word *things* in line 68 most likely to acknowledge the use of:
  - A. a term of art.
  - **B.** a technical term.
  - C. an ambiguous word.
  - **D.** an unsophisticated word.
- **40.** It can reasonably be inferred from the passage that the author:
  - **F.** values non-Euclidean geometry as a tool for understanding the universe.
  - **G.** enjoys theorizing with colleagues from various disciplines.
  - **H.** has collected empirical data on stars with constant average density.
  - **J.** believes in beings that live in two-dimensional worlds.

#### END OF TEST.



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

You are not permitted to use a calculator on this test.

# Passage I

In molecular biology, *transformation* is the term used to describe the genetic alteration of a cell's chromosomal DNA. After splicing the cell's naturally existing DNA strand between two consecutive genes, genetic engineers sometimes add a series of *foreign genes* (genes removed from a different strand of DNA).

Six genes in a given strand of chromosomal DNA (A, F, G, X, R, and S) repeat themselves in that order, as shown below:

 $\ldots \_ A \_ F \_ G \_ X \_ R \_ S \_ A \_ F \_ G \_ X \_ R \_ S \_ A \_ F \_ \ldots$ 

In an experiment, each of four genetic engineers removes six consecutive genes from the strand described above. The six genes are removed and added, one at time (in order) as foreign genes, to a host cell's naturally existing DNA strand that has already been spliced. The entire transformation takes 60 minutes and the rate of genetic alteration is constant. Thus, one gene is transferred every 10 minutes. Each genetic engineer completes the transformation in accordance with a different set of rules.

# Rules for Genetic Engineer 1

Transformation of the six foreign genes always begins with A and ends with S.

# Rules for Genetic Engineer 2

Transformation of the six foreign genes always begins with A or S. If A is first, S is last. Conversely, if S is first, A is last.

# Rules for Genetic Engineer 3

Transformation of the six foreign genes can begin with any one of the six foreign genes. Transformation then proceeds to the right (with respect to the strand as illustrated above). Thus, if G is transferred first, X is second, R is third, and so on, ending with the transfer of F.

# Rules for Genetic Engineer 4

Transformation of the six foreign genes can begin with any one of the six foreign genes. Transformation can then proceed to the right or left. Thus, if R is transferred first, either X or S could be second, and S or X last, respectively.

- **1.** Based on the information presented, if the transfer of the six foreign genes by any one of the genetic engineers were interrupted 35 minutes after the transformation began, the transfer of how many genes would be complete?
  - **A.** 2
  - **B.** 3
  - **C.** 4
  - **D.** 5
- 2. Based on the rules followed by Genetic Engineer 3, if all six foreign genes were transferred and the first gene transferred was X, the fourth gene transferred was:
  - **F.** Gene R
  - G. Gene S
  - H. Gene A
  - J. Gene F



- **3.** Suppose that Genetic Engineer 2 got interrupted 20 minutes into the transformation of the six foreign genes. Which of the following foreign genes would definitely NOT have been transferred to the host cell by Genetic Engineer 2?
  - A. Gene S
  - **B.** Gene X
  - C. Gene R
  - **D.** Gene F
- **4.** Suppose that the transfer of foreign genes by Genetic Engineer 2 was interrupted immediately after the transfer of Gene R. Based on this information, which of the following could be the amount of time Genetic Engineer 2 worked on the transformation?
  - **F.** 10 minutes
  - G. 30 minutes
  - **H.** 40 minutes
  - **J.** 50 minutes

- **5.** Based on the information presented, which of the following genetic engineers could have transferred Gene F second-to-last in a transformation of all six foreign genes?
  - **A.** Genetic Engineer 1 and 3 only
  - **B.** Genetic Engineers 3 and 4 only
  - C. Genetic Engineers 2 and 4 only
  - **D.** Genetic Engineers 2, 3, and 4 only

# Passage II

Water samples were collected from 4 lakes at 7:00 a.m. one summer morning. Later that same day, at 3:00 p.m., a second water sample was collected from each of the same 4 lakes. All 8 water samples were then analyzed by a laboratory technician.

Table 1 and Table 2 display the *clarity*, *odor*, *specific gravity*, and *concentration of suspended solids* of the morning and afternoon water samples, respectively.

The laboratory technician, in accordance with Good Laboratory Practices, calculated the specific gravity of the lake water samples as follows:

specific gravity = <u>density of sample</u> density of water

The normal range of specific gravity of lake water is 1.10-1.30. Swimming in lake water that has specific gravity of more than 1.30 is considered unhealthy and is forbidden by local authorities.

Table 1							
7:00 a.m. lake water samples							
LakeClarity*Odor**SpecificSuspendedClarity*Odor**GravitySolids (g/L)							
А	8	2	1.05	18.3			
В	6	3	1.15	36.7			
С	4	4	1.24	55.9			
D	2	8	1.33	74.7			
* Clarity was assigned by using a 0-10 scale: 0 being very opaque and 10 being very transparent.							

\*\* Odor was assigned by using a 0-10 scale: 0 being virtually no scent and 10 being very pungent.

Table 2							
	3:00 p.m. lake water samples						
Lake	LakeClarity*Odor**Specific GravitySuspended Solids (g/L)						
A B C D	6 4 3 2	3 4 5 8	1.16 1.22 1.25 1.32	36.8 56.0 65.6 74.5			

\* Clarity was assigned by using a 0-10 scale: 0 being very opaque and 10 being very transparent.

\*\* Odor was assigned by using a 0-10 scale: 0 being virtually no scent and 10 being very pungent.

- **6.** Do the data in Tables 1 and 2 support the conclusion that as lake water becomes less transparent, odor increases?
  - **F.** Yes, because samples with the highest clarity values had the highest odor values.
  - **G.** Yes, because samples with the lowest clarity values had the highest odor values.
  - **H.** No, because samples with the lowest clarity values had the highest odor values.
  - **J.** No, because samples with the lowest clarity values had the lowest odor values.
- **7.** Based on the results provided, as the concentration of suspended solids in lake water decreases, the specific gravity of the lake water:
  - A. remains constant.
  - **B.** decreases, then increases.
  - **C.** decreases only.
  - **D.** increases only.

- **8.** One liter of which of the following lake water samples would likely weigh the most?
  - F. The 7:00 a.m. sample from Lake A
  - **G.** The 7:00 a.m. sample from Lake B
  - H. The 3:00 p.m. sample from Lake C
  - **J.** The 3:00 p.m. sample from Lake B
- **9.** Based on the information presented, which one of the following statements best explains why the clarity and odor values of Lake D did not change from 7:00 a.m. to 3:00 p.m. on the day the samples were taken?
  - **A.** Solid particles in lake water are typically very pungent.
  - **B.** Lake D did not receive heavy rain the week before the samples were taken.
  - **C.** No one swam in Lake D on the day the samples were taken.
  - **D.** Swimmers in Lakes A, B, and C stirred up solid particles that would otherwise have remained undisturbed at the bottom of those lakes.

- **10.** Upon reviewing the data collected, the lab technician concluded that the clarity value of lake water is nearly *inversely proportional* to the odor value of lake water. (Note: Two variables are inversely proportional if their product is a constant.) Based on the information provided, is the lab technician's conclusion accurate?
  - **F.** No, because clarity values of the samples varied from lake to lake.
  - **G.** No, because the odor values of lake water samples are never constant.
  - **H.** Yes, because the product of the clarity and odor values of any given sample was in the 15 to 18 range.
  - **J.** Yes, because transparent lake water samples are as pungent as opaque lake water samples.

# Passage III

An astronomer performed three experiments using 4 different optical telescopes (1, 2, 3, and 4).

## Experiment 1

The astronomer viewed four pairs of adjacent stars (A, B, C, and D) through each of the optical telescopes. After each of the 16 viewings, the astronomer recorded whether the pair of stars had appeared as two distinct images or one blurred image. The data appear in Table 1.

Table 1						
Star		Optical Telescopes				
Pair	1	2	3	4		
А	•	•	•	0 0		
В	•	•	0 0	0 0		
С	•	0 0	0 0	0 0		
D	0 0	0 0	0 0	0 0		
• indicates star pairs that appeared blurred together						
°° indicates star pairs that appeared separate						

# **Experiment** 2

The astronomer then identified a star, Alpha Metron, with a known diameter of 0.002" (arcseconds). Next, the astronomer viewed Alpha Metron through each of the 4 optical telescopes, recording after each viewing its *apparent size* (the size, in arcseconds, of Alpha Metron's diameter based on a mathematical formula and the image size of Alpha Metron as seen through the optical telescope). Finally, the astronomer calculated the magnification (xM) associated with each optical telescope from the following formula:

 $xM = apparent size \div 0.002"$ 

The data appear in Table 2.

Table 2					
Optical Telescopes	Apparent Size	xM			
1 2 3 4	0.040" 0.200" 0.400" 0.800"	20 100 200 400			

# **Experiment 3**

The *angular resolution* of an optical telescope is defined as the smallest distance separating 2 objects such that the objects, like two stars, appear as two distinct images and not one blurred image. The angular resolution of an optical telescope is determined by the width of its *aperture* (the primary lens of the telescope) in accordance with the following formula:

$$a_{\rm R} = 138 \div {\rm D},$$

where  $a_R$  is the angular resolution in radians (rad) and D is the width of the aperture in millimeters (mm).

The astronomer calculated  $a_R$  for each of the optical telescopes. The data appear in Table 3.

Table 3				
Optical Telescopes	D (mm)	a <sub>R</sub> (rad)		
1 2 3 4	1,000 2,000 4,000 10,000	0.138 0.069 0.035 0.014		



- **11.** When viewing Star Pair C in Experiment 1, the astronomer was able to see two distinct images with how many of the optical telescopes?
  - **A.** 1
  - **B.** 2
  - **C.** 3
  - **D.** 4
- **12.** If the astronomer had viewed Alpha Metron through a fifth optical telescope in Experiment 2 and calculated an apparent size of 1.00", the xM associated with this optical telescope would have been:
  - **F.** 50.
  - **G.** 80.
  - **H.** 450.
  - **J.** 500.
- **13.** Based on the information in Experiment 3, which of the optical telescopes would show two stars known to be 0.050 radians apart as one blurred image, instead of two distinct images?
  - **A.** Optical Telescope 1 only
  - **B.** Optical Telescopes 1 and 2 only
  - C. Optical Telescopes 3 and 4 only
  - D. Optical Telescopes 2, 3, and 4 only
- 14. The astronomer calculated the  $a_R$  of a fifth optical telescope in accordance with the formula set forth in Experiment 3. The astronomer determined that for this fifth optical telescope,  $a_R$  is equal to 0.040 rad. Accordingly, the D of the telescope's aperture is most likely closest to which of the following?
  - **F.** 10,000 mm
  - **G.** 4,000 mm
  - **H.** 2,000 mm
  - **J.** 1,000 mm

- **15.** According to the results of Experiments 2 and 3, which of the following statements is most likely true?
  - **A.** Optical telescopes with high magnification values have low angular resolution values.
  - **B.** Optical telescopes with high magnification values have high angular resolution values.
  - **C.** Optical telescopes with low magnification values have low angular resolution values.
  - **D.** For optical telescopes, there is no relationship between magnification values and angular resolution values.
- **16.** If the astronomer had inadvertently used the value 0.0002" when calculating a magnification value for Table 2, the magnification value would have been:
  - **F.** too high by a factor of 10.
  - **G.** too low by a factor of 10.
  - **H.** too high by a factor of 100.
  - **J.** too low by a factor of 100.



# **Passage IV**

Students in a geology class set out to determine whether they could predict certain aspects of the climate of a particular region based on the *carbon ratio* of soil samples collected from the region. A carbon ratio compares the presence of 2 carbon isotopes (<sup>12</sup>C and <sup>13</sup>C) in a given sample of soil. The students compared the carbon ratio of soil samples collected with the carbon ratio of a *standard sample* (a sample from a known region). The standard sample was provided to the students by their professor. The comparison of the carbon ratio of a given soil sample with that of the standard sample is called the *carbon "i" index* (C<sup>i</sup>I). C<sup>i</sup>I values are calculated in accordance with the formula:

$$C^{i}I = \frac{({}^{12}C/{}^{13}C)_{standard} - ({}^{12}C/{}^{13}C)_{sample}}{({}^{12}C/{}^{13}C)_{standard}} \times 100$$

The students conducted two experiments to study the C<sup>i</sup>I of soil from 2 Arctic regions, 1 equatorial region, and 1 temperate zone region.

#### Experiment 1

The students collected soil samples from the following regions: Arctic 1 (A1), Arctic 2 (A2), Equatorial 1 (E1), and Temperate 1 (T1). Figure 1 shows the calculated  $C^{i}I$  values and average air temperatures for the regions.



## Figure1

#### **Experiment** 2

In the same regions studied in Experiment 1 (A1, A2, E1, and T1), the students collected soil samples from the surface and from 5 feet below the surface. The samples were analyzed for the presence of <sup>12</sup>C and <sup>13</sup>C and C<sup>i</sup>I values were calculated. The difference between C<sup>i</sup>I values from surface samples 5-foot-depth samples indicates annual and temperature fluctuations. More specifically, greater differences in C<sup>i</sup>I values indicate greater differences in historic annual high and low temperatures in a region and the smaller differences in C<sup>1</sup>I values indicate smaller differences in historic annual high and low temperatures in a region. The results of Experiment 2 are shown in Figure 2.



- **17.** According to Experiment 1, average air temperatures in the Equatorial 1 region were closest to:
  - A. 18°C
    B. 35°C
    C. 55°C
    D. 65°C

- **18.** Based on Figure 1, a region with an average air temperature of 30°C would most likely have soil with a C<sup>i</sup>I value in which of the following ranges?
  - **F.** 0-20
  - **G.** 21-40
  - **H.** 41-60
  - **J.** greater than 60
- **19.** Based on the information provided, if the carbon ratio of the standard sample provided by the professor had been higher than the one actually used by the students to calculate C<sup>i</sup>I values, the C<sup>i</sup>I values would have been:
  - A. higher for all four regions.
  - **B.** higher for A1 and A2, but lower for E1 and T1.
  - **C.** higher for E1 and T1, but lower for A1 and A2.
  - **D.** lower for all four regions.

- **20.** Based on Experiment 2, in which of the following regions has the difference in high and low annual temperature been the greatest historically?
  - **F.** A1**G.** A2**H.** E1
  - **J.** T1
- **21.** According to Experiment 2, which of the following statements is most accurate?
  - **A.** For each of the four regions, the C<sup>i</sup>I value of the surface sample was higher than the C<sup>i</sup>I value of the sample taken at a depth of 5 feet.
  - **B.** For each of the four regions, the C<sup>i</sup>I value of the surface sample was lower than the C<sup>i</sup>I value of the sample taken at a depth of 5 feet.
  - **C.** The C<sup>1</sup>I value of the surface sample was higher than the C<sup>1</sup>I value of the sample taken at a depth of 5 feet in one region only.
  - **D.** The information provided is not sufficient to determine the relationship between the C<sup>i</sup>I values of any two samples.

# Passage V

A constant pressure calorimeter measures the change in heat content of a chemical reaction in a solution during which the atmospheric pressure remains constant. Students in a chemistry lab create what is known as a *coffee-cup calorimeter* using two Styrofoam cups, one lid, a thermometer, and a stirring rod. The supplies are assembled as shown in Figure 1.

Figure 1



While a coffee-cup calorimeter is a relatively low tech device, once calibrated, it can yield remarkably accurate results. The change in heat content, measured in kilojoules (kJ), is calculated from the change in temperature of the solution. Table 1 shows the amounts of heat released when 1.0 gram (g) masses of different chemical compounds reacted with 40 milliliters (ml) of water (H<sub>2</sub>O) within the coffee-cup calorimeter. Table 2 shows the amounts of heat released when different amounts of Na<sub>2</sub>O<sub>2</sub> reacted with H<sub>2</sub>O.

Table 1				
Chemical Compound	Mass (g)	Change in water temperature (°C)	Heat released (kJ)	
NH₄Cl KCl KOH NaOH NaCl	1.0 1.0 1.0 1.0 1.0	2.7 4.8 2.3 1.8 1.5	3.2 5.8 2.8 2.2 1.8	

Table 2		
Amount of Na <sub>2</sub> O <sub>2</sub> (g)	Heat released (kJ)	
0.1	0.2	
0.5	1.2	
1.0	2.4	
2.0	4.8	
5.0	12.0	

- **22.** According to Table 1, as the heat released by a reaction increases, the change in water temperature of the reaction:
  - **F.** increases only.
  - G. decreases only.
  - H. increases, then decreases.
  - **J.** remains constant.
- **23.** Based on Tables 1 and 2, the heat released when 5.0 g of Na<sub>2</sub>O<sub>2</sub> reacts with water is approximately twice the amount of heat released when 1.0 g of which of the following chemical compounds reacts with water?
  - **A.** NH<sub>4</sub>Cl **B.** KCl **C.** KOH **D.** NaCl
- **24.** Based on Tables 1 and 2, as the mass of successive  $Na_2O_2$  samples increases, the change in the water temperature due to the chemical reaction within the coffee-cup calorimeter most likely:
  - **F.** increases only.
  - G. decreases only.
  - **H.** increases, then decreases.
  - J. decreases, then increases.

**25.** Which of the following graphs best illustrates the relationship between the heat released by the chemical compounds listed in Table 1 and the change in water temperature?



- **26.** According to Tables 1 and 2, which of the following lists the chemical compounds  $NH_4Cl$ , KCl, KOH, and  $Na_2O_2$  in increasing order of the amount of heat released when one gram of chemical compound reacts with water?
  - **F.** Na<sub>2</sub>O<sub>2</sub>, KOH, NH<sub>4</sub>Cl, KCl **G.** KCl, NH<sub>4</sub>Cl, KOH, Na<sub>2</sub>O<sub>2</sub> **H.** Na<sub>2</sub>O<sub>2</sub>, NH<sub>4</sub>Cl, KOH, KCl
  - J. KOH, KCl, Na<sub>2</sub>O<sub>2</sub>, NH<sub>4</sub>Cl
- **27.** Based on Tables 1 and 2, the heat released when 5.0 g of NaCl reacts with water in a coffee-cup calorimeter would be closest to which of the following?
  - **A.** 1 kJ
  - **B.** 7 kJ
  - **C.** 9 kJ
  - **D.** 18 kJ

# Passage VI

Students in a high school physics class tested their hypothesis that the surface texture of a ball would affect its *roll time* (the time it took the ball to roll one meter down an incline). See Figure 1.



Figure 1

Three identical plastic balls were used in the experiments. The surface of the first ball was left uncovered; the surface of the second ball was covered with coarse sand paper; and the surface of the third ball was covered with a thick, soft layer of felt. The angle of inclination was 5% in both experiments.

#### **Experiment 2**

The students measured the roll time of each plastic ball after the ball had rolled, from rest, half a meter down the incline. Thus, when roll time was measured, each ball had an initial velocity that was greater than zero. See Figure 2. The results are shown in Table 2.



Figure 2

Table 2		
Ball	Roll Time (sec)	
uncovered	1.1	
sand paper	1.3	
felt	1.8	

- **28.** According to Experiment 1, when compared to the roll time of the uncovered plastic ball, the roll times of the sand-paper and felt covered balls were:
  - **F.** both higher.
  - **G.** both lower.
  - H. higher for one and lower for the other.
  - J. identical.
- Table 1BallRoll Time (sec)uncovered2.2sand paper2.8felt3.1
- **29.** Based on Experiments 1 and 2, the roll time for each plastic ball decreased with:
  - A. an increase in the angle of inclination.
  - **B.** a decrease in the angle of inclination.
  - C. an increase in initial speed.
  - **D.** a decrease in initial speed.

#### Experiment 1

The students measured the roll time of each plastic ball when the ball started its downward roll from *rest* (an initial velocity of zero). The results are shown in Table 1.

- **30.** Based on the information provided (and assuming that both Figure 1 and Figure 2 are drawn to scale), it is reasonable to conclude that the ball with the greatest velocity at the bottom of the incline:
  - **F.** would be different for the two experiments.
  - **G.** would be the uncovered ball for both experiments.
  - **H.** would be the sand-paper-covered ball for both experiments.
  - **J.** would be the felt-covered ball for both experiments.
- **31.** Based on Tables 1 and 2, the range of roll times is:
  - A. greater for Experiment 1.
  - **B.** greater for Experiment 2.
  - **C.** equal for Experiments 1 and 2.
  - **D.** not possible to determine based on the information provided.

- **32.** If Experiments 1 and 2 were repeated with an angle of inclination of 10°, the roll times would most likely:
  - **F.** double.
  - G. triple.
  - H. decrease.
  - J. remain the same.

- **33.** If a fourth plastic ball neatly covered with newspaper were included in Experiment 1, its roll time would most likely be:
  - A. less than 2.2 sec.
  - **B.** between 2.2 sec and 2.8 sec.
  - C. between 2.8 sec and 3.1 sec.
  - **D.** greater than 3.1 sec.

# Passage VII

A smart meter is not merely a meter that measures the electricity, natural gas, or water consumed by a home. (Simple measuring meters have been used by utility companies for decades.) A smart meter is a relatively new meter that can not only measure power or water consumption in real time, but it can also transmit consumption information back to a utility company, or other organization, in real time. While most people agree that smart meters have the potential to help homeowners use energy and other resources more efficiently, many disagree regarding whether the government should invest in, and monitor energy and water consumption through, residential smart meters.

Two scientists debate the government's involvement in the residential smart meter industry.

# Scientist One

Although the government should encourage the efficient use of energy and other natural resources in American homes, it should not waste tax dollars on smart meters. The cost of purchasing and installing a smart meter in every American home would be astronomical. In addition, the various ways that smart meters can communicate with utilities or other interested organizations has not yet been completely standardized. Currently, there are several broadband or narrowband communication channels being developed. The problem is that they are not compatible with each other. In order to address this issue, the National Institute for Standards and Technology established the PAP15 group to study and one day recommend coexistence mechanisms with a focus on the harmonization of power-line communication standards for home area networks. Finally, the largest wasters of energy and other resources, wealthy individuals, would likely hire lawyers to find loopholes in government regulations, allowing them to "opt-out" without

penalty. In short, government investment in the residential smart meter industry is premature and it would, ultimately, be costly and ineffective.

# Scientist Two

The government should definitely invest in the residential smart meter field. Smart meters can communicate with organizations, like government agencies, through cell, satellite, radio, and/or powerline networks. ANSI C12.18 is a standard of the American National Standards Institute that describes the protocol used for two-way communications with smart meters. The C12.18 standard is written specifically for meter communications via an ANSI Type 2 Optical Port, and specifies lower-level protocol details. This means that communications between residential smart meters and government agencies can be secure regardless of the network used. Government agencies can use smart meter communications to offer rewards for households that use energy wisely and incentives for households that are deemed wasteful in their consumption of electricity, natural gas, and/or water. This way we as a nation can ensure that our natural resources can be enjoyed for many generations to come.

- **34.** Which of the following statements is most consistent with the arguments of Scientist Two? If the government regulates the residential use of power and other natural resources through smart meters, the government:
  - **F.** will not spend an astronomical amount of money.
  - G. will merely cater to the wealthiest households.
  - **H.** will help ration the consumption of America's natural resources.
  - **J.** will adopt standards that are more stringent than those set forth in ANSI C12.18.

- **35.** The cost argument of Scientist One reasonably relies on which of the following assumptions?
  - **A.** The government has the authority to raise taxes.
  - **B.** There is no way for the government to pass purchase and installation costs on to home-owners or the utilities.
  - **C.** The National Institute for Standards and Technology is a government-funded entity.
  - **D.** Wealthy Americans look to "opt-out" of most government programs.
- **36.** With which of the following statements would both Scientist One and Scientist Two likely agree?
  - **F.** Smart-meter communication standards should be established and adopted.
  - **G.** Smart meters can communicate best through broad-band connections.
  - **H.** Smart meters will help utilities increase profits.
  - **J.** Smart meters will help wealthy homeowners reduce energy costs.
- **37.** According to Scientist Two, smart meters can communicate with outside organizations through all of the following networks EXCEPT:
  - A. cell.
  - **B.** radio.
  - C. satellite.
  - **D.** cable.
- **38.** Unlike Scientist One, Scientist Two mentions which of the following aspects of smart-meter communication?
  - F. Security
  - G. Purchase cost
  - H. Standards
  - J. Installation logistics

- **39.** According to the passage, smart meters differ from simple measuring meters in that the smart meter:
  - A. has been around for decades.
  - **B.** can transmit usage information to an outside organization.
  - **C.** is more expensive.
  - **D.** is more difficult to install.
- **40.** Which of the following illustrations is most consistent with the description in the passage of smart-meter communication?



**END OF TEST**