

## Form 70A

(December 2011)



In response to your recent request for Test Information Release materials, this booklet contains the test questions and conversion tables used in determining your ACT scores. Enclosed with this booklet is a report listing your answers to the ACT multiple-choice tests and the answer key.

If you wish to order a photocopy of your answer document—including, if you took the Writing Test, a copy of your written essay—please use the order form on the inside back cover of this booklet.

We hope that you will find this information helpful.



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## ENGLISH TEST

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 choose an alternative.

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### PASSAGE I

#### A Better Way to Travel

On the first morning of my New York City vacation, I was awakened by unfamiliar snores  
in an unfamiliar room. Asleep in the other six beds were two college students from Mexico, a high school student from the U.S., a teacher from Canada, an engineer from Sweden, and an architect from Brazil. I'd gotten to know all of them the night before as we sat up late telling each other about our lives.

Over 37 million people visited New York City last year.

1. A. NO CHANGE  
B. awakened  
C. awoked  
D. awaken
2. F. NO CHANGE  
G. room asleep  
H. room, which asleep  
J. room, asleep
3. Given that all the choices are true, which one best introduces the main subject of the essay?  
A. NO CHANGE  
B. It was the first of my many experiences staying in hostels.  
C. I had never slept more soundly than I did that night.  
D. This was my first visit to New York City, and I had a difficult time finding the hostel.

It's been several years since that night, but I'm still friends with one of the students from Mexico.

On trips to other hostels, I've made more friends.

Once in a while, I cross paths with former hostel roommates.

5

Hosteling isn't just friendly, it's inexpensive. 6

Hostels can cost as little as \$7 a night in rural areas and

7

just over \$30 in some of the largest cities. 8 Compare that to Portland hotels, where the cheapest rooms are \$70!

4. E. NO CHANGE  
G. hostels when  
H. hostels during which  
J. hostels, and

5. Given that all the choices are true, which one most clearly expresses an enthusiasm for and a commitment to hosteling?

- A. NO CHANGE  
B. Hosteling can be highly unpredictable.  
C. Now, I wouldn't travel any other way.  
D. Sometimes, I can't find solitude in a hostel.

6. At this point, the writer is considering adding the following true statement:

Some hostels enforce curfews in order to ensure the safety and comfort of their guests.

Should the writer make this addition here?

- F. Yes, because it supports the essay's claim that hostels are safer than hotels.  
G. Yes, because it explains why hostels are able to offer such low rates.  
H. No, because it portrays hostel rules as unnecessarily restrictive for their guests.  
J. No, because it strays from the paragraph's discussion of how much hostels cost.

7. A. NO CHANGE

- B. night,  
C. night;  
D. night—

8. At this point, the writer is considering adding the following true statement:

The hostels in my hometown of Portland, Oregon, cost \$22 a night.

Should the writer make this addition here?

- F. Yes, because it explains why the narrator doesn't like to stay at hostels in his hometown.  
G. Yes, because it sets up the comparison provided in the next sentence.  
H. No, because it contradicts information provided earlier in the essay about the narrator's hometown.  
J. No, because it introduces the narrator's personal opinion into an essay that's otherwise objective.



Hostels aren't fancy <sup>9</sup> but the beds are comfortable and everything is clean. You usually have access to a

9. At this point, the writer is considering adding the following true statement:

—you usually sleep in a dorm room and share bathroom facilities—

Should the writer make this addition here?

- A. Yes, because it explains the benefits of sharing facilities.
- B. Yes, because it provides specific examples to illustrate the claim that hostels aren't fancy.
- C. No, because it provides a description that contradicts details given in the essay's opening paragraph.
- D. No, because it shifts the paragraph's focus from hotels to hostels.

kitchen, which provides an alternative, to costly

<sup>10</sup>

and expensive restaurant meals. Many hostels also offer fun activities for guests at no additional charge.

I've participated in a Scrabble tournament at a hostel in San Francisco, taken a hostel-sponsored tour of a medieval castle near Edinburgh in Scotland, but watched the movie Casablanca at a hostel on the Oregon coast.

Hostelers are explorers. And with thousands of hostels around the world, exploring is easy then you might imagine. If you can think of a place you want to go, there's

probably a hostel nearby. Though some people don't like hosteling because of the lack of privacy, I consider this

characteristic to be their main advantage. The communal nature of hosteling has given me the opportunity to meet people of all ages and nationalities who share my philosophy that is travel independently, live simply, and discover the world.

10. E. NO CHANGE  
G. kitchen which provides, an alternative  
H. kitchen, which provides an alternative  
J. kitchen which provides an alternative

11. A. NO CHANGE  
B. and high-priced  
C. and pricey  
D. DELETE the underlined portion.

12. F. NO CHANGE  
G. or  
H. and  
J. while I

13. A. NO CHANGE  
B. easy than  
C. easier then  
D. easier than

14. Which of the following alternatives to the underlined portion would NOT be acceptable?

- F. Since
- G. Although
- H. While
- J. Even though

15. A. NO CHANGE  
B. my  
C. its  
D. your

16. F. NO CHANGE  
G. philosophy:  
H. philosophy being  
J. philosophy

## PASSAGE II

## Stargazing

One clear January night when I was eight years old,  
I had went stargazing with my father. We tramped through  
<sup>17</sup> the snow in the backyard, then turned our faces upward.

The cold air was crisp and clear, the stars brilliant against  
<sup>18</sup> the black sky. Our breath appeared white above us.

[1] "And there's his sword also, see?" [2] He pointed out Orion to me, the first constellation I would know, the first commencement of a beginning  
<sup>19</sup> of a lifelong enchantment with the stars. [3] "Megan,  
there's Orion's belt," Dad said, he kneeled so I could  
<sup>20</sup> spot the unmistakable row of three stars, perfectly  
aligned, at the end, of his pointing index finger.

[4] Looking at the sword he showed me, I nodded in the dark as the winter sky reoriented itself  
forever in my mind meanwhile this celestial  
<sup>22</sup>

marker, Orion. 23

I was eager to learn as much as I could from my father. The Big Dipper was next, with its grand  
<sup>24</sup> sweep of handle and bowl. Then came the Pleiades,

a tight cluster of stars that created a bold smudge of  
<sup>25</sup>

noticeable light above overhead. I absorbed the  
<sup>26</sup> information he shared: the order of the planets in our solar system, the shapes of galaxies, theories about how the universe began.

17. A. NO CHANGE  
B. gone  
C. went  
D. had did some

18. Which of the following alternatives to the underlined portion would NOT be acceptable?  
F. clear; the stars looked  
G. clear. The stars were  
H. clear, and the stars were  
J. clear; the stars that were looking

19. A. NO CHANGE  
B. the  
C. the initial  
D. DELETE the underlined portion.

20. F. NO CHANGE  
G. kneeling  
H. started to kneel  
J. and having kneeled

21. A. NO CHANGE  
B. aligned, at the end  
C. aligned at the end,  
D. aligned; at the end

22. F. NO CHANGE  
G. therefore  
H. during  
J. around

23. For the sake of the logic and coherence of this paragraph, Sentence 1 should be placed:

- A. where it is now.  
B. after Sentence 2.  
C. after Sentence 3.  
D. after Sentence 4.

24. F. NO CHANGE  
G. whether it's a  
H. being its  
J. it had a

25. A. NO CHANGE  
B. will create  
C. creates  
D. created

26. F. NO CHANGE  
G. light  
H. visible light that was there  
J. light that looked something like a bright smear

For example, all that space and distance fascinated me.<sup>27</sup> It takes light more than eight minutes to travel from the Sun to Earth, I learned. I tried to imagine the distance involved in a light-year, and failed. I was amazed to find out that some of the stars I gazed at were really visual ghosts of stars: their light took so long to travel to my eyes that the stars had long ago burned out.

I couldn't take in ideas so incomprehensibly big, but the effort was invigorating, like sledding down a steep hill or racing my sister across a snowy field.

I live on my own now, but last week I was at my parents' house, and I again went outside one more time again to gaze at the night sky. I<sup>28</sup> looked up into the dark at the thin slice of moon near the horizon, the steady glow of the planets, the twinkle of the stars in their familiar formations. 39

27. A. NO CHANGE  
B. In contrast, all  
C. If so, all  
D. All

28. F. NO CHANGE  
G. incomprehensible big,  
H. incomprehensibly bigger,  
J. incomprehensible bigger,

29. A. NO CHANGE  
B. for the purpose of being able to look at and  
C. and left the house to go out  
D. DELETE the underlined portion.

30. Which of the following true sentences, if added here, would most effectively conclude the paragraph and the essay by returning directly to several of the essay's earlier images?

- F. That night, the endless expanse of sky made me feel lonesome, and I thought about my childhood best friend.  
G. The night sky looked just as it had always looked, never appearing any different as time passes.  
H. As I looked at the stars, the thin coating of ice on the trees made the branches glimmer.  
J. Orion appeared over my left shoulder, and I remembered my father pointing in the dark on a cold, clear night.



## PASSAGE III

The following paragraphs may or may not be in the most logical order. Each paragraph is numbered in brackets, and question 44 will ask you to choose where Paragraph 5 should most logically be placed.

**A Tennessee Tigerbelle**

[1]

These days, with athletics winning up to eight gold medals in one year's Olympic games; it's easy to forget <sup>31</sup>

that at one time winning multiple gold medals <sup>32</sup> were rare.

One of the first U.S. Olympic athletes to accomplish this was a young African American sprinter from Tennessee.

Wilma Rudolph was the first U.S. woman to win three gold medals, placing first in the 100- and 200-meter dashes and <sup>33</sup> anchoring her team to victory in the  $4 \times 100$ -meter relay.

[2]

Born in 1940 near Clarksville, Tennessee, Rudolph was diagnosed with polio at an early age. Her family was determined to help her fight this disease, which causes motor paralysis and often leads to permanent physical disabilities. Every week, her family took her to Nashville for heat and water therapy. They also massaged her affected leg daily and helped her with physical therapy.

Largely as a result, Rudolph no longer needed her <sup>34</sup> crutches, metal brace, or corrective shoes by the time she was a teenager.

31. A. NO CHANGE  
B. games, its  
C. games; its  
D. games, it's

32. F. NO CHANGE  
G. was  
H. are  
J. have been

33. A. NO CHANGE  
B. medals, she placed  
C. medals, placed  
D. medals; placing

34. F. NO CHANGE  
G. needed the following: her  
H. needed, her  
J. needed her



[3]

Her athletic career began when she joined the junior high basketball team. They weren't her basketball skills,

<sup>36</sup>

therefore, that would impress one of the country's best

<sup>36</sup>

coaches. During her sophomore year, Ed Temple,

<sup>37</sup>

Tennessee State University's track coach, noticed that

<sup>38</sup>

Rudolph might possibly have some ability maybe as a

<sup>38</sup>

sprinter. Temple was aware that her high school didn't have a track team, Temple invited Rudolph to attend a summer sports camp at the university.

[4]

Determined, Rudolph vowed to have even greater success in the next Olympics. Her family encouraged her aspirations, as did Coach Temple. With their support, Rudolph attended college on a track scholarship and competed for the famous Tennessee State Tigerbelles track team then she moved on to win her three gold medals for the 1960 U.S. Olympic team.

[5]

It quickly became clear that there would be no stopping Rudolph. In 1956, Rudolph, then just a high school junior,

<sup>41</sup>

qualified to participate in the Olympic trials.

35. A. NO CHANGE  
B. These weren't  
C. It wasn't  
D. That wasn't
36. F. NO CHANGE  
G. though,  
H. for example,  
J. additionally,
37. A. NO CHANGE  
B. year, Ed Temple—  
C. year, Ed Temple  
D. year Ed Temple
38. F. NO CHANGE  
G. noticed Rudolph's potential  
H. observed that Rudolph displayed some signs of possible potential ability  
J. saw Rudolph's possible ability to shine and excel
39. A. NO CHANGE  
B. Temple, aware  
C. Aware  
D. Temple, who was
40. Which choice most effectively emphasizes that Rudolph was determined?  
F. NO CHANGE  
G. decided she'd prefer  
H. though she wanted  
J. hoped to achieve
41. A. NO CHANGE  
B. team before moving  
C. team; before she moved  
D. team; then moving
42. If the writer were to delete the underlined portion (adjusting the punctuation as needed), the sentence would primarily lose information that:  
F. implies that Rudolph achieved her success when she was too young to enjoy it.  
G. helps establish the timeline of events and underscores Rudolph's talent by emphasizing her youth.  
H. interrupts the flow of the paragraph and introduces information that detracts from the paragraph's focus on Rudolph's training.  
J. supports the essay's claim that the best athletes display talent at a young age.



She made the Olympic team, and in Melbourne,

Australia. She ran with the  $4 \times 100$ -meter relay

43

team that won a bronze medal.

43. A. NO CHANGE  
B. Australia; she  
C. Australia, she  
D. Australia: she

Questions 44 and 45 ask about the preceding passage as a whole.

44. For the sake of the logic and coherence of the essay, Paragraph 5 should be placed:

- F. where it is now.  
G. after Paragraph 1.  
H. after Paragraph 2.  
J. after Paragraph 3.

45. Suppose the writer's goal had been to write an essay focusing on Coach Temple's influence on Rudolph's career. Would this essay accomplish that goal?

- A. Yes, because it describes how Rudolph came to be an Olympic athlete.  
B. Yes, because it describes how Temple recruited Rudolph to run for the Tennessee State Tigerbelles.  
C. No, because it focuses more generally on biographical information related to Rudolph's running career.  
D. No, because it focuses mainly on the influence Rudolph's basketball coaches had on Rudolph, not on Temple's influence.

#### PASSAGE IV

##### The Astonishing Features of Woodpeckers

Imagine a cross between an agile rock climber and a rugged construction worker, you will have some

46

idea of the astonishing traits of those small but noisy forest dweller—the woodpecker. The little creature

47

routinely travels up and down vertical surfaces with great skill and apparently no fear. Unlike most rock

48

climbers, this creature moves so fast that the observer sometimes sees nothing but a blur. Feet with some toes pointing forward and others pointing to the side or back allow woodpeckers to seemingly defy gravity as they move along at steep angles. Sturdy tails contribute significantly to their ability to propel themselves along tree trunks.

49

46. F. NO CHANGE  
G. and  
H. and you  
J. if so, you

47. A. NO CHANGE  
B. a lot of  
C. that  
D. some of the

48. F. NO CHANGE  
G. routinely travels up,  
H. routinely travels, up  
J. routinely, travels up

49. A. NO CHANGE  
B. the movement is so fast that  
C. moving so fast  
D. when the fast creature moves

50. Which of the following alternatives to the underlined portion would NOT be acceptable?

- F. permit  
G. make it possible for  
H. help  
J. make room for



Woodpeckers have extremely strong skulls and specialized frontal bones that act as shock absorbers.

These bones protect the woodpecker's brain from  
damaging harm when the bird drills into tree trunks

<sup>51</sup>  
with its chisel-shaped bill. On the contrary, the bird drills  
<sup>52</sup> for two reasons: to find food and to create nesting cavities. Once a hungry woodpecker has drilled into a tree for food, it uses its long, barbed tongue to explore the holes for a meal. A sticky substance covers the woodpecker's tongue and contributes to the bird's success at catching ants, beetles, spiders, caterpillars, and other insects are caught.

<sup>53</sup>  
Woodpecker species that excavate extensively  
<sup>54</sup> have feathered or narrowed nostrils that protect the bird  
at times like these. In other words, the bird is outfitted

<sup>55</sup>  
with the safety gear needed, to perform the work, it  
does to survive.

Though widely known for  
the rapid tapping sound they make,  
<sup>57</sup> woodpeckers also make a big impression

on experts and others, too. Many  
<sup>58</sup> woodpeckers have dazzling plumage.

51. A. NO CHANGE  
B. harmful damage  
C. damage  
D. damage that can harm it
52. F. NO CHANGE  
G. Nevertheless, the  
H. Even so, the  
J. The
53. A. NO CHANGE  
B. are consumed by the woodpecker.  
C. make up its diet.  
D. DELETE the underlined portion and end the sentence with a period.
54. E. NO CHANGE  
G. excavate extensively,  
H. excavate, extensively  
J. excavate; extensively.
55. Given that all the choices are true, which one provides the most specific information about the bird's behavior?  
A. NO CHANGE  
B. as it performs the functions for which it is so well adapted.  
C. from inhaling the sawdust that it produces so profusely.  
D. from external matter that might pose a problem for the bird.
56. F. NO CHANGE  
G. gear needed to perform the work  
H. gear, needed to perform the work  
J. gear needed to perform the work,
57. A. NO CHANGE  
B. rapid, tapping, sound  
C. rapid, tapping sound,  
D. rapid tapping sound,
58. Which choice most directly introduces the topic of this paragraph?  
F. NO CHANGE  
G. on many of us.  
H. even though they might not know it.  
J. with their appearance.



The males of some species, such as the downy and the hairy woodpeckers, sport eye-catching patches of red feathers on the neck or head. These crimson accents contrast dramatically with the black and white on the rest of the bird's body. To see, or hear, a woodpecker is one of the joys of a journey in the woods.

59. A. NO CHANGE  
B. to  
C. included for  
D. making up

Question 60 asks about the preceding passage as a whole.

60. Suppose the writer's goal had been to write a brief essay focusing on the life cycle of woodpeckers. Would this essay successfully fulfill that goal?  
E. Yes, because it provides a detailed explanation of what makes woodpeckers fascinating to birdwatchers.  
G. Yes, because it explains that woodpeckers are found in forests and feed on insects.  
H. No, because it focuses on downy woodpeckers and hairy woodpeckers, not on all woodpeckers.  
J. No, because it describes woodpeckers' traits but doesn't discuss their life cycle.

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PASSAGE V

**The Future of Music**

By his early twenties, Bear McCreary had already created music for a fair number of films. In 2003, he would begin contributing music to a remake of the 1970s science fiction television series *Battlestar Galactica* and, in so doing, emerge as one of today's most exciting composers. 62

61. Which choice provides the most specific indication of McCreary's early achievement?  
A. NO CHANGE  
B. numerous works in the medium of film.  
C. over thirty independent films.  
D. films.

62. At this point, the writer is considering adding the following true statement:  
A different version of *Galactica* had aired decades earlier.

Should the writer make this addition here?

- E. Yes, because it identifies the television series McCreary worked on.  
G. Yes, because the essay focuses mainly on contrasting the music found in the two versions of *Galactica*.  
H. No, because the essay focuses on the newer version of *Galactica*, making a mention of the earlier series irrelevant.  
J. No, because it essentially repeats information provided earlier in the paragraph.



McCreary's work on *Galactica* is fresh and unconventional. With fellow, composer, Richard Gibbs,  
<sup>63</sup> McCreary helped establish the show's musical style. The minimalist, percussion-heavy sound track they created contrasts with the luscious, brass-dominated sounds of earlier  
<sup>64</sup> science fiction shows and movies, including *Star Trek*, *Star*

*Wars*, and—surprisingly enough—the original *Galactica*.  
<sup>65</sup>

When Gibbs quit the show, McCreary took over the  
<sup>66</sup> composing duties.

"World music" is traditional (or folk) music usually  
<sup>67</sup> played by members of a particular culture. Taiko (Japanese drums), the duduk (an Armenian woodwind instrument), and Irish bagpipes and whistles make appearances. Words chanted in Sanskrit accompany a battle in space, and vocals in Italian, Senegalese, and Latin grace other scenes. McCreary also employs traditional Western orchestral instruments, these can be violins and cellos, as well as  
<sup>68</sup> modern synthesizers and electric guitars.

63. A. NO CHANGE  
B. fellow composer,  
C. fellow, composer  
D. fellow composer
64. Given that all the choices are true, which one most effectively completes the contrast that the writer sets up earlier in the sentence?  
E. NO CHANGE  
F. rich sounds of other instruments in  
H. sonically different musical style of  
J. sort of music found in
65. Which choice most clearly establishes that Gibbs and McCreary wanted the new show to have a style different from that of the original *Galactica*?  
A. NO CHANGE  
B. as it turned out—  
C. not unintentionally—  
D. ironically—
66. Which of the following alternatives to the underlined portion would NOT be acceptable?  
E. charge of  
G. out  
H. up  
J. on
67. Given that all the choices are true, which one most effectively introduces the subject of the paragraph?  
A. NO CHANGE  
B. For the series, McCreary uses a wide variety of sounds from around the world.  
C. A wealth of instruments finds its way into the modern music scene.  
D. McCreary is interested in many kinds of music.
68. F. NO CHANGE  
G. two examples are  
H. such as  
J. these include



Rather than just accompany on-screen action,

McCreary's music also illuminates characters and

<sup>69</sup>

ideas. Certain themes become associated with particular  
<sup>70</sup> characters—for example, mournful Celtic music with a

father and son. <sup>71</sup> Sometimes the music even seems to

shape the visuals that a viewer can see. One episode's  
<sup>72</sup> opening montage, which consists of scenes from four  
story lines, is accompanied by a swirling orchestral  
work set to a fairly slow dance rhythm. The piece,  
"Passacaglia," named for a type of composition that  
<sup>73</sup> consists of variations on the same theme. The repetition  
in the music helps weave the separate story lines together.

The result in this episode and others, is music that enriches

<sup>74</sup>

the stories and told its own artful story as well.

<sup>75</sup>

69. A. NO CHANGE  
B. in the same way  
C. because of this  
D. nonetheless

70. F. NO CHANGE  
G. have became  
H. had became  
J. becomed

71. The writer is considering changing the phrase "a father and son" in the preceding sentence to the following:  
an estranged father and son seeking reconciliation

Assuming that the revised phrase would still be accurate, should the writer make the revision or keep the phrase as it is?

- A. Make the revision, because the new version contributes to the paragraph's discussion of key scenes from the series.  
B. Make the revision, because the new version suggests why mournful music is paired with these characters.  
C. Keep the phrase as it is, because the original version is clearer and more concise.  
D. Keep the phrase as it is, because the paragraph focuses mainly on music, not on characters.

72. F. NO CHANGE  
G. aspects that are visual in nature.  
H. visuals seen.  
J. visuals.

73. A. NO CHANGE  
B. being named  
C. it's a name  
D. is named

74. F. NO CHANGE  
G. result is  
H. result—  
J. result,

75. A. NO CHANGE  
B. tells  
C. telling  
D. had told

**END OF TEST 1**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.**



## MATHEMATICS TEST

60 Minutes—60 Questions

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

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,

but some of the problems may best be 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 YOUR FIGURING HERE.

1. Karol had a meal that cost \$16.00. She tipped the waiter 20% of that amount for service. How much was the tip?  
**A.** \$0.80  
**B.** \$1.00  
**C.** \$1.60  
**D.** \$1.80  
**E.** \$3.20
2. The price of a pumpkin is directly proportional to its weight. If a pumpkin that weighs 15 pounds costs \$3.25, how much will a 10.4-pound pumpkin cost?  
**F.** \$0.71  
**G.** \$1.13  
**H.** \$1.95  
**J.** \$2.25  
**K.** \$4.69
3. If  $4x - 11 = 6x - 7$ , then  $x = ?$   
**A.** -9  
**B.** 2  
**C.** -2  
**D.**  $\frac{9}{5}$   
**E.**  $-\frac{9}{5}$
4. Neka earns his regular pay of \$9.00 per hour for up to 40 hours of work in a week. For each hour over 40 hours of work in a week, Neka is paid  $1\frac{1}{2}$  times his regular pay. How much does Neka earn for a week in which he works 43 hours?  
**F.** \$193.50  
**G.** \$387.00  
**H.** \$400.50  
**J.** \$451.50  
**K.** \$580.50

## DO YOUR FIGURING HERE.

5. To attend an annual banquet, members pay \$13 per ticket while nonmembers pay \$15 per ticket. What is the total amount, in dollars, from the sale of 90 member tickets and  $n$  nonmember tickets?

A.  $n + 90$   
B.  $15(n + 13)$   
C.  $15(n + 90)$   
D.  $15n + 13(90)$   
E.  $(15 + 13)n$

6. What is the volume, in cubic centimeters, of a rectangular solid that is 10 cm wide, 20 cm long, and 14 cm tall?

F. 480  
G. 696  
H. 1,240  
J. 1,936  
K. 2,800

7. If  $a = 3$ ,  $b = -5$ , and  $c = 4$ , then  $2a^2b - 5ac^2 = ?$

A. -330  
B. -180  
C. -150  
D. 60  
E. 330

8. The product  $(2x^3y)(4x^5y^3)$  is equivalent to:

F.  $6x^8y^4$   
G.  $6x^{15}y^3$   
H.  $8x^8y^3$   
J.  $8x^8y^4$   
K.  $8x^{15}y^3$

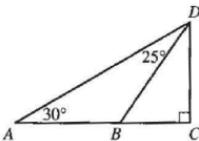
9. Ben and Chi are painting a room in the city recreation center. They started with 4 gallons of paint. On the first day, Ben used  $\frac{1}{4}$  gallon of paint and Chi used  $1\frac{1}{2}$  gallons of paint. How many gallons of paint were left after the first day?

A.  $1\frac{3}{4}$   
B.  $2\frac{1}{4}$   
C.  $2\frac{1}{2}$   
D.  $3\frac{1}{4}$   
E.  $3\frac{3}{4}$

10. What is the value of  $| -9 | - | 7 - 42 |$ ?

- F. -44
- G. -26
- H. 26
- J. 44
- K. 58

11. In right triangle  $\triangle ACD$  shown below,  $B$  lies on side  $\overline{AC}$ . Some angle measures are given. What is the measure of  $\angle BDC$ ?



12. What is the slope of the line given by the equation  $2x + 9y = -18$ ?

- F. -2
- G.  $-\frac{9}{2}$
- H.  $-\frac{2}{9}$
- J. 2
- K. 9

13. The product of 378 and which of the following powers of 10 is 0.000 037 8?

- A.  $10^{-2}$
- B.  $10^{-4}$
- C.  $10^{-5}$
- D.  $10^{-7}$
- E.  $10^{-8}$

14. Whenever  $a$ ,  $x$ , and  $y$  are positive integers, which of the following expressions is equivalent to  $x^a y^a$ ?

- F.  $(xy)^a$
- G.  $(xy)^{2a}$
- H.  $(x + y)^a$
- J.  $(x + y)^{2a}$
- K.  $x(y^a)$

**DO YOUR FIGURING HERE.**

15. Which of the following expressions is a factor of the polynomial  $x^2 - x - 12$ ?

- A.  $x - 4$
- B.  $x - 3$
- C.  $x + 2$
- D.  $x + 4$
- E.  $x + 6$

16. For the line segment below, the ratio of the length of  $\overline{PQ}$  to the length of  $\overline{QR}$  is 3:8. If it can be determined, what is the ratio of the length of  $\overline{PQ}$  to the length of  $\overline{PR}$ ?

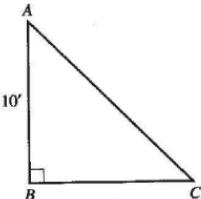


- F. 3:5
- G. 3:11
- H. 8:3
- J. 11:3
- K. Cannot be determined from the given information

17. Which of the following equations gives a function  $f(x)$  that satisfies  $f(5) = 12$ ?

- A.  $f(x) = x^2 - 13$
- B.  $f(x) = x^2 + 13$
- C.  $f(x) = x - 7$
- D.  $f(x) = 5x + 12$
- E.  $f(x) = 12x + 5$

18. In the isosceles right triangle below,  $AB = 10$  feet. What is the length, in feet, of  $\overline{AC}$ ?



- F. 5
- G. 10
- H. 20
- J.  $\sqrt{20}$
- K.  $\sqrt{200}$

19. Which of the following equations in the form  $y = mx + b$  is equivalent to  $3x + y + 4 = 14 + 2x$ ?

- A.  $y = -x + 10$
- B.  $y = x - 18$
- C.  $y = x - 10$
- D.  $y = 5x + 10$
- E.  $y = 5x + 18$

**DO YOUR FIGURING HERE.**

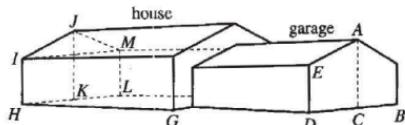


Use the following information to answer questions 20–22.

DO YOUR FIGURING HERE.

A contractor is building a garage onto the end of a house. The house consists of a triangular prism resting on top of a rectangular prism, as shown in the figure below. The roof of the house is formed by 2 congruent rectangles that are joined at the ridge. The house and the garage are geometrically similar, with each dimension of the garage  $\frac{5}{6}$  the corresponding dimension of the house. Some of the lengths of the house, in feet, are as follows:

$$\begin{array}{ll} GH = 60 & HL = 30 \\ HI = 12 & JK = 18 \end{array}$$



The contractor will use shingles that cost \$21 per bundle to cover the roof of the garage. Each 1-gallon can of paint used to paint the inside walls and ceiling of the garage covers exactly 400 square feet with 1 coat of paint.

20. What is the height of the garage,  $AC$ , in feet?

- F.  $7\frac{1}{2}$
- G. 9
- H. 10
- J. 13
- K. 15

21. The contractor determines that 36 bundles of shingles are needed to cover the surface of the roof of the garage. What is the price the contractor will pay for these shingles?

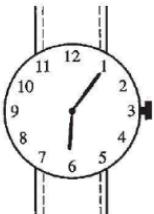
- A. \$457
- B. \$480
- C. \$630
- D. \$750
- E. \$756



22. The contractor will paint the ceiling and inside walls of the garage. The area to be painted, rounded to the nearest square foot, is 2,650 square feet. What is the *minimum* number of cans of paint that will be needed to paint this area with 2 coats of paint?

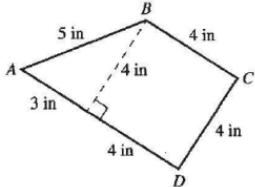
- F. 6  
G. 7  
H. 9  
J. 13  
K. 14
- 

23. On a wristwatch, shown below, the hour hand rotates  $30^\circ$  per hour and the minute hand rotates  $360^\circ$  per hour. How many degrees will the hour hand of the wristwatch rotate from 6:00 p.m. to 6:42 p.m. on the same day?



- A.  $12^\circ$   
B.  $21^\circ$   
C.  $30^\circ$   
D.  $105^\circ$   
E.  $252^\circ$

24. In square inches, what is the area of quadrilateral  $ABCD$  shown below?



- F. 18  
G. 22  
H. 24  
J. 28  
K. 31.5

25. The sides of a square are 6 cm long. One vertex of the square is at  $(2, 1)$  on a square coordinate grid marked in centimeter units. Which of the following points could also be a vertex of the square?

- A.  $(-10, 1)$   
B.  $(1, -1)$   
C.  $(1, 1)$   
D.  $(7, 1)$   
E.  $(8, 1)$

**DO YOUR FIGURING HERE.**



Use the following information to answer  
questions 26–28.

**DO YOUR FIGURING HERE.**

The first exam in Computer Skills is worth 100 points. Each exam score earned is a whole number of points. The table below gives the exam scores, in points, for 5 of 6 students in each of 3 groups in Computer Skills.

Group A	Group B	Group C
88	85	88
80	86	70
100	87	87
99	88	62
98	89	75

26. Which of the following percents is closest to the percent of the exam scores in the table that are at or above 85 points?

- F. 10%
- G. 11%
- H. 33%
- J. 67%
- K. 73%

27. What group has the greatest range in exam scores given in the table and what is that range, in points?

- A. Group A; 10
- B. Group A; 20
- C. Group B; 4
- D. Group C; 13
- E. Group C; 26

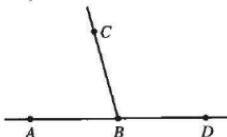
28. After the 6th student in each group takes the exam, an average score will be calculated for each group. Suppose the 6th student in Group B earns 100 points on her exam. What is the minimum exam score, in points, the 6th student in Group A would need to earn for Group A to have a higher average exam score than Group B with the 6th score?

- F. 69
- G. 71
- H. 75
- J. 79
- K. 85



29. The points  $A$ ,  $B$ , and  $D$  are collinear,  $B$  is between  $A$  and  $D$ , and  $C$  is a point not on  $\overleftrightarrow{AD}$ . Which of the following statements about the measures of the angles formed *must* be true?

(Note: The figure below shows 1 possible arrangement of these points.)



- A. The measure of  $\angle ABC$  is more than  $90^\circ$ .  
 B. The measure of  $\angle ABC$  is less than  $90^\circ$ .  
 C. The measure of  $\angle CBD$  is  $90^\circ$ .  
 D. The sum of the measures of  $\angle ABC$  and  $\angle CBD$  is  $180^\circ$ .  
 E. The sum of the measures of  $\angle ABC$  and  $\angle CBD$  is  $90^\circ$ .

30. For  $x^2 \neq 121$ ,  $\frac{(x-11)^2}{x^2 - 121} = ?$

- F.  $\frac{x-11}{x+11}$   
 G.  $\frac{1}{x-11}$   
 H.  $\frac{1}{x+11}$   
 J.  $-\frac{1}{11}$   
 K.  $\frac{1}{11}$

31. The quadratic equation  $12x^2 = 28x$  can be solved by factoring. Which of the following states the solutions?

- A.  $x = 0$  or  $x = 1$   
 B.  $x = 0$  or  $x = \frac{7}{3}$   
 C.  $x = 1$  or  $x = 1$   
 D.  $x = 1$  or  $x = \frac{7}{3}$   
 E.  $x = \frac{7}{3}$  or  $x = \frac{7}{3}$

DO YOUR FIGURING HERE.



**DO YOUR FIGURING HERE.**

32. Which of the following statements is a logical conclusion from the 3 true statements given below?

All meeps are smools.  
All larks are smools.  
All blins are meeps.

- F. No larks are meeps.  
G. No larks are blins.  
H. All blins are smools.  
J. All larks are meeps.  
K. All meeps are larks.

33. Which of the following inequalities is equivalent to

$$-\frac{5x}{3} + 2 > 12 ?$$

- A.  $x < -\frac{50}{3}$   
B.  $x < -\frac{42}{3}$   
C.  $x < -6$   
D.  $x > -6$   
E.  $x > 6$

34. What is the least common multiple of 70, 110, and 60 ?

- F. 80  
G. 240  
H. 462  
J. 4,620  
K. 462,000

35. What is the  $y$ -intercept of the graph of  $3x + 2y = 12$  in the standard  $(x,y)$  coordinate plane?

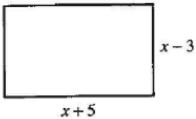
- A. 2  
B. 3  
C. 4  
D. 6  
E. 12

36. When running at 64% of its potential power, an aircraft engine consumes fuel at a rate of 11.5 gallons per hour. When running at 70% of its potential power, the engine consumes fuel at a rate of 14.7 gallons per hour. The rate of fuel consumption is linearly related to the percent of potential power. Which of the following is the best estimate of the fuel consumption of the aircraft engine, in gallons per hour, when running at 60% of its potential power?

- F. 4.9  
G. 6.2  
H. 7.3  
J. 8.3  
K. 9.4

37. Sandy is building a fence for her rectangular yard. A diagram of the yard is shown below. Which of the following expressions gives the perimeter of Sandy's yard?

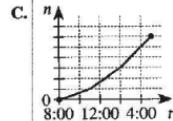
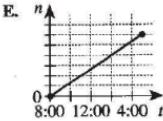
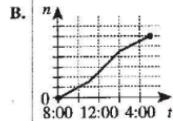
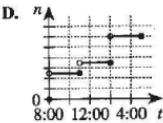
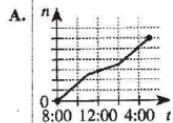
- A.  $2x + 2$
- B.  $2x + 8$
- C.  $4x + 4$
- D.  $4x + 16$
- E.  $x^2 + 2x - 15$



38. Mrs. Esposito owns a rabbit farm. Using past data, she developed an expression,  $200(1.5)^{0.5t}$ , that models her farm's rabbit population in  $t$  years. According to Mrs. Esposito's model, what will be her farm's rabbit population in 4 years?

- F. 300
- G. 450
- H. 600
- J. 980
- K. 1,200

39. Two copy machines copy at the same rate and will both be used to make copies of a report. At 8:00 a.m., both machines begin copying. One of the machines breaks down at 11:00 a.m. and begins copying again at 2:00 p.m. Both machines finish copying at 5:00 p.m. when the copying of the report is complete. One of the following graphs shows  $n$ , the number of copies made, as a function of  $t$ , the time at any given point during the copying. Which graph is it?

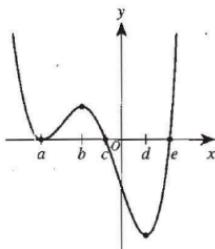


**DO YOUR FIGURING HERE.**



**DO YOUR FIGURING HERE.**

40. Consider the 4th-degree polynomial function graphed in the standard  $(x,y)$  coordinate plane below. The function has a local maximum at  $b$ , local minimums at  $a$  and  $d$ , and  $x$ -intercepts at  $a$ ,  $c$ , and  $e$ . On what interval(s) of  $x$  is the function increasing?

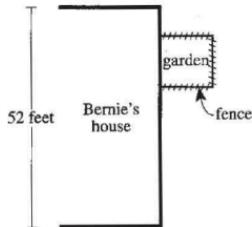


- E. From negative infinity to positive infinity  
 G. From negative infinity to  $a$  and from  $b$  to  $d$   
 H. From negative infinity to  $c$  and from  $e$  to positive infinity  
 J. From  $a$  to  $b$  and from  $d$  to positive infinity  
 K. From  $c$  to  $e$

41. Point  $A(2,1)$  is on a circle centered at  $(5,-1)$  in the standard  $(x,y)$  coordinate plane. What are the coordinates of the other end of the diameter through  $A$ ?

- A.  $(-1, 3)$   
 B.  $(3, -2)$   
 C.  $(3.5, 0)$   
 D.  $(7, 0)$   
 E.  $(8, -3)$

42. Bernie will fence a rectangular region next to his house for a garden. He needs to fence an area of exactly 144 square feet. He has 36 linear feet of fencing and will use the side of his house as one side of the garden instead of using fencing for that side, as shown below. If all the fencing is used, the garden can have which of the following dimensions, in feet?



- F. 3 by 48  
 G. 4 by 28  
 H. 6 by 24  
 J. 8 by 18  
 K. 9 by 16

43. In the standard  $(x,y)$  coordinate plane, which of the following numbers CANNOT be the  $x$ -coordinate of a point on the graph of  $y = \frac{x^2+x-2}{x^2-1}$ ?

A. 0  
B. 1  
C. 2  
D. 3  
E. 4

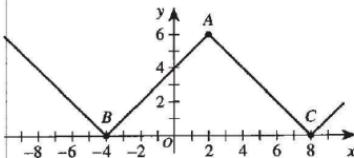
44. What is the 135th digit to the right of the decimal point in the repeating decimal  $0.\overline{428571}$ ?

F. 1  
G. 2  
H. 5  
J. 7  
K. 8

45. The domain of the real-valued function  $f(x) = \frac{2}{\sqrt{x-3}}$  is the set of all  $x$ -values that satisfy:

A.  $x > 0$   
B.  $x \geq 0$   
C.  $x > 2$   
D.  $x > 3$   
E.  $x \neq 3$

46. The graph of  $y = |6 - |x - 2||$  is shown in the standard  $(x,y)$  coordinate plane below. The turning points are  $A$ ,  $B$ , and  $C$ . Which of the following statements is true regarding  $\overline{AB}$  and  $\overline{AC}$ ?



F. They are congruent and perpendicular.  
G. They are congruent but NOT perpendicular.  
H. The reflection of  $\overline{AB}$  over the line  $y = 2$  is  $\overline{AC}$ .  
J. The reflection of  $\overline{AB}$  over the  $y$ -axis is  $\overline{AC}$ .  
K. They intersect at (2,5).

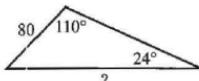
47. Keisha's weight does not vary more than 5 pounds from  $p$  pounds. Which of the following inequalities gives the range of Keisha's weight,  $w$ , in pounds?

A.  $|w - p| \leq 5$   
B.  $|w + p| \leq 5$   
C.  $|w - 5| < p$   
D.  $w - 5 < p$   
E.  $w + 5 < p$



## DO YOUR FIGURING HERE.

48. A surveyor is finding the dimensions of the triangular lot shown below. The length of 1 side is 80 feet. Which of the following is an expression for the length, in feet, of the side of the lot opposite the  $110^\circ$  angle?



(Note: The law of sines states that in every triangle, the ratio of a side's length to the sine of the angle opposite that side is equal for all 3 sides.)

- F.  $\frac{80 \sin 24^\circ}{\sin 110^\circ}$   
 G.  $\frac{\sin 24^\circ}{80 \sin 110^\circ}$   
 H.  $\frac{80}{(\sin 24^\circ)(\sin 110^\circ)}$   
 J.  $\frac{80 \sin 110^\circ}{\sin 24^\circ}$   
 K.  $\frac{\sin 110^\circ}{80 \sin 24^\circ}$
49. A well in the form of a right circular cylinder is 25 feet deep and 3 feet in diameter. In Figure 1 below, the Sun is shining directly down on the bottom of the well. Later in the day, Earth rotates so that the bottom of the well is just in shadow, creating the right triangle shown in Figure 2 below. Which of the following expressions gives  $\theta$ ?

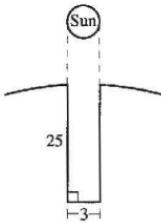


Figure 1.

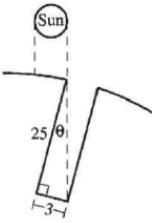


Figure 2.

- A.  $\sin^{-1}\left(\frac{3}{25}\right)$   
 B.  $\sin^{-1}\left(\frac{25}{3}\right)$   
 C.  $\cos^{-1}\left(\frac{3}{25}\right)$   
 D.  $\tan^{-1}\left(\frac{3}{25}\right)$   
 E.  $\tan^{-1}\left(\frac{25}{3}\right)$

**DO YOUR FIGURING HERE.**

50. Points  $A$  and  $B$  lie on a circle with center  $C$ . The circle has a radius of 16 inches. The measure of  $\angle ACB$  is  $90^\circ$ . What is the length, in inches, of minor arc  $\overarc{AB}$ ?

- E.  $4\pi$
- G.  $8\pi$
- H.  $16\pi$
- J.  $32\pi$
- K. Cannot be determined from the given information

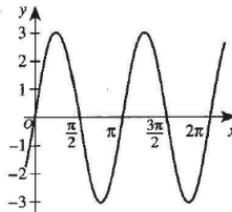
51. Whenever  $\sin \theta = 1$ , the value of  $\cos \theta$  is:

- A. -1
- B.  $-\frac{1}{2}$
- C. 0
- D.  $\frac{1}{2}$
- E. 1

52. Which of the following sets of 3 lengths, in decimeters, are the side lengths of an obtuse triangle?

- F. {3, 4, 4}
- G. {3, 4, 5}
- H. {5, 12, 13}
- J. {6, 8, 9}
- K. {6, 9, 13}

53. The graph of the function  $y = 3 \sin(2x)$  is shown below in the standard  $(x,y)$  coordinate plane. What are the amplitude and the period of the function?



amplitude      period

- |    |   |                 |
|----|---|-----------------|
| A. | 3 | $\pi$           |
| B. | 3 | $2\pi$          |
| C. | 6 | $\pi$           |
| D. | 6 | $2\pi$          |
| E. | 6 | $\frac{\pi}{2}$ |

2



2

54. The height that a certain ball rebounds after it hits the ground is directly proportional to the height from which it falls. When the ball falls from an initial height of 270 cm, it hits the ground for the first time and rebounds to a height of 180 cm. Arranged in order starting with the first bounce, the heights, in centimeters, that the ball rebounds form a sequence. Which of the following characterizes this sequence?

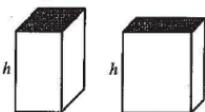
- F. Arithmetic with common difference -90  
 G. Arithmetic with common difference 90  
 H. Geometric with common ratio  $\frac{2}{3}$   
 J. Geometric with common ratio  $\frac{3}{2}$   
 K. Neither arithmetic nor geometric
55. For what value of  $a$  would the following system of equations have infinitely many solutions?  

$$\begin{aligned} 4x - 2y &= 15 \\ 12x - 6y &= 5a \end{aligned}$$
- A. 3  
 B. 9  
 C. 15  
 D. 45  
 E. 75
56. Three circles have the same center. Their radii measure 1, 2, and 3 inches, respectively. If a point is chosen at random in the interior of the largest circle, what is the probability that the point is also in the interior of the smallest circle?

- F.  $\frac{1}{3}$   
 G.  $\frac{1}{4}$   
 H.  $\frac{1}{9}$   
 J.  $\frac{4}{9}$   
 K.  $\frac{8}{9}$
57. Given  $a + b = 54$  and  $\frac{a}{b} = \frac{7}{11}$ , what is  $\frac{a+b}{ab}$ ?  
 A.  $\frac{6}{77}$   
 B.  $\frac{18}{77}$   
 C.  $\frac{54}{77}$   
 D.  $\frac{22}{7}$   
 E.  $\frac{77}{6}$

DO YOUR FIGURING HERE.

58. Each of the 2 rectangular prisms shown below has height  $h$  units, and the areas of the shaded sides are equal. Which of the following measures for the 2 prisms *must* be equal?



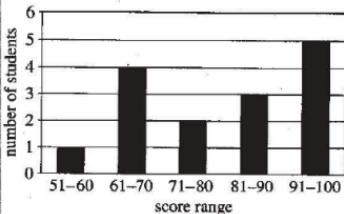
- F. Volumes  
G. Surface areas  
H. Lengths of the diagonals  
J. Lengths of the shaded sides  
K. Perimeters of the shaded sides

59. For all  $x > 2$ ,  $\log(x - 2) + \log x = ?$

- A.  $\log(-2)$   
B.  $\log(2x - 2)$   
C.  $\log(x^2 - 2x)$   
D.  $\log\left(\frac{x-2}{x}\right)$   
E.  $\log\left(\frac{x}{x-2}\right)$

60. Fifteen students took a test. All their scores were integers in the ranges shown in the bar graph below. What is the highest possible value for the median score for these 15 students on this test?

(Note: The median of an odd number of scores is the middle score when the scores are ordered from least to greatest.)



- F. 80  
G. 85  
H. 88  
J. 90  
K. 91

**DO YOUR FIGURING HERE.**

**END OF TEST 2**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.  
DO NOT RETURN TO THE PREVIOUS TEST.**

## READING TEST

*35 Minutes—40 Questions*

**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

**PROSE FICTION:** This passage is adapted from the novel *Second Hand* by Michael Zadoorian (©2000 by Michael Zadoorian).

I sleep in until about ten-thirty, which is unusual for me. It's a little late to go junking, but I definitely want to open up the store. I feel surprisingly okay. I'm looking forward to work. I shave, shower, get dressed, 5 grab a toaster pastry, and head out the door to work.

At work, nothing happens. No one comes in. I just sit there.

Finally, at about three-o'clock, this guy walks in, not the kind of guy I usually get in here, with an 10 expensive-looking overcoat and a tie.

"How much is that old Emerson radio up there?" he says, pointing to one of the ancient radios that line the ceiling of my shop.

"Those aren't for sale," I say. "None of the radios 15 are for sale." This is not for any big reason, it's just because radios from the Fifties and Sixties are something I still like to collect. It's not like they're worth that much. These just look kind of neat up there.

He looks disappointed, then he says, "I'll give you 20 a hundred for it."

My heart rises, then I remember its history. Half the tubes are missing, the others toasted. Just like looking at the things, I'm not really much for fixing them up. "It's really not in working condition," I say.

25      "I don't care. I just want it. One twenty-five?"

The guy's practically pleading with me. Now maybe I'm a dope who doesn't know his radios (which I am), but I start to think I am looking at someone who just really wants this object. I can see it in him. Serious 30 collectors always maintain their distance, like they couldn't care less if you sell them something. They always need to have the upper hand.

"Okay," I say to the guy. "But it doesn't work. Just so you know that."

35      He's smiling like a maniac by this time. "It's okay, really."

This is a rare occurrence. No one ever comes in here and offers me a lot of money for anything. There are plenty of weeks when I don't make one hundred and 40 twenty-five dollars. Despite the cash, it makes me feel good to see someone really want something just for the beauty of it.

"Do you collect old radios?" I say, after I box up the Emerson and collect the cash. I'm hoping he 45 doesn't tell me that I just sold him a rare prototype worth thousands.

"No. My mom and dad had one just like it when I was a kid. I've never seen another one like it until today."

50      This makes me even gladder that I sold it to him. This is something I have experienced myself, wanting something because it reminded me of my childhood. This is a strange thing about people. We own something as children, then as adults we are willing to buy it again 55 for about a hundred times the original cost. We think we're buying back our youth or our innocence or something like that, but what we're really buying back is our ignorance. We want to remember a time when we didn't know so much.

60      There's a guy in California who runs a junk museum. That's not what he calls it, but that's what it is. The purpose of the museum is to have people see things that spark intense memories of their lives. Here's what happens: You're strolling around, taking in everything, then suddenly—pow!—you see a juice glass just like the one you had when you were six years old. There is no doubt. You know just as you know your name that it is just like your favorite juice glass.

65      It is a slap in the cerebrum. This object that was so important to you at one time of your life had so completely disappeared from conscious thought, been so thoroughly buried, you hadn't even thought about it in decades. Memories, feelings, ideas, fears from that time return to you. And it doesn't have to be a juice glass, it 70 can be anything—a radio, a Strawberry Shortcake lunch box, an old Ferrante & Teicher LP, spaceship bedroom curtains, anything.

These epiphanies, these occasions of shattering remembrance, are the junk moments of our lives, 75 memory detritus that we have scattered and stashed in the musty, bent-corner cardboard folds of our brains.

**GO ON TO THE NEXT PAGE.**

It's quite a mess there in our attics. Things get chipped, they fade and shrink, crumble and yellow. But these things that seem insignificant are what compose our personal histories. That's why we need junk stores. As time passes, we realize those things we ignored have become valuable. We must revisit them, give them life again. That's what my store is about.

I remember something from college, Wordsworth 90 or one of those guys, talking about "spots of time," moments of experience when something ordinary becomes significant. That's what junk is for me, finding these little spots of time, only they're things that you can hold in your hand, things that you can find every- 95 where. You just need to know where to look.

**1. The main theme of the passage is that:**

- A. what one person considers junk, another will pay a lot of money for.
  - B. treating someone else fairly can yield benefits for both people.
  - C. ordinary objects can be powerful links to a person's past.
  - D. most people would rather live in the past than in the present.
- 2. The passage best supports which of the following statements about the customer's offer of \$125 for the radio?**
- F. The customer knows that the radio would still be a bargain at \$125, and the narrator hopes to sell it for more.
  - G. The customer has raised his offer as high as he intends to go, and the narrator gratefully accepts it.
  - H. The customer assumes that the narrator is negotiating a price with him, but the narrator isn't trying to.
  - J. The customer tries to hide his enthusiasm while making his offer, but the narrator sees through the attempt.
- 3. The narrator indicates that what makes him happiest about selling the radio to the customer is that the:**
- A. sale interrupts what has been an uneventful and unprofitable day at the shop.
  - B. customer wants to purchase the radio because he thinks it's beautiful.
  - C. narrator has managed to sell the radio despite the fact that it doesn't work.
  - D. customer has made a strong personal connection to the radio.
- 4. Regarding the day described in the passage, the narrator does NOT make clear:**
- E. what time he woke up in the morning.
  - G. whether he wanted to open up the store.
  - H. what time his first customer arrived.
  - J. why it surprised him that he felt okay.

5. In the context of the passage, lines 44–46 most strongly suggest that the narrator:

- A. unknowingly has some rare prototype radios at his store.
- B. doesn't always know how much money the items in his store are worth.
- C. prefers selling junk to dealing in expensive collector's items.
- D. likes it when customers keep their personal lives to themselves.

6. The narrator states that despite what people might think, when they buy things that remind them of their childhood, they are really buying back their:

- F. ignorance.
- G. innocence.
- H. youth.
- J. past.

7. It can reasonably be inferred from the passage that the narrator's usual time to go junking is:

- A. early morning to mid morning.
- B. late morning.
- C. early afternoon to mid afternoon.
- D. late afternoon.

8. The narrator indicates that he still collects radios from the Fifties and Sixties because of the radios':

- F. financial value.
- G. aesthetic appeal.
- H. historical importance.
- J. technological sophistication.

9. In the passage, the narrator metaphorically compares brains to:

- A. shops.
- B. attics.
- C. junk.
- D. memories.

10. Consider this interpretation of the "spots of time" alluded to in line 90 of the passage:

"Spots of time" for Wordsworth are past experiences . . . which continue to resonate with new meanings many years after the events themselves.

Assuming that this is a reasonable interpretation of Wordsworth's concept, this information suggests that the narrator has:

- F. by and large faithfully applied Wordsworth's concept to junk.
- G. ignored Wordsworth's belief that past experiences still resonate.
- H. adapted Wordsworth's notion to a discussion of the narrator's own poetry.
- J. offered a definition of "spots of time" that's fundamentally different from Wordsworth's.

## Passage II

**SOCIAL SCIENCE:** This passage is adapted from *Taylor's Guide to Roses*, edited by Peter Schneider (©1995 by Houghton Mifflin Company).

Fossils found in Europe, Asia, and North America indicate that roses existed approximately 30 million years ago. Among the earliest representations of the flower were decorations on jewelry and ornaments from 5 the early Minoan civilization, which flourished on the island of Crete from about 2800 to 2100 BC. Approximately 1,000 years later, roses began to appear in the paintings and carvings of the later inhabitants of this same island.

10 It appears that the earliest cultivation of roses may have taken place in China; according to Confucius (551–479? BC), roses were grown in the imperial garden of the Chou dynasty. The Greeks also grew roses but not to the extent that the Romans did. In the 15 ancient world, the cultivation of roses reached its peak in the Roman Empire, in the 300 years following the birth of Christ.

The Romans were extravagant in their love of roses. Wealthy citizens used hundreds of thousands of 20 rose petals to carpet their floors. Nets filled with petals were suspended from the ceiling; released during an evening's festivities, they sent a gentle cascade of color and fragrance onto the guests below. The Romans made beds of rose petals and added the fragrant flowers to 25 their bathwater to perfume and preserve their skin.

Eventually the clamor for roses became so great that even the huge shipments imported to Rome from Egypt were not sufficient to fill the need. In due course, the Romans began to grow their own roses. Displaying 30 the same ingenuity that had led to the building of impressive networks of aqueducts and the sumptuous pleasure palaces at Pompeii, citizens of the empire built greenhouses, where piped-in hot water created the warmth necessary for cultivated plants to produce blossoms throughout the winter.

Long an emblem of festivity and luxury, the rose began to signify more than simple pleasure when Roman civic leaders endowed it with political import. A rose hanging from the ceiling during the course of a 40 political meeting signaled confidentiality—those present must never reveal the secrets exchanged *sub rosa*.

Rose oil has been used by many civilizations as a perfume and to anoint the dead. In China, where the rose was a royal flower, only the ruling classes were 45 permitted to use these precious oils. And in medieval France, commoners were allowed to enjoy this magnificent fragrance only on their wedding day. At various periods in history, this oil has commanded huge prices—up to six times its weight in gold.

50 In the 18th century, more than one-third of all herbal remedies for various ailments called for the use

of roses, and historically the flower has been significant in a wide range of medicinal applications. The healing properties ascribed to the rose were supposed to lie 55 chiefly in the petals—particularly those of *Rosa gallica*, which is widely known as the Apothecary Rose.

A conserve made from rose petals was once widely used to strengthen the stomach and assist in digestion. Syrup of roses, made from the Damask Rose, was once commonly prescribed as a purgative. Rose vinegar, made by adding dried petals to a distilled vinegar, was given to relieve headaches. And even the fruit of the rose was employed in early medicine. The pulp 65 was separated from the seeds; blended with sugar, it was sold as a curative for numerous ailments.

At present, roses are not so widely used in medicine; nonetheless, rose hips are employed in a large number of commercial products, notably tea and 70 preserves. They are also one of the chief sources of vitamin C today.

Most of today's cultivated rose varieties are descended from seven or eight species of wild roses, most of which are in the group that botanists term *Galicanae*—*Rosa gallica* and its near relatives. The evolution 75 of garden roses is complex. When the China Rose was introduced in Europe in 1789, a sort of rose revolution took place. Until that time, the only roses found in Europe were hardy shrubs that bloomed for a short period in late spring or summer. This and other oriental species brought with them a capacity for repeat-flowering. Some of them bore yellow flowers—a novelty—and some had a climbing or trailing habit.

By the late 19th century, the roses of the East and 85 West had been crossed and recrossed many times, creating a range of repeat-flowering roses in many colors and culminating in the creation of the hybrid tea class. Although other classes have come into being since that time, the hybrid teas are still considered to be the most 90 popular of all roses.

11. It is most accurate to say that the information about roses in the passage is organized in a way that is:
- loosely chronological.
  - strictly chronological.
  - chronologically reversed, that is, starting with the present and moving backward in time.
  - chronologically random.

12. According to the passage, the "later inhabitants" referred to in line 8 can accurately be described as all of the following EXCEPT:
- F. people who lived around 1100 BC.
  - G. residents of Crete.
  - H. creators of paintings and carvings.
  - J. importers of roses.
13. As it is used in line 38, the word *import* most nearly means:
- A. merchandise.
  - B. meaning.
  - C. disruption.
  - D. newcomer.
14. As it is used in lines 77–78, the term *rose revolution* most nearly refers to which of the following?
- F. A civil war fought during the 1400s to determine who would control the throne of England.
  - G. The growth of Egypt's flower industry as a result of the demand for roses in the ancient world.
  - H. The effect of modern technology on the flower industry's ability to grow and deliver roses.
  - J. The variety in rose types that was brought about by the introduction of oriental roses to Europe.
15. Which of the following is presented in the passage as a possibility rather than as a fact?
- A. Romans heated their greenhouses with piped-in hot water.
  - B. The earliest cultivation of roses took place in China.
  - C. Rose oil has sometimes been valued at six times its weight in gold.
  - D. Most of today's cultivated rose varieties are descended from seven or eight species of wild roses.
16. According to the passage, where and when did the cultivation of roses reach its peak in the ancient world?
- F. On the island of Crete between 2800 and 2100 BC.
  - G. In Greece between 551 and 479 BC.
  - H. In the Roman Empire in the three hundred years following the birth of Christ.
  - J. In Egypt during the reign of the pharaohs.
17. Which of the following is a detail used in the passage to support the point that at one time Romans' demand for roses exceeded the supply?
- A. Wealthy Romans began making their beds out of goose down instead of rose petals.
  - B. Romans began growing their own roses.
  - C. Poor Romans stopped using roses at wedding celebrations.
  - D. Romans started importing roses from Greece.
18. Which of the following statements about the medicinal aspects of roses is supported by the passage?
- F. At one time, more than one-third of all herbal remedies called for the use of roses.
  - G. The Damask Rose is also known as the Apothecary Rose.
  - H. The most potent healing properties of the rose were attributed to the seeds.
  - J. Greenhouse roses tend to be used for medicinal purposes more than wild roses are.
19. According to the passage, which of the following parts of a rose is an ingredient of rose vinegar?
- A. Hips
  - B. Leaves
  - C. Seeds
  - D. Petals
20. Based on the passage, a person picking a rose in Europe in AD 1600 would have been picking a flower from a plant that could accurately be described as a:
- F. climbing vine.
  - G. winter bloomer.
  - H. hardy shrub.
  - J. hybrid tea.

## Passage III

**HUMANITIES:** This passage is adapted from the article "A Fire Born of the Mexican Revolution" by Grace Glueck (©2002 by The New York Times Company).

The *Epic of American Civilization*, a mural by the Mexican painter José Clemente Orozco (1883–1949) in the Baker Library at Dartmouth College, has a throbbing vitality that keeps viewers' eyes wide open. Punctuated by doors, windows and other architectural bits and pieces as it runs the 92-foot length of the basement reserve reading room, the 26-panel fresco is densely packed with symbolic figures and stagy events. A blend of myth, history and contemporary comment, much affected by premonitions of the pending World War II, it aptly conveys Orozco's dour, apocalyptic vision of human fate.

The rhythmic orchestration of this montage excited the interest of Jackson Pollock, among other artists, and its thunderous presence has helped it serve, for better or for worse, as a role model for the development of public art in the United States. A narrative that pairs the legend of Mexico's founding by Quetzalcoatl, the Aztec god represented by a feathered serpent, with 20 images from the Eurocentric period that began in the New World with the 16th-century Spanish conquest of Mexico, the mural was Orozco's most ambitious venture in the United States. Aside from its grim world view, the Dartmouth fresco reveals Orozco's dual artistic involvement, with Mexico's heritage and with the modern-art movements of the 20th century.

At the time (1932), Dartmouth's commissioning of a mural by a "revolutionary" Mexican artist made waves. There were accusations of extravagance, considered inappropriate during Depression days. (Over two years, the artist received \$10,000, including expenses.) There were chauvinistic protests against giving the commission to a foreigner, particularly one of leftist political views. And there were outcries over the strong 35 social commentary in the planned work, as opposed to, say, an amiable depiction of New England scenery. To its credit, Dartmouth rose above these protests, with the help of an art faculty that saw the aesthetic and humanistic strengths of the Mexican mural movement and—40 not least—with the help of the Rockefeller family, some of whom were alive to the art world's interest in things Mexican.

After visiting California in 1917–19, Orozco came back to the United States in December 1927. By then 45 recognized in Mexico as a leading mural painter, he sought new patrons for commissions. While in the United States, in addition to the three mural jobs he did win, he produced a good deal of work in other mediums and exhibited a number of earlier pieces done in Mexico: Goyaesque drawings of the Mexican Revolution (in which he served mostly as an observer), political cartoons, vignettes of Mexican life and preparatory drawings for several of his murals back home.

During his early months in New York, he 55 immersed himself in the city's culture. He signed on with a dealer, Alma Reed, and through her began to frequent the Ashram, a salon steeped in the culture of early Greece. Impressed by New York's vivacity, he made his first lithograph in 1928, *Vaudeville in Harlem*. 60 A cartoonish scene, it is one of some 20 prints done from 1928 to 1930 that achieved commercial and critical success. Other subject matter in the lithographs is grimmer. And some are milder in tone, like *Mexican Peasants Working* (1929), a sharp sketch of men and women toiling past a giant cactus and rocks in an inhospitable landscape.

Orozco's take on New York is expressed in a number of oil paintings that deal with urban types, Depression subjects and architecture. They run from 70 *Elevated* (1929–30), a powerful abstract impression of rising girders and structural supports, to *Successful People* (1931), a cartoonish study of a very snooty couple, perhaps at the opera. The latter demonstrates Orozco's considerable gift for caricature, which he 75 often depicted but was not above using in his murals.

The first of Orozco's work to draw real critical attention, however, was that dealing with the Mexican Revolution, which began in 1910 and lasted through 1917. The more than 40 ink-and-graphite war drawings, 80 done from memory beginning in 1926, were attempts to integrate the large revolutionary themes of his murals with the informality of his political caricatures. Emphasizing the conflict among social classes, they depict bodies strewn on battlefields, soldiers marching, the 85 victims of a dynamited train, a group solemnly participating in a requiem vigil.

After his return to Mexico in June 1934, Orozco is said to have done some of his finest work. Apparently his achievements in the United States served as a 90 prelude to the culmination of his career on his homeground.

21. The main purpose of the passage is to:

- A. compare and contrast Orozco's work in Mexico with his work in the United States.
- B. depict the influence Orozco exerted over the Mexican mural movement.
- C. offer an explanation of Orozco's dour, apocalyptic vision.
- D. discuss Orozco's work during a creatively fertile period for him in the United States.

22. The author's perspective on and approach toward Orozco is most nearly that of:

- E. a contemporary and friend.
- G. a critic and satirist.
- H. an art historian and biographer.
- J. an enthusiastic but uninformed collector.

23. The author characterizes the effect of *The Epic of American Civilization* on viewers most nearly as:
- A. fascinating and calming.
  - B. mesmerizing and dynamic.
  - C. inspiring and cheering.
  - D. unsettling and unsatisfying.
24. The passage indicates that Dartmouth's commissioning Orozco for a mural drew controversy for all of the following reasons EXCEPT:
- F. the perceived expense of the project during hard economic times.
  - G. Orozco's status as a foreigner and his leftist politics.
  - H. the content of the proposed mural.
  - J. Orozco's commentary on Dartmouth's faculty.
25. The author indicates that the oil paintings *Elevated* and *Successful People* are similar in that:
- A. they portray an abstract urban landscape.
  - B. they are parts of larger murals.
  - C. their subject matter is related to the same city.
  - D. they use caricature as an expressive device.
26. The passage supports which of the following statements about Orozco and caricature?
- F. He used caricature but had little real talent as a caricaturist.
  - G. He decried caricature and refrained from using it in his murals.
  - H. He often expressed contradictory opinions about caricature to members of the press.
  - J. He was a gifted caricaturist but nonetheless spoke out against the technique.
27. The author indicates that *The Epic of American Civilization* is connected to World War II in that the mural:
- A. is infused with the looming threat of the war.
  - B. documents certain events from the war.
  - C. avoids dealing with the impending war.
  - D. predicts a peaceful resolution prior to the war.
28. The author states that *The Epic of American Civilization* caught the eye of Pollock and other artists because of its:
- F. staging of historical events.
  - G. rhythmic orchestration.
  - H. controversy in the art world.
  - J. bold use of Aztec imagery.
29. The author makes which of the following assessments of the impact of *The Epic of American Civilization* on art?
- A. It began a movement popularizing Mexican culture.
  - B. It has influenced the development of public art in the United States.
  - C. Its style and content have seldom been imitated by other artists.
  - D. It has a presence that has yet to be appreciated by those interested in public art.
30. The main point of the last paragraph is that Orozco:
- F. went on to even greater artistic achievements once he left the United States in 1934 to return to Mexico.
  - G. returned to Mexico in 1934 after reaching the culmination of his career in the United States.
  - H. faced an uncertain future in his homeland after having done great work in the United States.
  - J. regarded his work in the United States as having been some of the finest of his career.

## Passage IV

**NATURAL SCIENCE:** This passage is adapted from the article "A Flash From the Past: New Evidence Supports Moon Blast" by Henry Fountain (©2003 by The New York Times Company).

Humans have gazed at the Moon in wonder since ancient times, but what Dr. Leon Stuart observed one night in 1953 was more wonderful than what anyone had seen before since.

5 Looking through his eight-inch telescope at his home near Tulsa, Okla., Dr. Stuart, a radiologist by profession but an astronomer by avocation, saw and photographed a bright flash on the Moon's surface.

Dr. Stuart was certain that he had witnessed a 10 small asteroid hitting the Moon, the flash being the fireball from the event. An amateur astronomy journal published his photograph and report, and it has remained a curiosity over the years. While some scientists thought his explanation plausible, others were convinced that he 15 saw an optical aberration or a much closer object, like a meteorite in Earth's atmosphere (or, embarrassingly, an airplane passing overhead).

Now new research shows that Dr. Stuart's flash on the Moon was no flash in the pan. An astronomer at 20 NASA's Jet Propulsion Laboratory, poring over high-resolution lunar photographs, has found a fresh crater in the precise area where Dr. Stuart saw his flash.

"I think it's a very good candidate," Dr. Bonnie J. Buratti, an astronomer, said of the crater, which is about 250 to 800 yards in diameter. Dr. Buratti worked on the project with Lanc Johnson, then a student at Pomona College; the two published their findings in the astronomical journal *Icarus*.

At the Jet Propulsion Laboratory, Dr. Buratti 30 served on the science team for the Clementine spacecraft, which thoroughly photographed the Moon in 1994. As part of that work, she and others had looked for evidence of transient phenomena like asteroid impacts and had found none. Just as they were preparing 35 a paper on their research, a colleague mentioned what is known as Stuart's event.

"I had never heard of it," Dr. Buratti said. But her curiosity was piqued, so she found a 1956 copy of the amateur journal *The Strolling Astronomer* and looked at 40 the photo.

She and Johnson were able to determine the approximate location of the flash, a circular area with a radius of about 20 miles. From the brightness of the event, they estimated the force of the impact to be 45 about half a megaton, equal to a small hydrogen bomb. Their best guess as to the size of a feature created by such an impact, including a crater and its ejecta blanket, the material thrown out around the sides, was 1.2 miles or less—too small to see from ground-based 50 photographs.

So first they looked at photographs taken by the lunar orbiters in the 1960s, which mapped areas of the Moon to prepare for the Apollo landings. These photos were inconclusive, so they turned to the huge database 55 of two million images from Clementine. Many of these photographs were taken with color filters, which can help in determining the age of a surface feature.

On the Moon, material that is freshly exposed has a slight bluish tinge. Over time, because of the constant 60 bombardment of cosmic rays, other high-energy particles and micrometeorites, the structure of the material changes and iron particles tend to predominate, making the material slightly red.

In the Clementine photos, Dr. Buratti and Johnson 65 found one small crater that was "very, very blue and fresh appearing," Dr. Buratti said. It also happened to be in the exact center of the area they were looking. And it was the proper size—slightly less than a mile across, including the ejecta blanket. Dr. Buratti estimated 70 the size of the asteroid at 20 yards in diameter.

She said that although there was a good deal of uncertainty in their study, she was "about 90 percent" confident that the crater was the one created by the fireball Dr. Stuart observed. "There's no other object that 75 stands out as a candidate," she said.

Dr. Stuart, who died in the 1960s, was not one to make wild claims. "He was very careful to eliminate all the other possibilities," she said. "At the time, scientists didn't even agree that craters were caused by impacts. So he was very conservative."

If Dr. Stuart observed an asteroid impact, he saw something that was extremely rare: a rock of that size hits the Moon only once or twice a century, according to best estimates.

85 But Dr. Buratti said she wasn't surprised there was a witness. "I would contend that at any given time, some amateur or professional astronomer is watching the Moon," she said. "With a blast of this sort, someone would be likely to see it."

31. Which of the following events referred to in the passage occurred first chronologically?

- A colleague mentioned what is known as Stuart's event to Buratti.
- The Clementine spacecraft carried out its mission.
- Buratti looked at photos in a 1956 issue of *The Strolling Astronomer*.
- Buratti and Johnson found an image of a small blue crater on the Moon.

32. Which of the following statements about Stuart is NOT supported by the passage?
- He was a radiologist.
  - He lived in Oklahoma.
  - He photographed the Moon.
  - He died in the 1980s.
33. The main idea of the third paragraph (lines 9–17) is that:
- having first assumed that he had seen an airplane passing overhead, Stuart later realized he had in fact seen an asteroid hitting the Moon.
  - thanks to an article in an amateur astronomy journal, doubts were removed concerning Stuart's claims about an asteroid hitting the Moon.
  - Stuart consulted with other astronomers to arrive at the conclusion that he had seen an asteroid hitting the Moon.
  - scientists had different opinions about the true nature of what Stuart asserted was an asteroid hitting the Moon.
34. According to the passage, Buratti's conclusion that Stuart's claim was likely correct hinges on photographs taken by:
- Johnson when he was a student at Pomona College.
  - Buratti herself as part of the Apollo missions.
  - the Clementine spacecraft in 1994.
  - photographers for *Icarus*.
35. Which of the following phrases best describes the first paragraph?
- A precise summary of Stuart's most significant contribution to his profession
  - An indication that for years, controversy has surrounded the event witnessed by Stuart
  - A general reference to the astronomical incident that is the focus of the passage
  - An indication that astronomers overestimated the significance of what was observed through a telescope one night in 1953
36. It can most reasonably be inferred from the passage that among serious astronomers, confusing an airplane with an asteroid is considered a:
- common occurrence when using a telescope that is eight inches or smaller.
  - problem that occurs less often as amateurs gain access to professional-quality telescopes.
  - sign that the viewer was not using a telescope when observing the skies.
  - mistake indicating poor judgment on the part of the viewer.
37. Which of the following would Buratti most likely consider an accurate description of Stuart's event?
- An example of an "optical aberration" (line 15)
  - An example of "transient phenomena" (line 33)
  - An example of "lunar orbiters" (line 52)
  - An example of "micrometeorites" (line 61)
38. According to the passage, what is an ejecta blanket?
- A thin layer of iron particles on the surface of a newly formed crater
  - The surface of an asteroid
  - The reddish hue around photographs taken with color filters
  - The material thrown out around the sides of a crater formed by an impact
39. The color filters mentioned in the passage are described as being useful in determining the:
- distance between features on the Moon.
  - temperature of objects in space.
  - age of surface features on the Moon.
  - weight of objects on the Moon.
40. That Stuart was conservative in describing his findings is most clearly identified in the passage as the opinion of:
- Buratti.
  - the publishers of *Icarus*.
  - Stuart himself.
  - the scientists who first read his 1956 report.

**END OF TEST 3**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.  
DO NOT RETURN TO A PREVIOUS TEST.**



## SCIENCE TEST

**35 Minutes—40 Questions**

**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

Scientists have observed that if mature cocklebur plants (*Xanthium strumarium*) are maintained on a 16L:8D light-dark cycle (a light-dark cycle with 16 hr of light, L, then 8 hr of darkness, D), they do not flower. However, if the plants are maintained on a 14L:10D light-dark cycle, they do flower. Three hypotheses were proposed to explain these observations.

#### Hypothesis 1

Mature cocklebur plants flower if, and only if, their leaves are exposed to a total of 10 or more hours of darkness each day.

#### Hypothesis 2

Mature cocklebur plants flower if, and only if, their leaves are exposed to a block of 10 or more continuous hours of darkness each day. If daily exposure to darkness exceeds a total of 10 hr, but is not continuous for 10 or more hours, the plants do not flower.

#### Hypothesis 3

Mature cocklebur plants flower if, and only if, their stems are exposed to a total of 9 or more hours of darkness each day. Leaves are not necessary for flowering. A mature cocklebur plant without leaves will flower if its stems are exposed to a total of 9 or more hours of darkness each day.

#### Experiments

Figure 1 shows the results of flowering experiments performed with mature cocklebur plants maintained on various 24 hr light-dark cycles. Figure 2 shows the results of similar experiments with mature cocklebur plants having various levels of *defoliation* (leaf removal). In each experiment involving plants with no defoliation or with partial defoliation, during each light-dark cycle, the amount of light received by the stems was equal to the amount of light received by the leaves. (Note: In the figures, a white box indicates hours of exposure to light and a black box indicates hours of exposure to darkness.)

Experiment	Light-dark cycle				Flowering
1	20	4			no
2	4	20			yes
3	12	12			yes
4	6	6	6	6	no
5	8	4	8	4	no
6	4	8	4	8	no
7	1	5	1	5	no
8	1	7	1	3	no
9	10	2	10	2	no

Figure 1

<u>Experiment</u>	<u>Defoliation</u>	<u>Light-dark cycle</u>		<u>Flowering</u>
10	none	12	12	yes
11	partial	12	12	yes
12	complete	12	12	no
13	partial	4	20	yes
14	complete	4	20	no

Figure 2

1. Based on Hypothesis 2, which of the following light-dark cycles results in flowering?
- A. A sequence of six alternating light (white) and dark (black) bars, each labeled '4'.
- B. A sequence of eight alternating light (white) and dark (black) bars, where the first two pairs are labeled '3L 1D' and the next six are labeled '3L'.
- C. A sequence of four alternating light (white) and dark (black) bars, where the first and third are labeled '1L' and the second and fourth are labeled '11D'.
- D. A sequence of six alternating light (white) and dark (black) bars, where the first and third are labeled '1L' and the second, fourth, and fifth are labeled '7D'.
2. The results of which of the following experiments support Hypothesis 1?
- F. Experiment 2  
G. Experiment 4  
H. Experiment 6  
J. Experiment 7
3. All 3 hypotheses would have predicted that flowering would occur in which of the following experiments?
- A. Experiment 3  
B. Experiment 4  
C. Experiment 5  
D. Experiment 6
4. Do the results of Experiment 14 support Hypothesis 3?
- F. Yes, because the plants flowered.  
G. Yes, because the plants did not flower.  
H. No, because the plants flowered.  
J. No, because the plants did not flower.
5. Based on Hypothesis 1, which of the following light-dark cycles would NOT result in flowering?
- A. 2L,10D,2L,10D  
B. 6L,18D  
C. 3L,9D,3L,9D  
D. 18L,6D
6. Both Hypothesis 2 and Hypothesis 3 would have predicted that flowering would occur in which of the following experiments?
- E. Experiment 1  
G. Experiment 10  
H. Experiment 12  
J. Experiment 14
7. Which of the 3 hypotheses, if any, is weakened by the results of Experiment 9?
- A. Hypothesis 1  
B. Hypothesis 2  
C. Hypothesis 3  
D. None of the hypotheses



## Passage II

In mountainous regions, a *terrace* is made by first building a low rock wall, then creating an area of level soil behind the wall (see Figure 1). Rainfall erodes the soil from terraces at different rates depending on whether a terrace is being farmed or is being used for animal grazing.

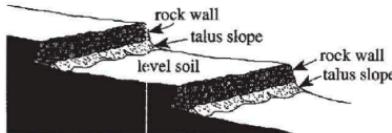


Figure 1

A study done in June of one year considered 86 terraces in the same  $100 \text{ km}^2$  mountainous region, all at approximately the same altitude. Each terrace was assigned to 1 of 3 categories: farmed, lightly grazed, or heavily grazed. Also studied were *talus slopes*, which are inclined areas composed of rock fragments and small amounts of soil.

For each terrace or talus slope, erosion was measured in 5 different locations. At each location, a  $1,385 \text{ cm}^2$  area was isolated, and simulated rainfall was applied evenly to the area at a rate of  $75 \text{ mm/hr}$  for 45 min. The *time to runoff* (time elapsed between the beginning of rainfall and the beginning of runoff) was recorded (in sec).

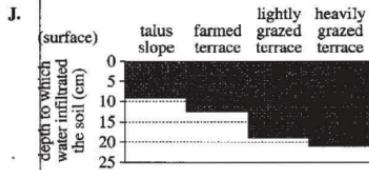
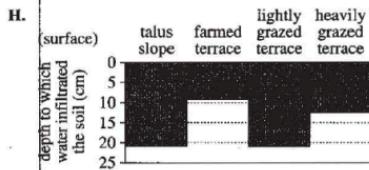
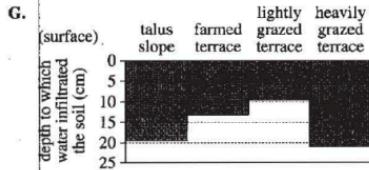
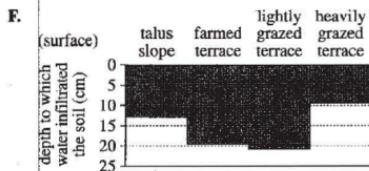
All runoff from each isolated area was collected over the 45 min to determine the runoff rate (in  $\text{mm/hr}$ ), the soil concentration in the runoff (in  $\text{g/L}$ ), and the soil erosion rate (in  $\text{g/m}^2/\text{hr}$ ). The *wetting front* was also determined at the end of 45 min. The wetting front was the depth (in cm) to which rainwater had infiltrated the soil. The results, averaged for each of the 4 types of surfaces, are shown in Table 1.

Table 1

Type of surface	Time to runoff (sec)	Runoff rate ( $\text{mm/hr}$ )	Soil concentration ( $\text{g/L}$ )	Soil erosion rate ( $\text{g/m}^2/\text{hr}$ )	Wetting front (cm)
Talus slope	301	36.7	0.77	22.0	12.7
Terrace	farmed	629	18.5	0.41	19.1
	lightly grazed	645	16.2	0.33	21.1
	heavily grazed	398	35.1	0.82	9.8

Figure and table adapted from Teodoro Lasanta et al., "Marginal Lands and Erosion in Terraced Fields in the Mediterranean Mountains." ©2001 by the International Mountain Society and the United Nations University.

8. Which of the following graphs best represents the wetting front results in Table 1?



9. Is the statement "The average soil erosion rate was greatest for the talus slopes" supported by the results of the study?

- A. Yes; the average soil erosion rate for the talus slopes was greater than that for any of the 3 categories of terraces.
- B. Yes; the average soil erosion rate for the talus slopes was less than that for any of the 3 categories of terraces.
- C. No; the average soil erosion rate for the talus slopes was greater than that for the farmed terraces and that for the lightly grazed terraces, but less than that for the heavily grazed terraces.
- D. No; the average soil erosion rate for the talus slopes was greater than that for the farmed terraces, but less than that for the lightly grazed terraces and that for the heavily grazed terraces.

10. The most likely reason that terraces located in the same mountainous region were selected for study was to ensure that the terraces would be as similar as possible with respect to which of the following variables?

- E. Soil erosion rate
- G. Runoff rate
- H. Climate
- J. Terrace category

11. According to the results of the study, for the farmed terraces, the average time elapsed between the beginning of the simulated rainfall and the beginning of runoff, in min, was closest to which of the following?

- A. 5 min
- B. 10 min
- C. 15 min
- D. 20 min

12. Do the results of the study support the statement "On average, for all 4 types of surfaces, all of the simulated rainfall that was applied ran off"?

- E. Yes, because for all 4 types of surfaces the runoff rate was greater than 75 mm/hr and the wetting front was zero.
- G. Yes, because for all 4 types of surfaces the runoff rate was less than 75 mm/hr and the wetting front was greater than zero.
- H. No, because for all 4 types of surfaces the runoff rate was greater than 75 mm/hr and the wetting front was zero.
- J. No, because for all 4 types of surfaces the runoff rate was less than 75 mm/hr and the wetting front was greater than zero.

13. Which of the following statements best explains why the soil erosion rate for heavily grazed terraces differed from the soil erosion rate for lightly grazed terraces? Heavily grazed terraces had:

- A. more vegetation cover than did lightly grazed terraces, and therefore were more resistant to erosion.
- B. more vegetation cover than did lightly grazed terraces, and therefore were less resistant to erosion.
- C. less vegetation cover than did lightly grazed terraces, and therefore were less resistant to erosion.
- D. less vegetation cover than did lightly grazed terraces, and therefore were more resistant to erosion.

**Passage III**

A capacitor is a device for storing electrical charge. Students in a science class determined the charge on a parallel-plate capacitor having a fixed *capacitance* (the ratio of the amount of charge on each plate to the voltage between the plates). Measurements were taken while the capacitor was being charged and while it was being discharged.

Table 1	
<i>t</i> (sec)	<i>Q</i> (pC)
0	0
5	160
10	250
15	310
20	350
25	370
30	380

**Study 1**

The students constructed an electrical circuit consisting of the capacitor, which was initially uncharged, a 4-volt (4 V) battery, a  $10^{10}$ -ohm resistor, and a switch (see Figure 1).

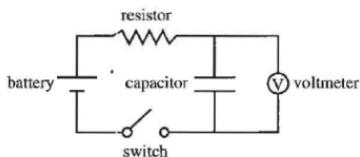


Figure 1

They closed the switch and charged the capacitor. During charging, the voltage across the capacitor,  $\epsilon$ , in V, was monitored with a voltmeter. A computer that was connected to the voltmeter plotted  $\epsilon$  versus time,  $t$ , in seconds (sec). The results are shown in Figure 2.

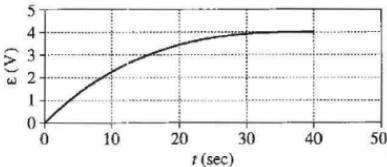


Figure 2

Once the capacitor was fully charged,  $\epsilon$  equaled the voltage supplied by the battery. Using the data in Figure 2, the computer calculated the charge,  $Q$ , on the capacitor at various  $t$ , in picoulombs (pC;  $1 \text{ pC} = 10^{-12} \text{ coulomb}$ ). The results are shown in Table 1.

**Study 2**

With the capacitor fully charged, the students opened the switch, removed the battery from the circuit, and substituted a picoammeter (see Figure 3) capable of measuring currents as small as  $1 \times 10^{-12}$  amp = 1 picoamp (pA). Then they closed the switch, allowing the capacitor to discharge through the resistor.

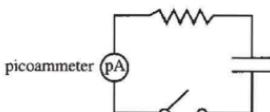


Figure 3

While the capacitor discharged, the students measured the electrical current,  $I$ , flowing through the resistor. The computer plotted  $I$  versus  $t$  (see Figure 4) and then, using the plotted values, calculated  $Q$  for various  $t$  (see Table 2).

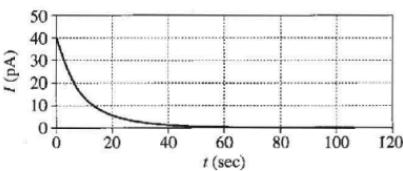


Figure 4

Table 2	
<i>t</i> (sec)	<i>Q</i> (pC)
0	400
5	240
10	150
15	90
20	60
25	30
30	20

14. Between  $t = 0$  sec and  $t = 30$  sec in Study 1, the voltage across the capacitor:
- F. increased only.
  - G. decreased only.
  - H. varied, but with no general trend.
  - J. remained the same.
15. Based on Table 2, starting at  $t = 0$  sec, it most likely took how long for the charge on the capacitor to equal  $200\text{ }\mu\text{C}$  in Study 2?
- A. Less than 5 sec
  - B. Between 5 sec and 10 sec
  - C. Between 10 sec and 15 sec
  - D. More than 15 sec
16. Suppose that in Study 1 the voltage of the battery had been 10 V instead of 4 V. Based on Figure 2, once the capacitor was fully charged, the voltage across the capacitor would have been:
- F. 4 V.
  - G. 10 V.
  - H. 14 V.
  - J. 20 V.
17. Which of the following statements best explains the value of  $Q$  at  $t = 0$  sec in Study 1? At  $t = 0$  sec, the:
- A. capacitor was uncharged.
  - B. capacitor was fully charged.
  - C. battery's voltage was 0 V.
  - D. battery's voltage was 4 V.
18. Based on Table 1 and Figure 2, as the capacitor was being discharged between  $t = 0$  sec and  $t = 30$  sec in Study 2, the voltage across the capacitor:
- F. increased only.
  - G. decreased only.
  - H. varied, but with no general trend.
  - J. remained the same.
19. Which of the following statements best explains the value of  $I$  at  $t = 100$  sec in Figure 4? At  $t = 100$  sec, the:
- A. battery's voltage was 0 V.
  - B. battery's voltage was 4 V.
  - C. capacitor was fully charged.
  - D. capacitor was fully discharged.


**Passage IV**

Figure 1 is a simplified *periodic table* giving the name, symbol, and *atomic number* (number of protons in the nucleus) for 20 elements. The elements in a column belong to a *group*. The elements in a row belong to a *period*.

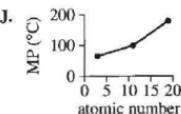
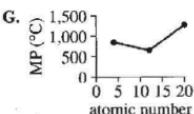
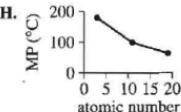
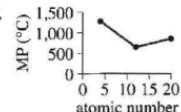
Table 1 gives the melting point at 1 atmosphere (atm) of pressure (the MP), the boiling point at 1 atm (the BP), and the *atomic radius* for one or more of the elements in each group.<sup>12</sup> The atomic radius, in *picometers* (pm; 1 pm =  $10^{-12}$  m), is a measure of the size of an atom. Table 1 also lists an ion for each element and the *ionic radius* of that ion (a measure of its size).

Period	Group						
	1A	2A	3A	4A	5A	6A	7A
2	3 Li lithium	4 Be beryllium	5 B boron	6 C carbon	7 N nitrogen	8 O oxygen	9 F fluorine
3	11 Na sodium	12 Mg magnesium	13 Al aluminum	14 Si silicon	15 P phosphorus	16 S sulfur	17 Cl chlorine
4	19 K potassium	20 Ca calcium					35 Br bromine
5	37 Rb rubidium	38 Sr strontium					53 I iodine

Figure 1

Table 1					
Element	MP (°C)	BP (°C)	Atomic radius (pm)	Ion	Ionic radius (pm)
Lithium	130	1,330	152	Li <sup>+</sup>	60
Sodium	98	890	186	Na <sup>+</sup>	95
Potassium	54	774	231	K <sup>+</sup>	133
Beryllium	1,230	2,477	111	Be <sup>2+</sup>	31
Magnesium	650	1,110	160	Mg <sup>2+</sup>	65
Calcium	850	1,487	197	Ca <sup>2+</sup>	99
Boron	2,300	3,930	88	B <sup>3+</sup>	27
Aluminum	660	2,470	143	Al <sup>3+</sup>	50
Silicon	1,410	3,260	117	Si <sup>4+</sup>	40
Nitrogen	-210	-196	70	N <sup>3-</sup>	171
Oxygen	-218	-183	66	O <sup>2-</sup>	140
Fluorine	-220	-188	64	F <sup>-</sup>	136
Chlorine	-101	-35	99	Cl <sup>-</sup>	181
Bromine	-7	59	114	Br <sup>-</sup>	195

20. According to Figure 1 and Table 1, which of the following graphs best shows how MP varies with atomic number for the Group 2A elements listed in Table 1?



21. Barium (Ba), like Sr, is a Group 2A element. The atomic number of Ba is 56. Based on Figure 1 and Table 1, which of the following is the most plausible set of values for the atomic radius of Sr and of Ba?

- |           |        |
|-----------|--------|
| Sr        | Ba     |
| A. 50 pm  | 70 pm  |
| B. 70 pm  | 50 pm  |
| C. 220 pm | 235 pm |
| D. 235 pm | 220 pm |

22. Based on Table 1, at 1,000°C and 1 atm, aluminum exists in what state and sodium exists in what state?

	aluminum	sodium
F.	solid	liquid
G.	liquid	solid
H.	liquid	gas
J.	gas	liquid

23. According to Figure 1 and Table 1, for the Period 3 elements in Groups 1A–4A and the ions listed for those elements, as atomic number increases, ionic radius:
- A. increases only.
  - B. increases, then decreases.
  - C. decreases only.
  - D. decreases, then increases.
24. Which of the following statements comparing the ionic radius to the atomic radius for a given element is best supported by Table 1? Compared to the size of an atom, the size of the ion is:
- E. smaller, regardless of the charge on the ion.
  - F. larger, regardless of the charge on the ion.
  - G. smaller if the ion is negative, but larger if the ion is positive.
  - H. larger if the ion is negative, but smaller if the ion is positive.



### Passage V

Chickens can have different types of *combs* (red crests on the top of the head). Two unlinked genes that influence comb type in chickens are Gene R and Gene P. Table 1 lists 4 comb types in chickens and gives the Gene R and Gene P genotype(s) responsible for each comb type. In the genotypes, capital letters indicate dominant alleles and lower-case letters indicate recessive alleles.

Table 1	
Comb type	Genotype
Walnut	<i>RRPP</i> <i>RRPp</i> <i>RrPP</i> <i>RrPp</i>
Rose	<i>Rkpp</i> <i>Rrpp</i>
Pea	<i>rrPP</i> <i>rrPp</i>
Single	<i>rrpp</i>

Several chickens with the genotype *Rrpp* were crossed with chickens having the genotype *rrPp*. The percent of the resulting offspring having each comb type is shown in Table 2.

Table 2	
Comb type	Percent of offspring
Walnut	25
Rose	25
Pea	25
Single	25

25. Based on their genotypes for Gene R and Gene P, the parents in each of the *Rrpp* × *rrPp* crosses most likely had which comb type(s)?
- Both parents had rose combs.
  - Both parents had walnut combs.
  - One parent had a walnut comb and the other parent had a pea comb.
  - One parent had a rose comb and the other parent had a pea comb.
26. What was the genotype, for Gene R and Gene P, of the walnut-combed offspring of the *Rrpp* × *rrPp* crosses?
- RRPP*
  - RRPp*
  - RrPP*
  - RrPp*
27. Based on Table 1, which of the following crosses would produce walnut-combed offspring only?
- rrpp* × *rppp*
  - Rrpp* × *rrPP*
  - RRpp* × *rrPP*
  - RRpp* × *rrPp*
28. Based on Table 1, a chicken that is homozygous recessive for both Gene R and Gene P will have which type of comb?
- Walnut
  - Rose
  - Pea
  - Single
29. Suppose 2 single-combed chickens were crossed. Based on Table 1, the percent of the offspring with walnut combs would most likely be closest to which of the following?
- 0%
  - 25%
  - 50%
  - 100%

**Passage VI**

Three cars were employed in a study of relative motion. Cars X and Y moved along an east-west highway. Car Z was always parked beside the highway between Cars X and Y (see Figure 1; figure not to scale).

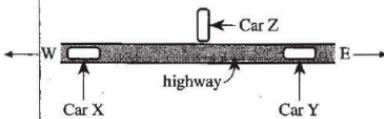


Figure 1

During each trial, a passenger in each of the 3 cars used a radar gun to measure the velocities, in m/sec, of the other 2 cars. If 2 cars got farther apart, the velocity of each car, as measured from the other car, would be positive. If 2 cars got closer together, the velocity of each car, as measured from the other car, would be negative.

Table 1 lists the symbols used to represent the measured velocities. Table 2 gives the results of various trials.

Table 1

Symbol	Velocity represented
$V_{XZ}$	Velocity of Car X when measured from Car Z
$V_{ZX}$	Velocity of Car Z when measured from Car X
$V_{YZ}$	Velocity of Car Y when measured from Car Z
$V_{ZY}$	Velocity of Car Z when measured from Car Y
$V_{XY}$	Velocity of Car X when measured from Car Y
$V_{YX}$	Velocity of Car Y when measured from Car X

Table 2

Trial	$V_{XZ}$ (m/sec)	$V_{ZX}$ (m/sec)	$V_{YZ}$ (m/sec)	$V_{ZY}$ (m/sec)	$V_{XY}$ (m/sec)	$V_{YX}$ (m/sec)
1	-3	-3	-2	-2	-5	-5
2	-3	-3	-3	-3	-6	-6
3	-3	-3	-4	-4	-7	-7
4	-3	-3	-5	-5	-8	-8
5	+3	+3	-2	-2	+1	+1
6	+3	+3	-3	-3	0	0
7	+3	+3	-4	-4	-1	-1
8	+3	+3	-5	-5	-2	-2

30. In which of the following trials was the distance between Car X and Car Y increasing?

- F. Trial 1
- G. Trial 5
- H. Trial 6
- J. Trial 8

31. In Trial 8, based on the measurement by the passenger in Car X, how far did Car Y travel in 5 sec?

- A. 10 m
- B. 15 m
- C. 20 m
- D. 25 m

32. Suppose that an additional trial is conducted, with the results  $V_{XZ} = -3$  m/sec,  $V_{ZX} = -3$  m/sec,  $V_{YZ} = -1$  m/sec, and  $V_{ZY} = -1$  m/sec. In this additional trial,  $V_{YX}$  is most likely closest to which of the following?

- E. +4 m/sec
- G. +2 m/sec
- H. -2 m/sec
- J. -4 m/sec

33. According to the measurements by the passenger in Car X, in what trial was Car Y moving the fastest with respect to Car X?

- A. Trial 1
- B. Trial 4
- C. Trial 5
- D. Trial 8

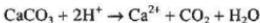
34. In Trial 5, did Car X move toward Car Z or away from Car Z, and did Car Y move toward Car Z or away from Car Z?

- |              |              |
|--------------|--------------|
| <u>Car X</u> | <u>Car Y</u> |
| F. away      | toward       |
| G. toward    | away         |
| H. away      | away         |
| J. toward    | toward       |



## Passage VII

Calcium carbonate ( $\text{CaCO}_3$ ) is the primary component of chalk, eggshell, and other substances. When  $\text{CaCO}_3$  reacts with an acid,  $\text{CO}_2$  gas is produced:



Students did 2 experiments to determine the  $\text{CaCO}_3$  content of several common substances.

### Experiment 1

A flask was fitted with an airtight cap. The cap contained a pressure sensor connected to a computer. Next, 30 mL of acid solution (a volume sufficient to react with up to 0.5 g of  $\text{CaCO}_3$ ) was added to the flask. Then, 0.01 g of powdered  $\text{CaCO}_3$  was added to the solution. The flask was quickly recapped, and pressure readings (in kilopascals, kPa) were recorded every 0.1 sec for 14 sec. The procedure was repeated using different masses of powdered  $\text{CaCO}_3$  (see Figure 1).

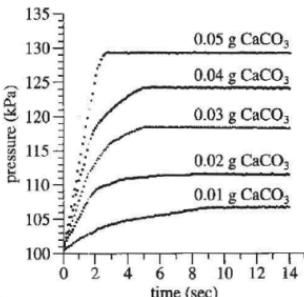


Figure 1

For each trial, the total change in pressure ( $\Delta P$ ) was calculated using the equation below:

$$\Delta P = (\text{maximum pressure}) - (\text{initial pressure})$$

The  $\Delta P$  value for each trial was then plotted against the mass of  $\text{CaCO}_3$  added in that trial and a best-fit line was drawn through the points (see Figure 2).

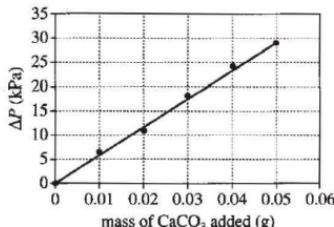


Figure 2

Figures adapted from M. M. F. Choi and P. S. Wong, "Using a Data-logger to Determine First Order Kinetics and Calcium Carbonate in Eggshells." ©2004 by Division of Chemical Education, Inc., American Chemical Society.

### Experiment 2

Students used the procedure from Experiment 1 to test 0.05 g samples of powders made from antacid tablets, calcium supplement tablets, and other substances. After calculating the  $\Delta P$  value for each trial, they used the best-fit line in Figure 2 to convert each  $\Delta P$  value to a mass of  $\text{CaCO}_3$ , and then calculated the  $\text{CaCO}_3$  content (percent of the total mass that is  $\text{CaCO}_3$ ) for each substance using the equation below:

$$\text{CaCO}_3 \text{ content} = \frac{\text{mass of } \text{CaCO}_3 \text{ found using Figure 2}}{0.05 \text{ g}} \times 100$$

The results are shown in Table 1.

Table 1		
Substance	$\Delta P$ (kPa)	$\text{CaCO}_3$ content (%)
Antacid A	10.0	34
Antacid B	0.0	0
Antacid C	11.7	40
Supplement A	9.1	31
Supplement B	0.0	0
Eggshell	25.5	87
Cement	7.3	25



35. A 0.05 g sample of powdered seashell was tested as in Experiment 2. The  $\text{CaCO}_3$  content was calculated to be 81%. Based on Figure 2 and Table 1,  $\Delta P$  for the seashell sample was most likely:
- A. less than 16 kPa.
  - B. between 16 kPa and 21 kPa.
  - C. between 21 kPa and 26 kPa.
  - D. greater than 26 kPa.
36. If an additional trial had been done in Experiment 1 in which 0.06 g of  $\text{CaCO}_3$  had been tested,  $\Delta P$  would most likely have been:
- F. less than 30 kPa.
  - G. between 30 kPa and 40 kPa.
  - H. between 40 kPa and 50 kPa.
  - J. greater than 50 kPa.
37. A student claimed that, in Experiment 1, increasing the amount of  $\text{CaCO}_3$  that was added to the acid solution increased the reaction rate. Does Figure 1 support this claim?
- A. Yes, because the time to reach the maximum pressure was shorter in the trial for 0.05 g than it was in the trial for 0.01 g.
  - B. Yes, because the time to reach the maximum pressure was longer in the trial for 0.05 g than it was in the trial for 0.01 g.
  - C. No, because the time to reach the maximum pressure was shorter in the trial for 0.05 g than it was in the trial for 0.01 g.
  - D. No, because the time to reach the maximum pressure was longer in the trial for 0.05 g than it was in the trial for 0.01 g.
38. Which of the following assumptions must be made to properly interpret the results of Experiment 2?
- F. In each trial, the pressure stopped decreasing by time = 14 sec.
  - G. In each trial, the pressure stopped increasing by time = 14 sec.
  - H. Each of the substances tested was composed entirely of  $\text{CaCO}_3$ .
  - J. None of the substances tested contained  $\text{CaCO}_3$ .
39. Which of the following assumptions was made about each substance tested in Experiment 2?
- A.  $\text{CaCO}_3$  was the only component of the substance that would not react in the acid solution to produce a gas.
  - B.  $\text{CaCO}_3$  was the only component of the substance that would react in the acid solution to produce a gas.
  - C. None of the components of the substance would react in the acid solution to produce a gas.
  - D. All of the components of the substance would react in the acid solution to produce a gas.
40. Suppose 1 g of Supplement B were mixed with 1 g of eggshell to form homogeneous Powder X, and then 1 g of Antacid C and 1 g of cement were mixed to form homogeneous Powder Y. Based on Table 1, if Powders X and Y were each tested as in Experiment 2, which powder would have a higher  $\Delta P$ ?
- E. Powder X, because Powder X would have the higher  $\text{CaCO}_3$  content.
  - G. Powder X, because Powder X would have the lower  $\text{CaCO}_3$  content.
  - H. Powder Y, because Powder Y would have the higher  $\text{CaCO}_3$  content.
  - J. Powder Y, because Powder Y would have the lower  $\text{CaCO}_3$  content.

**END OF TEST 4**

**STOP! DO NOT RETURN TO ANY OTHER TEST.**