Form C01

(July 2020)

Math/Science
Version

The **ACT**® 2019 | 2020

In response to your request for Test Information Release materials, this booklet contains the test questions, scoring keys, and conversion tables used in determining your ACT scores. Enclosed with this booklet is a report that lists each of your answers, shows whether your answer was correct, and, if your answer was not correct, gives the correct answer.

If you wish to order a photocopy of your scanned 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.

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.

---

1. The parallelogram below has consecutive angles with measures $x°$ and $25°$. What is the value of x ?

   DO YOUR FIGURING HERE.
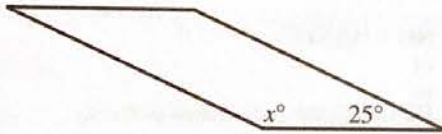
   A. 100
   B. 115
   C. 130
   D. 140
   E. 155

2. A retail sales associate's daily commission during 1 week was $30 on Monday and Tuesday and $70 on Wednesday, Thursday, and Friday. What was the associate's average daily commission for these 5 days?

   F. $50
   G. $51
   H. $54
   J. $55
   K. $56

3. What is the greatest common factor of 45, 50, and 84 ?

   A. 0
   B. 1
   C. 2
   D. 3
   E. 5

4. For what value of x is the equation $2(x - 12) + x = 36$ true?

   F. 4
   G. 8
   H. 16
   J. 20
   K. 30

5. A bag contains exactly 22 solid-colored buttons: 4 red, 6 blue, and 12 white. What is the probability of randomly selecting 1 button that is NOT white?

A. $\frac{5}{11}$

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

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

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

E. $\frac{1}{10}$

6. On a map, $\frac{1}{2}$ inch represents 12 actual miles. Two towns that are 5 inches apart on this map are how many actual miles apart?

F. 120
G. 60
H. 30
J. 24
K. 12

7. Caden had exactly 45 plants to sell. After Day 1 of his sale, he had exactly 42 plants left. After Day 2, Caden had exactly 39 plants left. After Day 3, he has exactly 36 plants left. Assuming Caden will continue to sell plants at that daily rate, how many of these plants will he have left at the end of Day 6 ?

A. 33
B. 27
C. 24
D. 6
E. 3

8. An on-demand movie service charges $5 per month, plus $2 for each movie rented. Which of the following equations models the relationship between M, the number of movies rented per month, and T, the total monthly cost, in dollars, for the service?

F. $M = 5 + 2T$
G. $M = 2 + 5T$
H. $T = 5 + 2M$
J. $T = 2 + 5M$
K. $T = (5 + 2)M$

9. What are the solutions to the quadratic equation $(2x + 5)(3x - 4) = 0$?

A. -5 and 4

B. $-\frac{5}{2}$ and $-\frac{4}{3}$

C. $-\frac{5}{2}$ and $\frac{4}{3}$

D. $\frac{5}{2}$ and $-\frac{4}{3}$

E. $\frac{5}{2}$ and $\frac{4}{3}$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

10. An 8-inch-by-6-inch rectangle is cut along a diagonal to form 2 triangles. What is the area, in square inches, of each triangle?

   F. 7
   G. 12
   H. 14
   J. 24
   K. 48

11. In a class of tenth graders, no student participated in more than 1 of the following extracurricular activities: $\frac{2}{3}$ the class played in the band; $\frac{1}{6}$ sang in the chorus; $\frac{1}{10}$ played football; and $\frac{1}{60}$ played basketball. What fraction of the class did not participate in any 1 of these 4 activities?

   A. 0

   B. $\frac{1}{5,400}$

   C. $\frac{1}{20}$

   D. $\frac{74}{79}$

   E. $\frac{57}{60}$

12. What is the smallest integer greater than $\sqrt{61}$?

   F. 4
   G. 7
   H. 8
   J. 10
   K. 31

13. In $\triangle ABC$ shown below, $\sin C = \frac{2}{3}$ and the length of $\overline{AB}$ is 6 inches. What is the length, in inches, of $\overline{AC}$?

   A. $\sqrt{5}$
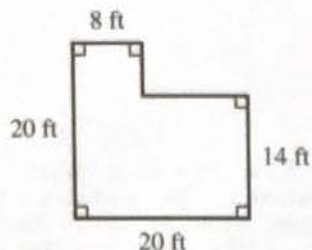   B. $\sqrt{13}$
   C. 4
   D. 5
   E. 9
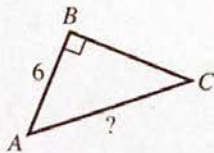
14. The table below shows the first 5 terms of an arithmetic sequence. Which of the following is a general expression for the nth term?

Term position (n)	nth term
1	1
2	5
3	9
4	13
5	17

F. $2n - 1$
G. $3n - 2$
H. $4n - 3$
J. $5n - 4$
K. $6n - 5$

15. What is the perimeter, in feet, of the figure shown below?

8 ft

20 ft

14 ft

20 ft

A. 60
B. 62
C. 70
D. 80
E. 84

16. Manuel estimates that $\frac{2}{3}$ of a pizza is left. Stephen estimates that $\frac{3}{4}$ is left. They are going to compromise for a joint estimate by using the number halfway between their 2 estimates. What is their joint estimate?

F. $\frac{17}{24}$

G. $\frac{5}{12}$

H. $\frac{5}{8}$

J. $\frac{5}{7}$

K. $\frac{1}{2}$

17. So far this basketball season, Sherita made 46 of her first 60 free throws, giving her a free-throw average of about 76.7%. What is the minimum number of free throws she would need to make from now on in order to have a free-throw average of at least 80% ?

A. 2
B. 3
C. 10
D. 14
E. 20

18. Two functions are defined as $f(x) = 2x - 1$ and $g(x) = x^2 + 1$. Which of the following expressions represents $f(g(x))$?

F. $x^2 + 2x$

G. $2x^2 + 1$

H. $2x^2 + 2$

J. $4x^2$

K. $4x^2 - 4x + 2$

DO YOUR FIGURING HERE.

19. Data Set A consists of the 8 numbers listed below. Data Set B consists of the 8 numbers in A and a 9th number, which is greater than 90. How will the mean and the median of B compare to the mean and the median of A ?

$$62, 76, 76, 80, 82, 87, 94, 96$$

A. The mean and the median of B will each be greater than the mean and the median of A.

B. The mean and the median of B will each be less than the mean and the median of A.

C. The mean and the median of B will each be the same as the mean and the median of A.

D. The mean of B will be the same as the mean of A, and the median of B will be greater than the median of A.

E. The mean of B will be greater than the mean of A, and the median of B will be the same as the median of A.

20. A truck traveling at 35 mph has a leaky radiator that is losing 4 fluid ounces per minute. How many *miles* will the truck travel before the radiator, which held 480 fluid ounces when it began to leak, is empty?

F. 13.7

G. 17.5

H. 35.0

J. 70.0

K. 120.0

21. In the standard (x,y) coordinate plane, what is the midpoint of the line segment that has endpoints $(-5,8)$ and $(3,-1)$?

A. $(-2, -9)$

B. $\left(-1, \frac{7}{2}\right)$

C. $\left(\frac{3}{2}, 1\right)$

D. $\left(4, -\frac{9}{2}\right)$

E. $(8, -9)$

18

GO ON TO THE NEXT PAGE.

22. The ordered pairs (x, y) in one of the following tables belong to a linear function. Which one?

F.

x	y
0	1
1	0
2	1
3	0

J.

x	y
0	0
1	0
2	0
3	1

G.

x	y
0	2
1	1
2	1
3	0

K.

x	y
0	0
1	1
2	4
3	9

H.

x	y
0	3
1	2
2	1
3	0

23. In $\triangle ABC$ shown below, $m\angle A = x°$, $m\angle B = (2x)°$, $m\angle C = (3x)°$, $AB = c$ inches, $AC = b$ inches, and $BC = a$ inches. Which of the following inequalities correctly relates the side lengths of $\triangle ABC$?

(Note: $m\angle A$ denotes the measure of $\angle A$, and AB denotes the length of $\overline{AB}$. The triangle is NOT drawn to scale.)
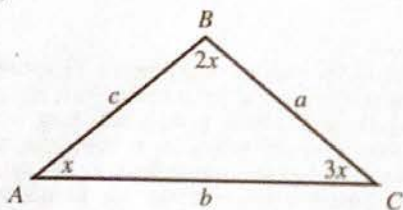
- **A.** $a < b < c$
- **B.** $a < c < b$
- **C.** $b < a < c$
- **D.** $c < a < b$
- **E.** $c < b < a$

24. What is the slope of the line that passes through $(1,5)$ and $(17,7)$ in the standard (x,y) coordinate plane?

- **F.** $\frac{1}{8}$
- **G.** $\frac{2}{3}$
- **H.** $\frac{3}{2}$
- **J.** $\frac{5}{2}$
- **K.** 8

25. The perimeter of a particular rectangle is 36 centimeters. The longer sides of the rectangle are each 2 centimeters longer than each of the shorter sides of the rectangle. What is the length, in centimeters, of one of the longer sides of this rectangle?

- A. 8
- B. 9
- C. 10
- D. 18
- E. 32

Use the following information to answer questions 26–28.

Winter Fun Ski Resort sells only 2 types of tickets—adult and student. On Monday, the resort sold 200 tickets, 1 ticket to each skier. Of those tickets, 25 were sold to first-time skiers. When Alyssa skis the resort's main run, her elevation, E feet, at any point on the run is modeled by the equation $E = \frac{300,000}{t + 100}$ where t is the number of seconds after she begins skiing at the start of the main run.

26. The resort collected a total of $6,000 in ticket sales on Monday. The price of an adult ticket is $50 and the price of a student ticket is $25. How many adult and student tickets were sold on Monday?

	adult	student
F.	40	160
G.	80	120
H.	100	100
J.	120	80
K.	160	40

27. On Monday, the resort sold 1 ticket to each of the 8 members of the Herzog family. Assume this family is a representative sample of all of the skiers at the resort on Monday. How many of the 8 members of the Herzog family are NOT first-time skiers?

- A. 1
- B. 2
- C. 4
- D. 6
- E. 7

28. What is Alyssa's elevation, in feet, at the start of the main run?

- F. 30
- G. 300
- H. 3,000
- J. 30,000
- K. 300,000

2 △ △ △ △ △ △ △ △ △ 2

29. One side of square *ABCD* has a length of 18 meters. A certain rectangle whose area is equal to the area of *ABCD* has a width of 6 meters. What is the length, in meters, of the certain rectangle?

A. 18
B. 24
C. 27
D. 30
E. 54

30. The 2×2 matrices A and B below are related to matrix C by the equation $C = 2A - 3B$. What is matrix C ?

$$A = \begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix} \quad B = \begin{bmatrix} -4 & 5 \\ 2 & 1 \end{bmatrix}$$

F. $\begin{bmatrix} 18 & -5 \\ -10 & -1 \end{bmatrix}$

G. $\begin{bmatrix} 13 & -10 \\ -8 & -2 \end{bmatrix}$

H. $\begin{bmatrix} 10 & 5 \\ -6 & 1 \end{bmatrix}$

J. $\begin{bmatrix} 6 & -1 \\ -5 & -1 \end{bmatrix}$

K. $\begin{bmatrix} -6 & 25 \\ 2 & 5 \end{bmatrix}$

31. Jen is doing an experiment to determine whether a high-protein food affects the ability of white mice to find their way through a maze. The mice in the experimental group were given the high-protein food; the mice in the control group were given regular food. Jen then timed the mice as they found their way through the maze. The table below shows the results.

Mouse number	Experimental group	Control group
1	1 min 46 sec	2 min 13 sec
2	2 min 2 sec	1 min 49 sec
3	2 min 20 sec	2 min 28 sec
4	1 min 51 sec	2 min 7 sec
5	1 min 41 sec	1 min 58 sec

The average time the mice in the experimental group took to find their way through the maze was how many seconds less than the average time taken by the mice in the control group?

A. 8
B. 11
C. 13
D. 16
E. 19

32. In the United States, phone numbers begin with a 3-digit area code. Now, there are restrictions on some of the digits, but in the future, as more and more area codes are needed, the restrictions may need to be lifted. If, and when, there are no restrictions and each of the 3 digits can be any integer from 0 through 9, how many area codes will be possible?

F. 27
G. 30
H. 720
J. 729
K. 1,000

33. The function $y = 2 \sin(8\pi x)$ is graphed in the standard (x,y) coordinate plane below. How many x-intercepts does the graph of this function have on the interval $0 < x < 1$?
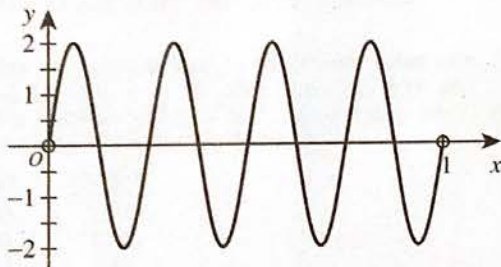
A. 2
B. 4
C. 7
D. 8
E. 9

34. If both x and $\left(\frac{x}{3} + \frac{x}{7} + \frac{x}{9}\right)$ are positive integers, what is the least possible value of x?
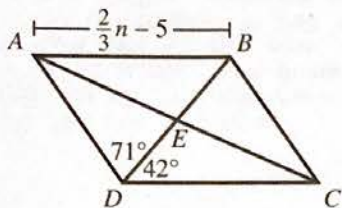
F. 21
G. 27
H. 36
J. 63
K. 189

DO YOUR FIGURING HERE.

Use the following information to answer questions 35–38.

In parallelogram *ABCD* shown below, the diagonals intersect at *E*, $m\angle BDC = 42°$, $m\angle BDA = 71°$, and $AB = \left(\frac{2}{3}n - 5\right)$ inches.

(Note: The figure is NOT drawn to scale; $m\angle PQR$ denotes the measure of $\angle PQR$.)

35. What is $m\angle BAD$?
- **A.** 23°
- **B.** 42°
- **C.** 48°
- **D.** 67°
- **E.** 71°

36. Given that $DC = \left(\frac{1}{3}n + 7\right)$ inches, what is the value of *n* ?
- **F.** 2
- **G.** 4
- **H.** 6
- **J.** 12
- **K.** 36

37. Suppose *A* and *C* are located at (2,10) and (30,3), respectively, in the standard (*x*,*y*) coordinate plane. What are the coordinates of *E* ?
- **A.** $\left(-\frac{7}{2}, 14\right)$
- **B.** $\left(\frac{13}{2}, 16\right)$
- **C.** $\left(14, -\frac{7}{2}\right)$
- **D.** $\left(14, \frac{7}{2}\right)$
- **E.** $\left(16, \frac{13}{2}\right)$

**38.** Which of the following triangles is congruent to $\triangle ABE$?
- **F.** $\triangle ADC$
- **G.** $\triangle AED$
- **H.** $\triangle BCE$
- **J.** $\triangle BCD$
- **K.** $\triangle CDE$

39. Which of the following expressions is equal to $(a + \sqrt{b})(a - 2\sqrt{b})$ for all positive real numbers a and b ?

   A. $a^2 - 3a\sqrt{b}$
   B. $a^2 - a\sqrt{b} - 2b$
   C. $a^2 - a\sqrt{b} - 2\sqrt{2b}$
   D. $a^2 - 3a\sqrt{b} - 2b$
   E. $a^2 + 3a\sqrt{b} - 2b$

40. The track for a model railroad display is set up as 2 circles that are tangent to one another and have diameters of 30 feet and 50 feet, respectively, as shown below. The engine of the train travels at a constant rate of 75 feet per minute. To the nearest minute, how many minutes does the engine take to go in a figure 8 pattern around the entire track exactly 1 time?
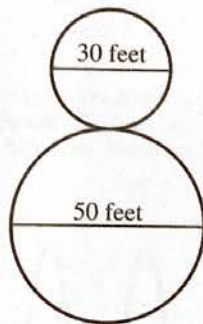
   F. 1
   G. 2
   H. 3
   J. 4
   K. 7

41. $\left(\frac{4}{5}\right)^{-\frac{3}{2}} = ?$

   A. $\frac{5}{2}$

   B. $\frac{5\sqrt{5}}{8}$

   C. $\frac{4\sqrt{2}}{5}$

   D. $\frac{\sqrt{5}}{2}$

   E. $-\frac{6}{5}$

42. What is the value of the positive real number x such that $\log_x\left(\frac{1}{25}\right) = -2$?

   F. 5

   G. 50

   H. $\frac{1}{50}$

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

   K. $\frac{25}{2}$

43. The points $(-4,-5)$, $(0,-3)$, and $(6,0)$ lie on a line in the standard (x,y) coordinate plane. Which of the following points also lies on that line?

    A. $(-3,-4)$
    B. $(-1,-4)$
    C. $(1,-2)$
    D. $(4,-1)$
    E. $(9, 1)$

44. Rya and Sampath start running laps from the same starting line at the same time and in the same direction on a certain indoor track. Rya completes one lap in 16 seconds, and Sampath completes the same lap in 28 seconds. Both continue running at their same respective rates and in the same direction for 10 minutes. What is the fewest number of seconds after starting that Rya and Sampath will again be at their starting line at the same time?

    F. 88
    G. 112
    H. 120
    J. 220
    K. 448

45. The CFO of Math King Enterprises estimates that if the company sets a price of c cents for each unit of their new product, then the weekly profit from selling the product will be modeled by $p(c) = 1,600c - 4c^2$, where $0 \le c \le 400$. According to this model, for which of the following values of c will the weekly profit for this product be the largest?

    A. 20
    B. 40
    C. 100
    D. 200
    E. 400

46. Given consecutive positive integers a, b, c, and d such that $a < b < c < d$, which of the following expressions has the greatest value?

    F. $\dfrac{a}{b}$

    G. $\dfrac{b}{c}$

    H. $\dfrac{c}{d}$

    J. $\dfrac{a+b}{b+c}$

    K. $\dfrac{b+c}{c+d}$

47. The ratio of the perimeters of two squares is 2:3. If the area of the larger square is 324 square feet, what is the length, in feet, of the side of the smaller square?

    A. 12
    B. 18
   C. 24
    D. 27
    E. 36

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

ACT-C01

48. What is the set of all integer solutions for the inequality $-1 \le x - \sqrt{5} < 4$?

F. $\{3, 4, 5\}$
G. $\{2, 3, 4, 5, 6\}$
H. $\{2, 3, 4, 5\}$
J. $\{1, 2, 3, 4, 5, 6\}$
K. $\{1, 2, 3, 4, 5\}$

49. Wind blowing against a flat surface exerts a maximum force equal to kSv^2, where S is the area of the surface, v is the wind's velocity, and k is a constant. If a 40 mile-per-hour (mph) wind can exert a maximum force of 50 pounds on a 1-square-foot flat surface, what is the maximum force, in pounds, that an 80 mph wind can exert on a 2-square-foot flat surface?

A. 100
B. 128
C. 200
D. 400
E. 1,600

50. Roger will pour concrete to make a sidewalk with the dimensions, in feet, shown in the figure below. He will pour the concrete to a depth of 4 *inches*. One bag of concrete mix makes 0.6 cubic feet of concrete. What is the least whole number of bags of concrete mix that Roger needs in order to make the sidewalk?
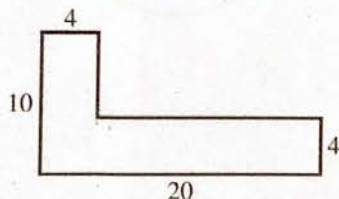
F. 16
G. 44
H. 50
J. 58
K. 67

51. Radius $\overline{OA}$ of the circle shown below is perpendicular to $\overline{AP}$. The circle intersects $\overline{OP}$ at B. The length of $\overline{AP}$ is 12 centimeters, and the measure of $\angle APO$ is 20°. Which of the following values is closest to the length, in centimeters, of $\overline{BP}$?
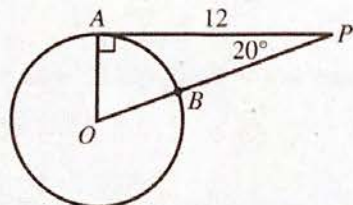
(Note: $\sin 20° \approx 0.342$, $\cos 20° \approx 0.940$, and $\tan 20° \approx 0.364$)

A. 2.1
B. 4.4
C. 6.9
D. 7.6
E. 8.4

52. The average of 10 test scores is x. When the highest score and lowest score are removed from the 10 scores, the average is y. Which of the following is an expression for the average of the highest score and lowest score?

F. $10x - 8y$

G. $\dfrac{x+y}{2}$

H. $\dfrac{10x + 8y}{2}$

J. $\dfrac{10x - 8y}{2}$

K. $\dfrac{10x + 8y}{18}$

DO YOUR FIGURING HERE.

53. Which of the following is the solution set of $27^{n^2} = 9^{5n-4}$?

A. $\left\{-4, \dfrac{2}{3}\right\}$

B. $\left\{-1, \dfrac{8}{3}\right\}$

C. $\left\{-\dfrac{2}{3}, 4\right\}$

D. $\{1, 4\}$

E. $\left\{\dfrac{4}{3}, 2\right\}$

54. Each face of 2 cubes with faces numbered from 1 through 6 has a $\dfrac{1}{6}$ chance of landing up when the 2 cubes are tossed. What is the probability that the sum of the numbers on the faces landing up will be less than 6 ?

F. $\dfrac{5}{36}$

G. $\dfrac{5}{18}$

H. $\dfrac{5}{13}$

J. $\dfrac{5}{12}$

K. $\dfrac{13}{36}$

GO ON TO THE NEXT PAGE.

55. At 2:00 p.m., Louisa leaves Kansas City in her car traveling east on I-70 toward St. Louis at an average speed of 68 mph. At precisely the same time, Antonio leaves St. Louis in his car traveling west on I-70 toward Kansas City at an average speed of 57 mph. The driving distance from St. Louis to Kansas City is 240 miles. At what time, to the nearest minute, will they drive past each other on I-70 ?

   A. 3:46 p.m.
   B. 3:50 p.m.
   C. 3:53 p.m.
   D. 3:55 p.m.
   E. 4:06 p.m.

56. There are 10 points in a plane, and no 3 of the points are collinear. These 10 points, taken 2 points at a time, determine how many distinct lines?

   F. 10
   G. 20
   H. 35
   J. 45
   K. 90

57. The expression $n!$ (read as n *factorial*) is defined as the product of all positive integers up to and including n, whenever n is a positive integer. For example, $4! = 1 \cdot 2 \cdot 3 \cdot 4$. Whenever n is a positive integer, which of the following is equivalent to $\dfrac{(n+1)!6!}{n!3!}$?

   A. $120(n+1)$

   B. 120

   C. 2

   D. $\dfrac{2(n+1)}{n}$

   E. $\dfrac{(6n+6)!}{(3n)!}$

58. Which of the following *must* be true for each set of 4 consecutive positive integers?

   I. At least 1 of the 4 integers is prime.
   II. At least 2 of the 4 integers have a common prime factor.
   III. At least 1 of the 4 integers is a factor of at least 1 of the 3 other integers.

   F. I only
   G. II only
   H. I and III only
   J. II and III only
   K. I, II, and III

DO YOUR FIGURING HERE.

59. When $(x + 1)^4$ is expanded and like terms are combined, what is the coefficient of x^2 ?

    A. 0
    B. 1
    C. 2
    D. 4
    E. 6

DO YOUR FIGURING HERE.

60. A hill makes an angle of 20° with the horizontal, $\overrightarrow{AD}$, as shown below. A taut guy wire, $\overline{AB}$, extends from the base of the hill, point A, to point B on a vertical pole. Point B is 25 ft directly above where the pole is inserted into the ground at point C. Given that the length of $\overline{AC}$ is 60 ft, which of the following expressions represents the length, in feet, of the guy wire?

(Note: For a triangle with sides of length a, b, and c that are opposite angles $\angle A$, $\angle B$, and $\angle C$, respectively, $\dfrac{\sin \angle A}{a} = \dfrac{\sin \angle B}{b} = \dfrac{\sin \angle C}{c}$ and $c^2 = a^2 + b^2 - 2ab \cos \angle C$.)
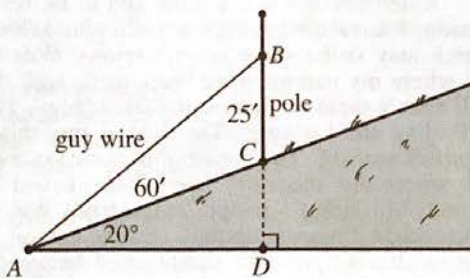
    F. $\dfrac{25 \sin 60°}{\sin 20°}$

    G. $\dfrac{25 \sin 70°}{\sin 20°}$

    H. $\dfrac{25 \sin 110°}{\sin 20°}$

    J. $\sqrt{60^2 + 25^2 - 2(60)(25) \cos 70°}$

    K. $\sqrt{60^2 + 25^2 - 2(60)(25) \cos 110°}$

END OF TEST 2

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

DO NOT RETURN TO THE PREVIOUS TEST.

SCIENCE TEST

35 Minutes—40 Questions

DIRECTIONS: There are several 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

The termite *Reticulitermes flavipes* consumes wood and bark. A study examined whether the consumption of wood or bark mulch by *R. flavipes* varies with the type of mulch or the age of the mulch. Separate portions of each of 5 types of mulch were aged (allowed to decay) for 1, 24, and 48 weeks. Then, 2 g of each type of 1-week-old mulch were put into a box, 2 g of each type of 24-week-old mulch were put into a second box, and 2 g of each type of 48-week-old mulch were put into a third box. Next, 1 g of *R. flavipes* was added to each box. After 15 days, the mass of mulch consumed, in milligrams (mg), was determined for each type and age of mulch (see figure).
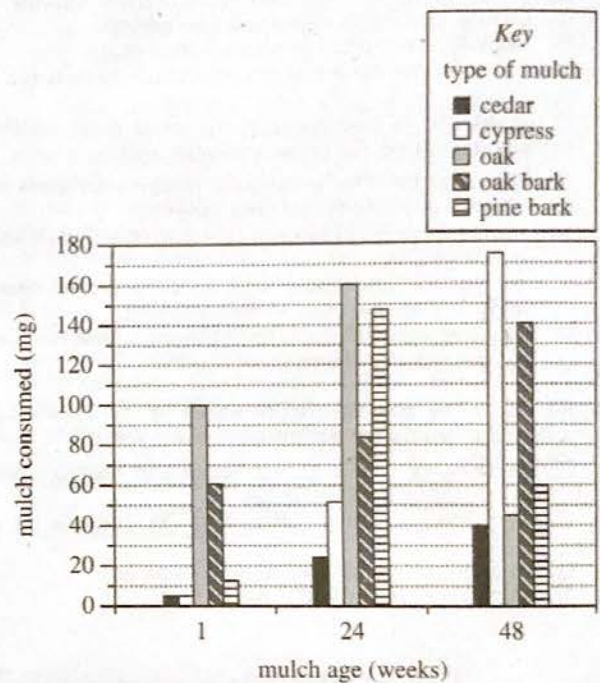

Figure adapted from O. P. Pinzon, R. M. Houseman, and C. J. Starbuck, "Feeding, Weight Change, Survival, and Aggregation of *Reticulitermes flavipes* (Kollar) (Isoptera: Rhinotermitidae) in Seven Varieties of Differentially-Aged Mulch." ©2006 by the Horticultural Research Institute.

1. Of the following combinations of type of mulch and mulch age, which combination resulted in the greatest mass of mulch consumed by *R. flavipes* ?

	type of mulch	mulch age
A.	oak	24 weeks
B.	pine bark	24 weeks
C.	oak	48 weeks
D.	pine bark	48 weeks

2. Which of the following statements about the effect of mulch age on the consumption of mulch by *R. flavipes* is consistent with the figure? As mulch age increased from 1 week through 48 weeks, the mass of mulch consumed by *R. flavipes*:

F. decreased for all 5 types of mulch.
G. increased for all 5 types of mulch.
H. initially decreased for all 5 types of mulch, but then increased for some of the 5 types of mulch.
J. initially increased for all 5 types of mulch, but then decreased for some of the 5 types of mulch.

3. Based on the passage, would *R. flavipes* be classified as an autotroph or as a detritivore, and why?

A. Autotroph, because *R. flavipes* produces its own energy without consuming organic material.
B. Autotroph, because *R. flavipes* obtains its energy by consuming decaying organic material.
C. Detritivore, because *R. flavipes* produces its own energy without consuming organic material.
D. Detritivore, because *R. flavipes* obtains its energy by consuming decaying organic material.

4. Based on the passage, is the primary food source of *R. flavipes* more likely cellulose or cholesterol?

F. Cellulose; *R. flavipes* consumes the cell membranes of animal cells, and the cell membranes of animal cells contain cellulose.
G. Cellulose; *R. flavipes* consumes the cell walls of plant cells, and the cell walls of plant cells consist primarily of cellulose.
H. Cholesterol; *R. flavipes* consumes the cell membranes of animal cells, and the cell membranes of animal cells contain cholesterol.
J. Cholesterol; *R. flavipes* consumes the cell walls of plant cells, and the cell walls of plant cells consist primarily of cholesterol.

5. Which of the following statements comparing the consumption by *R. flavipes* of 1-week-old oak mulch, 24-week-old oak mulch, and 48-week-old oak mulch is supported by the figure?

A. More 1-week-old mulch was consumed than 24-week-old mulch, and more 24-week-old mulch was consumed than 48-week-old mulch.
B. Less 1-week-old mulch was consumed than 24-week-old mulch, and less 24-week-old mulch was consumed than 48-week-old mulch.
C. More 1-week-old mulch was consumed than 24-week-old mulch, and less 24-week-old mulch was consumed than 48-week-old mulch.
D. Less 1-week-old mulch was consumed than 24-week-old mulch, and more 24-week-old mulch was consumed than 48-week-old mulch.

6. What mass, in *grams* (NOT milligrams), of the 48-week-old oak bark mulch was consumed by *R. flavipes* ?

F. 0.06 g
G. 0.14 g
H. 0.6 g
J. 1.4 g

Passage II

Samples of Species C bacteria must often be transported from the areas in which they are collected. During transport, the samples are typically packed in ice to keep them alive. However, ice is not always available where the samples are collected.

Scientists studied how *lyophilization* (a freeze-drying process that doesn't require ice) followed by incubation affects the survival of 2 strains (Strain E and Strain V2) of Species C bacteria.

Experiment 1

The scientists placed a 100 μL (1 μL = 10^{-3} mL) sample of a nutrient medium containing 4×10^6 Strain E elementary bodies into each of 8 sterile test tubes. An *elementary body* is the infective form of Species C. The sample in each of the tubes was then lyophilized, and each tube was sealed. Two of the tubes were incubated at 4°C, 2 were incubated at 20°C, 2 were incubated at 30°C, and 2 were incubated at 37°C.

One week after the start of incubation, the *percent survival* (the percent of the elementary bodies that survived) was determined for the sample in 1 of the 2 tubes at each temperature. Then, 1 month after the start of incubation, the percent survival was determined for the sample in the remaining tube at each temperature. The results are shown in Table 1.

Table 1			
Strain	Incubation temperature (°C)	Percent (%) survival at:	
		1 week	1 month
E	4	52	51
	20	69	42
	30	5	4
	37	0	0

Experiment 2

The scientists repeated Experiment 1, except with Strain V2 instead of Strain E. The results are shown in Table 2.

Table 2			
Strain	Incubation temperature (°C)	Percent (%) survival at:	
		1 week	1 month
V2	4	59	6
	20	29	4
	30	2	2
	37	0	0

Tables adapted from Adrian Eley et al., "Effect of Storage Temperature on Survival of *Chlamydia trachomatis* after Lyophilization." ©2006 by American Society for Microbiology.

7. Which of the following statements describes a difference between Experiment 1 and Experiment 2 ?

   A. A different incubation temperature was tested in Experiment 1 than in Experiment 2.
   B. A different strain of Species C was tested in Experiment 1 than in Experiment 2.
   C. Samples in Experiment 1 were lyophilized before being transported, whereas samples in Experiment 2 were transported on ice.
   D. Samples in Experiment 1 were incubated for 1 week before being transported, whereas samples in Experiment 2 were incubated for 1 month before being transported.

8. Suppose that in Experiment 2 the scientists had determined the percent survival for a sample incubated at 25°C for 1 week. The percent survival of the Strain V2 elementary bodies in the sample would most likely have been:

   F. 0%.
   G. between 2% and 29%.
   H. between 29% and 59%.
   J. greater than 59%.

9. At which 2 temperatures was the percent survival of Strain V2 elementary bodies less for the longer incubation time than for the shorter incubation time?

   A. 4°C and 20°C
   B. 4°C and 37°C
   C. 20°C and 30°C
   D. 20°C and 37°C

10. Which of the following questions was NOT addressed by the experiments?

    F. Does incubation time affect the percent survival of Strain E and Strain V2 elementary bodies after lyophilization?
    G. Does temperature affect the percent survival of Strain E and Strain V2 elementary bodies after lyophilization?
    H. Does the number of Strain E or Strain V2 elementary bodies present in a sample before lyophilization affect their percent survival?
    J. Do Strain E elementary bodies have a greater percent survival than Strain V2 elementary bodies after lyophilization and incubation?

11. One week after the start of incubation, which of the 4 samples of Strain V2 elementary bodies would have been *least* likely to infect another organism that came into contact with the samples?

    A. The sample that had been incubated at 4°C
    B. The sample that had been incubated at 10°C
    C. The sample that had been incubated at 20°C
    D. The sample that had been incubated at 37°C

12. Suppose that a scientist wants to transport a lyophilized sample of Strain E elementary bodies. Based on the results of Experiment 1, which of the following combinations of temperature and transportation time would most likely ensure the greatest percent survival of the elementary bodies?

    F. 4°C and 1 week
    G. 4°C and 1 month
    H. 20°C and 1 week
    J. 20°C and 1 month
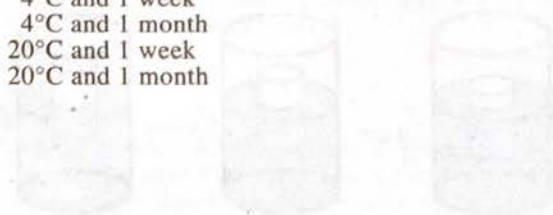
13. Consider the rating system in the table below for the percent survival of elementary bodies after lyophilization.

Rating	Percent survival
Excellent	> 90%
Good	≥ 30% and ≤ 90%
Poor	< 30%

Based on this table, what is the total number of tubes in Experiment 1 that contained samples having a poor percent survival?

    A. 2
    B. 4
    C. 6
    D. 8

Passage III

When an object is submerged in a fluid, the object displaces a volume of fluid equal to the object's submerged volume. The fluid exerts an upward *buoyant force* on the object that is equal in magnitude to the weight of the displaced fluid. The object floats if the buoyant force equals the object's weight.

A group of students conducted 2 studies on buoyant forces using 3 fluids—water, Fluid A, and Fluid B—having densities of 1.0 g/cm^3, 1.25 g/cm^3, and 1.50 g/cm^3, respectively.

Study 1

The students placed a 10 cm long cylinder in a container of water and measured the length of the portion of the cylinder that was submerged. They then repeated this procedure with a container of Fluid A and a container of Fluid B (see Figure 1).

7.4 cm   5.9 cm   4.9 cm

water   Fluid A   Fluid B
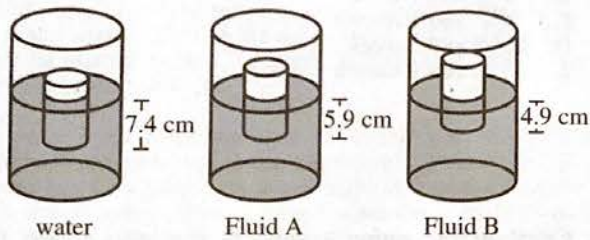
Figure 1

Study 2

The students placed a stone—either Stone X, Stone Y, or Stone Z—in a net that was tied to a spring balance. They recorded the force measured by the balance as the stone's weight, W. They then submerged the stone in water and again recorded the force measured by the balance (see Figure 2).
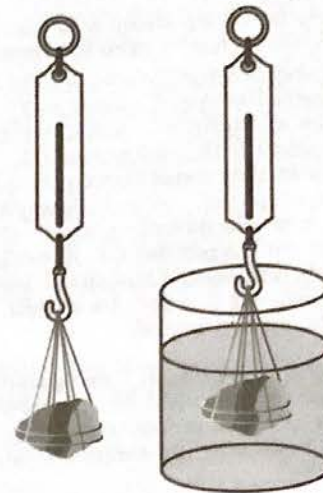
Figure 2

The students calculated the buoyant force on the stone in water as W minus the force that was measured when the stone was submerged. They repeated this procedure to test all 3 stones in all 3 fluids. Table 1 lists each stone's volume, in cm^3, and W, in newtons (N), as well as the buoyant force, in N, on each stone in the fluid.

			Table 1		
	Volume	W	Buoyant force (N) in:		
Stone	(cm^3)	(N)	water	Fluid A	Fluid B
X	48	1.50	0.47	0.59	0.70
Y	96	1.50	0.94	1.18	1.41
Z	96	3.00	0.94	1.18	1.41

14. Based on the results of Study 2, as the density of the fluid in which Stone X was submerged increased, the buoyant force on Stone X:

F. decreased only.
G. increased only.
H. decreased and then increased.
J. varied with no general trend.

15. Based on the results of Study 2, for Stone Y, what was the difference between the buoyant force in Fluid A and the buoyant force in Fluid B ?

A. 0.11 N
B. 0.23 N
C. 0.47 N
D. 0.71 N

16. Suppose the students decide to study whether a cylinder's volume determines the submerged length of the cylinder in a given fluid. Which of the following procedural changes should the students make to Study 1 ? The students should test:

F. a single cylinder with multiple fluids; the fluids should each have the same density as the cylinder.
G. a single cylinder with multiple fluids; the fluids should have different densities.
H. multiple cylinders with a single fluid; the cylinders should have different volumes but the same density.
J. multiple cylinders with a single fluid; the cylinders should have different weights but the same volume.

17. In Study 1, did the cylinder displace a greater volume of water or a greater volume of Fluid A ?

A. Water, because the cylinder's submerged length was greater in water than in Fluid A.
B. Water, because the cylinder's submerged length was greater in Fluid A than in water.
C. Fluid A, because the cylinder's submerged length was greater in water than in Fluid A.
D. Fluid A, because the cylinder's submerged length was greater in Fluid A than in water.

18. Suppose that in Study 1 the students had placed the cylinder in a container of fluid having a density of 1.60 g/cm^3. The submerged length of the cylinder would most likely have been:

F. less than 4.9 cm.
G. between 4.9 cm and 5.9 cm.
H. between 5.9 cm and 7.4 cm.
J. greater than 7.4 cm.

19. Suppose that in Study 2 the students had tested a stone having the same weight as Stone Z but a larger volume than Stone Z. Which of the following statements about the buoyant force on this submerged stone would be correct? The buoyant force on this stone in:

A. water would have been less than 0.94 N.
B. Fluid A would have been less than 1.18 N.
C. Fluid B would have been greater than 1.41 N.
D. water would have been greater than the buoyant force on this stone in Fluid A.

20. Assume that Atlantic Ocean water has a density of 1.01 g/cm^3 and that Pacific Ocean water has a density of 1.03 g/cm^3. Based on the results of Study 1, in which ocean would a given iceberg more likely have the greater submerged volume?

F. The Atlantic Ocean, because the results of Study 1 indicate that submerged volume increases as fluid density decreases.
G. The Atlantic Ocean, because the results of Study 1 indicate that submerged volume decreases as fluid density decreases.
H. The Pacific Ocean, because the results of Study 1 indicate that submerged volume increases as fluid density decreases.
J. The Pacific Ocean, because the results of Study 1 indicate that submerged volume decreases as fluid density decreases.

GO ON TO THE NEXT PAGE.

Passage IV

Chemical reactions that release heat are *exothermic* reactions. The amount of heat released depends on the number of moles of reactants consumed in the reaction. A *mole* of any substance is 6×10^{23} molecules or formula units of the substance.

When sodium hypochlorite (NaClO) and sodium iodide (NaI) are dissolved in acidic H_2O, an exothermic reaction occurs:

$$NaClO + NaI \rightarrow products + heat$$
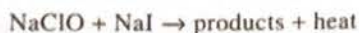
Students did an experiment to study this reaction.

Experiment

In each of 8 trials, the students performed Steps 1–5:

1. A known volume of a 0.2 mole/L aqueous NaClO solution was poured into a foam coffee cup. A lid was placed on the cup.

2. A thermometer was placed into the solution through a hole in the lid. The solution's initial temperature, T_i, of 22.0°C was recorded.

3. The lid was lifted, and a known volume of a 0.2 mole/L aqueous NaI solution, also at a T_i of 22.0°C, was poured into the cup. The lid was put back on the cup, and the solution was swirled.

4. The solution's final (maximum) temperature, T_f, was measured.

5. The change in temperature, ΔT, was calculated:

$$\Delta T = T_f - T_i$$

The data for each trial are shown in Table 1.

Table 1

Trial	Volume of NaClO solution (mL)	Volume of NaI solution (mL)	T_f (°C)	ΔT (°C)
1	0	100	22.0	0.0
2	25	75	25.5	3.5
3	50	50	29.0	7.0
4	70	30	31.7	9.7
5	75	25	32.5	10.5
6	80	20	30.6	8.6
7	90	10	26.2	4.2
8	100	0	22.0	0.0

The students plotted ΔT versus the volume of NaClO solution for each trial (see Figure 1).
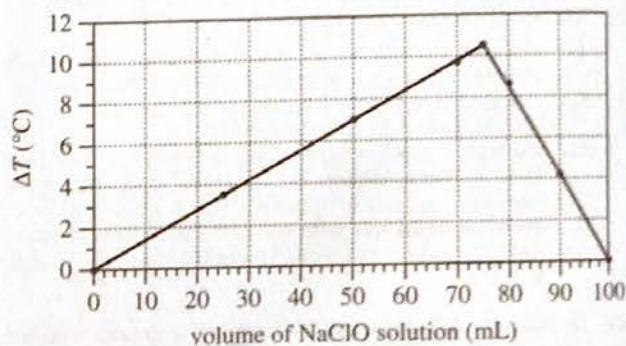

Figure 1

Table and figure adapted from M. Jerome Bigelow, "Thermochemistry of Hypochlorite Oxidations." ©1969 by Division of Chemical Education, Inc., American Chemical Society.

Then they identified the trial for which ΔT had its greatest value. The ratio of the volume of the NaClO solution to the volume of the NaI solution for this trial is the *mole ratio* for the reaction.

44

21. If a trial had been performed with 60 mL of NaClO solution and 40 mL of NaI solution, T_f would most likely have been:

   A. less than 25.5°C.
   B. between 25.5°C and 29.0°C.
   C. between 29.0°C and 31.7°C.
   D. greater than 31.7°C.

22. Before the experiment, a student predicted that ΔT for Trial 2 would be greater than ΔT for Trial 6. Do the results shown in Table 1 support this prediction?

   F. No; ΔT for Trial 2 was 5.1°C less than ΔT for Trial 6.
   G. No; ΔT for Trial 2 was 8.6°C less than ΔT for Trial 6.
   H. Yes; ΔT for Trial 2 was 5.1°C greater than ΔT for Trial 6.
   J. Yes; ΔT for Trial 2 was 8.6°C greater than ΔT for Trial 6.

23. In each trial, the *total* volume of solution poured into the cup was:

   A. 25 mL.
   B. 50 mL.
   C. 75 mL.
   D. 100 mL.

24. Consider the trial for which the volume of NaClO was 4 times as great as the volume of NaI. For this trial, T_f was:

   F. 25.5°C.
   G. 26.2°C.
   H. 30.6°C.
   J. 32.5°C.

25. Suppose a trial had been performed with 20 mL of NaClO solution and 80 mL of NaI solution. Based on Figure 1, ΔT for this new trial would most likely have been closest to which of the following?

   A. 1°C
   B. 3°C
   C. 5°C
   D. 7°C

26. Which of the following statements best explains why ΔT was 0.0°C for Trial 8 ? The volume of solution added was 0 mL for one of the:

   F. products, NaClO, so no reaction had occurred.
   G. products, NaI, so no reaction had occurred.
   H. reactants, NaClO, so no reaction had occurred.
   J. reactants, NaI, so no reaction had occurred.

27. Suppose that the reaction studied had been *endothermic*. As the endothermic reaction progressed, would the solution temperature more likely have decreased or increased?

   A. Decreased, because the reaction would have released heat.
   B. Decreased, because the reaction would have absorbed heat.
   C. Increased, because the reaction would have released heat.
   D. Increased, because the reaction would have absorbed heat.

Passage V

When rocks are melted at very high temperatures beneath Earth's surface, *magma* (molten rock) is formed. The gases CO_2 and H_2O can dissolve in magma. Figure 1 shows, for 4 different magmas (leucitite, basanite, rhyolite, and tholeiitic basalt), how the solubility of CO_2 in the magma at 1,150°C varies with pressure (in megapascals, MPa).
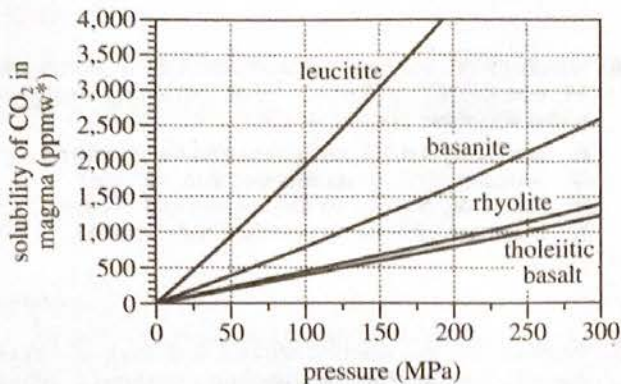
*parts per million by weight

Figure 1

Figure 2 shows, at 3 different pressures, how the solubility of CO_2 in rhyolite magma varies with temperature.
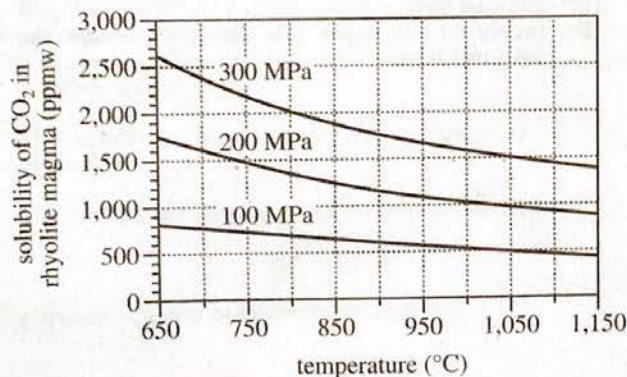
Figure 2

Figure 2 adapted from Robert A. Fogel and Malcolm J. Rutherford, "The Solubility of Carbon Dioxide in Rhyolitic Melts: A Quantitative FTIR Study." ©1990 by the Mineralogical Society of America.

Figure 3 shows, at 4 different pressures, how the solubility of CO_2 in rhyolite magma at 750°C varies with the weight percent of H_2O in the magma.
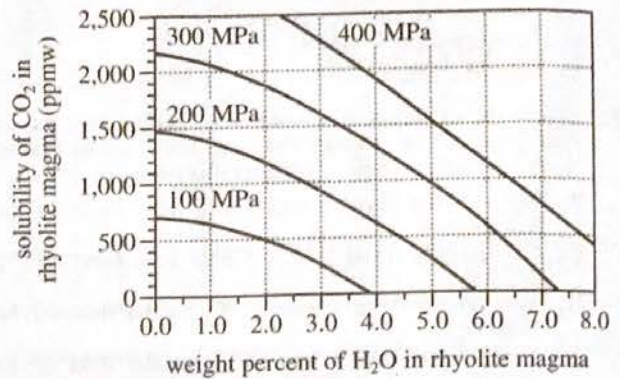
Figure 3

Figures 1 and 3 adapted from Jacob B. Lowenstern, "Carbon Dioxide in Magmas and Implications for Hydrothermal Systems." ©2001 by Springer-Verlag.

28. According to Figure 2, at 300 MPa, the solubility of CO_2 in rhyolite magma is closest to 2,000 ppmw at which of the following temperatures?

   F. 700°C
   G. 750°C
   H. 800°C
   J. 850°C

29. Based on Figure 3, at 750°C and 350 MPa, rhyolite magma having a solubility of CO_2 equal to 1,250 ppmw would most likely have a weight percent of H_2O that is:

   A. less than 2.0%.
   B. between 2.0% and 4.0%.
   C. between 4.0% and 6.0%.
   D. greater than 6.0%.

46

GO ON TO THE NEXT PAGE.

30. According to Figure 1, at 1,150°C, the solubility of CO_2 in basanite magma and the solubility of CO_2 in tholeiitic basalt magma are closest in value at which of the following pairs of pressures?

	basanite magma	tholeiitic basalt magma
F.	50 MPa	200 MPa
G.	50 MPa	250 MPa
H.	125 MPa	200 MPa
J.	125 MPa	250 MPa

31. Based on Figure 1, at 1,150°C and 150 MPa, the solubility of CO_2 in leucitite magma is approximately how much greater than or less than the solubility of CO_2 in rhyolite magma?

A. 1,750 ppmw greater
B. 2,300 ppmw greater
C. 1,750 ppmw less
D. 2,300 ppmw less

32. According to Figure 2, increasing the temperature from 650°C to 1,150°C has the *lesser* effect on the solubility of CO_2 in rhyolite magma at which pressure, 100 MPa or 300 MPa ?

F. 100 MPa; the solubility of CO_2 decreases by about 400 ppmw.
G. 100 MPa; the solubility of CO_2 decreases by about 1,300 ppmw.
H. 300 MPa; the solubility of CO_2 decreases by about 400 ppmw.
J. 300 MPa; the solubility of CO_2 decreases by about 1,300 ppmw.

33. Consider the solubility of CO_2 in rhyolite magma at 750°C and 200 MPa, as shown in Figure 2. According to Figure 3, this rhyolite magma has a weight percent of H_2O closest to which of the following?

A. 0.0%
B. 2.0%
C. 4.0%
D. 6.0%
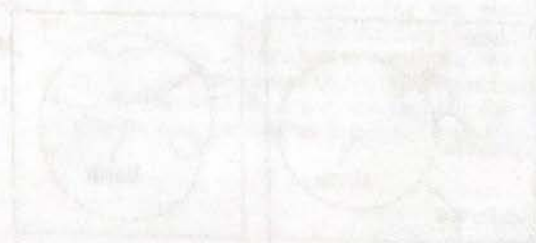
Passage VI

When viewed from Earth, the other planets in the solar system usually appear to move *prograde* (eastward relative to the stars). Occasionally, however, each planet appears to briefly move *retrograde* (westward relative to the stars). For example, Figure 1 shows Mars's position relative to the stars on 9 dates between July 24, 2005, and February 26, 2006.
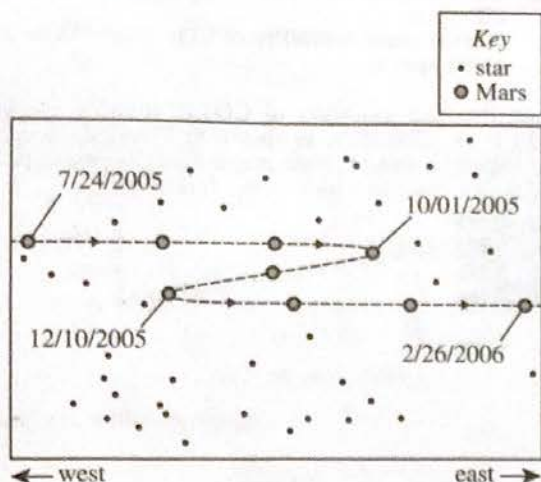
Figure 1

Two hypotheses were proposed to explain why the planets occasionally appear to move retrograde.

Hypothesis 1

Earth is the solar system's central body, and the other bodies move around Earth in looped orbits. Each body (except Earth) has 2 circles associated with it: a *deferent* and an *epicycle*. Both circles rotate counterclockwise, and their combined motions result in a body following a looped orbit. In Figure 2, the left panel shows Mars's deferent and epicycle, and the right panel shows Mars's orbit.
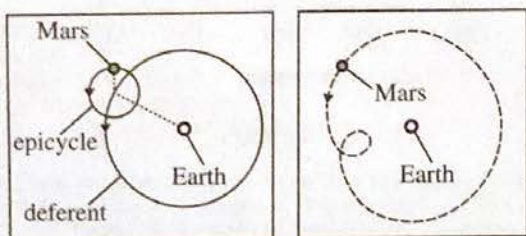
Figure 2

As a body passes through a loop, the body's motion changes from prograde to retrograde and back. The larger a body's deferent, the more loops in the body's orbit, and the more often that body passes through a loop.

Hypothesis 2

The Sun is the solar system's central body, and the planets move counterclockwise around the Sun in elliptical orbits. The larger a planet's orbit, the more time the planet takes to complete a revolution around the Sun. As a result, the line of sight from Earth to a given planet drifts over time. Figure 3 shows the orbits of Earth and Mars, and the positions of Earth and Mars, on each of the 4 dates labeled in Figure 1. For each date, the line of sight from Earth to Mars is projected onto a view of the sky.

There are 2 rules for apparent retrograde motion:

- A planet with an orbit larger than Earth's appears to move retrograde whenever Earth passes between the Sun and that planet. The larger that planet's orbit, the more often a pass occurs.

- A planet with an orbit smaller than Earth's appears to move retrograde whenever that planet passes between the Sun and Earth. The *smaller* that planet's orbit, the more often a pass occurs.
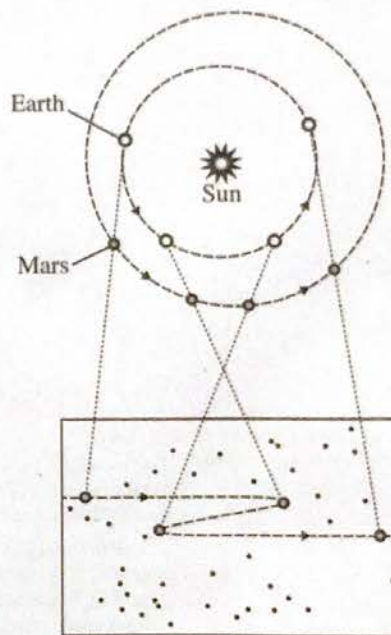
Figure 3

34. Which of the following statements best describes a primary difference between the two hypotheses? Hypothesis 1 claims that all planets follow:

F. looped orbits around Earth, whereas Hypothesis 2 claims that all planets follow elliptical orbits around the Sun.
G. looped orbits around Earth, whereas Hypothesis 2 claims that all planets follow elliptical orbits around Earth.
H. elliptical orbits around the Sun, whereas Hypothesis 2 claims that all planets follow looped orbits around the Sun.
J. elliptical orbits around the Sun, whereas Hypothesis 2 claims that all planets follow looped orbits around Earth.

35. Assume that Figures 2 and 3 are drawn to scale. Which of the figures, if either, implies that the distance between Earth and Mars varies with time?

A. Figure 2 only
B. Figure 3 only
C. Both Figure 2 and Figure 3
D. Neither Figure 2 nor Figure 3

36. Consider both the interval of time represented in Figures 1 and 3 and the reason that, according to Hypothesis 2, the line of sight from Earth to Mars drifts over time. Is the top portion of Figure 3 consistent with that reason?

F. Yes; Earth is shown as having the smaller orbit and as having completed a greater percentage of its revolution around the Sun than is Mars.
G. Yes; Earth is shown as having the larger orbit and as having completed a greater percentage of its revolution around the Sun than is Mars.
H. No; Earth is shown as having the smaller orbit and as having completed a greater percentage of its revolution around the Sun than is Mars.
J. No; Earth is shown as having the larger orbit and as having completed a greater percentage of its revolution around the Sun than is Mars.

37. Based on Figure 1, as viewed from Earth, for approximately how many days between July 2005 and February 2006 did Mars move retrograde?

A. 30
B. 70
C. 150
D. 220

38. A supporter of Hypothesis 1 and a supporter of Hypothesis 2 would both be likely to agree with which of the following statements? When viewed from Earth, if a planet appears to be moving prograde, that planet is actually moving:

F. clockwise around Earth.
G. clockwise around the central body in the solar system.
H. counterclockwise around the Sun.
J. counterclockwise around the central body in the solar system.

39. Based on Figures 1 and 3, if Hypothesis 2 is correct, which of the following figures most likely shows the positions of Earth and Mars on November 7, 2005 ?
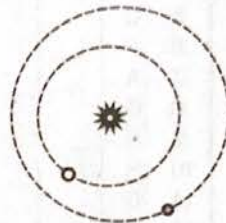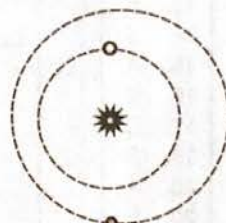
40. Can Hypothesis 2 explain why Venus occasionally appears to move retrograde?

F. Yes; Hypothesis 2 accounts for the motion of planets that are closer to the Sun than Earth is.
G. Yes; Hypothesis 2 accounts for the motion of planets that are farther from the Sun than Earth is.
H. No; Hypothesis 2 does not account for the motion of planets that are closer to the Sun than Earth is.
J. No; Hypothesis 2 does not account for the motion of planets that are farther from the Sun than Earth is.

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.

Scoring Keys for Form C01

Use the scoring key for each test to score your answer document for the multiple-choice tests. Mark a "1" in the blank for each question you answered correctly. Add up the numbers in each reporting category and enter the total number correct for each reporting category in the blanks provided. Also enter the total number correct for each test in the blanks provided. The total number correct for each test is the sum of the number correct in each reporting category.

Test 1: English—Scoring Key

*Reporting Categories
POW = Production of Writing
KLA = Knowledge of Language
CSE = Conventions of Standard English

	Key	POW	KLA	CSE		Key	POW	KLA	CSE
1.	C			—	39.	C			—
2.	H			—	40.	F			—
3.	B		—		41.	A	—		
4.	H			—	42.	F			—
5.	C			—	43.	B		—	
6.	F	—			44.	F	—		
7.	A	—			45.	C	—		
8.	G	—			46.	F			—
9.	A	—			47.	A		—	
10.	H			—	48.	F	—		
11.	D			—	49.	B			—
12.	G			—	50.	G			—
13.	B			—	51.	D			—
14.	J		—		52.	J			—
15.	A	—			53.	A			—
16.	J			—	54.	G	—		
17.	C			—	55.	D			—
18.	F	—			56.	J	—		
19.	A		—		57.	C	—		
20.	F	—			58.	J	—		
21.	B			—	59.	B			—
22.	J			—	60.	H	—		
23.	B			—	61.	D			—
24.	H			—	62.	F			—
25.	A	—			63.	C	—		
26.	J			—	64.	H			—
27.	A		—		65.	D			—
28.	H		—		66.	G		—	
29.	D			—	67.	A		—	
30.	G			—	68.	J		—	
31.	D		—		69.	D			—
32.	G			—	70.	J		—	
33.	B			—	71.	B			—
34.	J			—	72.	H			—
35.	D				73.	A			—
36.	G				74.	H			—
37.	C	—			75.	B	—		
38.	F			—					

Number Correct (Raw Score) for:	
Production of Writing (POW)	_____ (23)
Knowledge of Language (KLA)	_____ (12)
Conventions of Standard English (CSE)	_____ (40)
Total Number Correct for English Test (POW + KLA + CSE)	_____ (75)

Test 2: Mathematics—Scoring Key

	Key	N	A	F	G	S	IES	MDL
1.	E				—			
2.	H							—
3.	B						—	—
4.	J	—						
5.	A							
6.	F						—	—
7.	B						—	
8.	H		—					—
9.	C		—					
10.	J						—	
11.	C						—	
12.	H	—						
13.	E				—			
14.	H			—				
15.	D						—	
16.	F						—	
17.	C					—		—
18.	G			—			—	
19.	A					—		
20.	J						—	—
21.	B				—			
22.	H			—				
23.	A						—	
24.	F	—						
25.	C						—	
26.	F		—					
27.	E						—	—
28.	H						—	—
29.	E						—	
30.	F	—						

	Key	N	A	F	G	S	IES	MDL
31.	B					—		—
32.	K					—		—
33.	C				—			
34.	J		—					—
35.	D				—			
36.	K		—					
37.	E				—			
38.	K				—			
39.	B	—						
40.	H						—	—
41.	B	—						
42.	F				—			
43.	D				—			—
44.	G						—	—
45.	D				—			
46.	H						—	—
47.	A						—	
48.	G	—						
49.	D						—	—
50.	J						—	—
51.	E				—			
52.	J					—		
53.	E		—					
54.	G						—	—
55.	D						—	—
56.	J					—		—
57.	A						—	
58.	G						—	
59.	E	—						
60.	K				—			—

Combine the totals of these columns and put in the blank for PHM in the box below.

*Reporting Categories
PHM = Preparing for Higher Math
  N = Number & Quantity
  A = Algebra
  F = Functions
  G = Geometry
  S = Statistics & Probability
IES = Integrating Essential Skills
MDL = Modeling

Number Correct (Raw Score) for:	
Preparing for Higher Math (PHM) (N + A + F + G + S)	____ (35)
Integrating Essential Skills (IES)	____ (25)
Total Number Correct for Mathematics Test (PHM + IES)	____ (60)
Modeling (MDL) (Not included in total number correct for mathematics test raw score)	____ (24)

Test 3: Reading—Scoring Key

	Key	KID	CS	IKI
1.	D	—		
2.	J	—		
3.	C	—		
4.	H	—		
5.	B		—	
6.	H		—	
7.	A		—	
8.	F			—
9.	D			—
10.	F			—
11.	B	—		
12.	F	—		
13.	B	—		
14.	F	—		
15.	A	—		
16.	H	—		
17.	D			—
18.	J	—		
19.	C	—		
20.	J	—		

	Key	KID	CS	IKI
21.	C			—
22.	G		—	
23.	B		—	
24.	H		—	
25.	D	—		
26.	G	—		
27.	A	—		
28.	F	—		
29.	B	—		
30.	F		—	
31.	B		—	
32.	F			—
33.	D		—	
34.	H	—		
35.	B		—	
36.	H	—		
37.	A	—		
38.	F	—		
39.	C			—
40.	J	—		

*Reporting Categories
KID = Key Ideas & Details
CS = Craft & Structure
IKI = Integration of Knowledge & Ideas

Number Correct (Raw Score) for:	
Key Ideas & Details (KID)	(23)
Craft & Structure (CS)	(11)
Integration of Knowledge & Ideas (IKI)	(6)
Total Number Correct for Reading Test (KID + CS + IKI)	(40)

Test 4: Science—Scoring Key

	Key	IOD	SIN	EMI
1.	A	—		
2.	J	—		
3.	D	—		
4.	G	—		
5.	D			—
6.	G	—		
7.	B		—	
8.	G		—	
9.	A	—		
10.	H		—	
11.	D			—
12.	H			—
13.	B	—		
14.	G	—		
15.	B	—		
16.	H		—	
17.	A			—
18.	F		—	
19.	C		—	
20.	F			—

	Key	IOD	SIN	EMI
21.	C		—	
22.	F			—
23.	D		—	
24.	H	—		
25.	B		—	
26.	J	—		
27.	B			—
28.	H	—		
29.	C	—		
30.	J	—		
31.	B	—		
32.	F	—		
33.	A	—		
34.	F			—
35.	C			—
36.	F			—
37.	B			—
38.	J			—
39.	B			—
40.	F			—

*Reporting Categories
IOD = Interpretation of Data
SIN = Scientific Investigation
EMI = Evaluation of Models, Inferences & Experimental Results

Number Correct (Raw Score) for:	
Interpretation of Data (IOD)	(16)
Scientific Investigation (SIN)	(10)
Evaluation of Models, Inferences & Experimental Results (EMI)	(14)
Total Number Correct for Science Test (IOD + SIN + EMI)	(40)

Explanation of Procedures Used to Obtain
Scale Scores from Raw Scores

On each of the four tests on which you marked any responses, the total number of correct responses yields a raw score. Use the table below to convert your raw scores to scale scores. For each test, locate and circle your raw score or the range of raw scores that includes it in the table below. Then, read across to either outside column of the table and circle the scale score that corresponds to that raw score. As you determine your scale scores, enter them in the blanks provided on the right. The highest possible scale score for each test is 36. The lowest possible scale score for any test on which you marked any responses is 1.

Next, compute the Composite score by averaging the four scale scores. To do this, add your four scale scores and divide the sum by 4. If the resulting number ends in a fraction, round it off to the nearest whole number. (Round down any fraction less than one-half; round up any fraction that is one-half or more.) Enter this number in the blank. This is your Composite score. The highest possible Composite score is 36. The lowest possible Composite score is 1.

ACT Test C01   **Your Scale Score**

English   _____

Mathematics   _____

Reading   _____

Science   _____

Sum of scores   _____

Composite score (sum ÷ 4)   _____

NOTE: If you left a test completely blank and marked no items, do not list a scale score for that test. If any test was completely blank, do not calculate a Composite score.

Scale Score	Test 1 English	Test 2 Mathematics	Test 3 Reading	Test 4 Science	Scale Score
		Raw Scores			
36	73-75	58-60	39-40	39-40	36
35	70-72	56-57	38	38	35
34	69	54-55	37	—	34
33	68	52-53	36	37	33
32	67	51	35	36	32
31	66	50	—	—	31
30	65	48-49	34	35	30
29	64	46-47	33	34	29
28	62-63	44-45	32	33	28
27	61	41-43	31	32	27
26	59-60	38-40	30	31	26
25	57-58	36-37	29	29-30	25
24	54-56	34-35	28	27-28	24
23	51-53	32-33	26-27	25-26	23
22	49-50	30-31	25	23-24	22
21	46-48	29	24	21-22	21
20	43-45	28	22-23	19-20	20
19	41-42	26-27	21	18	19
18	40	24-25	20	16-17	18
17	38-39	21-23	18-19	14-15	17
16	35-37	18-20	17	13	16
15	31-34	14-17	15-16	12	15
14	29-30	11-13	14	10-11	14
13	27-28	9-10	12-13	9	13
12	24-26	7-8	11	8	12
11	21-23	6	9-10	7	11
10	18-20	5	8	6	10
9	16-17	4	7	5	9
8	13-15	3	6	4	8
7	11-12	—	5	—	7
6	9-10	2	4	3	6
5	7-8	—	3	2	5
4	5-6	1	2	—	4
3	4	—	2	1	3
2	2-3	—	1	—	2
1	0-1	0	0	0	1