Student Name:
School Name:
Teacher/Class:

Montana Comprehensive Assessment System (MontCAS CRT)

Grade 10
Common Released Items
Spring 2009

OPI

OFFICE OF PUBLIC INSTRUCTION

SECURE MATERIALS. MAY NOT BE DUPLICATED.

General Directions

This test contains nine sessions: three in reading, three in mathematics, and three in science. The sessions are made up of multiple-choice questions and questions for which you must show your work or write out your answers. Write your answers to all of the questions in your Student Response Booklet. For the reading parts of the test, read each selection before answering the questions.

For each multiple-choice question, choose the best answer. Fill in the bubble in your Student Response Booklet that corresponds to your answer choice for that question.

Some questions ask you to show your work or to write out your answers. Write your answers to these questions in the spaces provided in your Student Response Booklet. Your answers must fit in the spaces provided. Any part of an answer outside the box might not be scored.

Be sure to answer all parts of each question, and to answer completely. For example, if a question asks you to explain your reasoning or show your work, be sure to do so. You can receive points for a partially correct answer, so try to answer every question.

Reading
Session 1

No items released from this session in 2008/2009.

Please STOP. Do not go on to the next page.

Reading
Session 2

This test session includes a reading selection and multiple-choice questions. After you read the selection, answer the questions about it in the spaces provided in your Student Response Booklet. You may not use a dictionary or any other reference tool during this session.

Read this poem about the plant called goldenrod. Then answer the questions that follow.

Goldenrod*

On roadsides,
in fall fields,
in rumpy bunches,
saffron and orange and pale gold,

in little towers,
soft as mash,
sneeze-bringers and seed-bearers,
full of bees and yellow beads and perfect flowerlets

and orange butterflies.
I don't suppose
much notice comes of it, except for honey,
and how it heartens the heart with its

blank blaze.
I don't suppose anything loves it except, perhaps,
the rocky voids
filled by its dumb dazzle.

For myself,
I was just passing by, when the wind flared
and the blossoms rustled,
and the glittering pandemonium

leaned on me.
I was just minding my own business
when I found myself on their straw hillsides,
citron and butter-colored,

* goldenrod: a common weed

Please go on to the next page.

and was happy, and why not?
Are not the difficult labors of our lives
full of dark hours?
And what has consciousness come to anyway, so far,

that is better than these light-filled bodies?
All day
on their airy backbones
they toss in the wind,

they bend as though it was natural and godly to bend,
they rise in a stiff sweetness,
in the pure peace of giving
one's gold away.

—Mary Oliver

Mark your answers in the section marked "Reading—Session 2" in your Student Response Booklet.

Use the dictionary entry below to answer question 35.

void 1. *n* empty space: *The void in his heart could not be filled.* **2.** *adj* lacking use or basis: *Their void chatter bothered their classmates.* **3.** *adj* unsuccessful: *His void attempts did not fix things.* **4.** *v* to make without legal force or effect: *The contract was voided.*

35. Which definition of the word void is used in line 15?

A. definition 1
B. definition 2
C. definition 3
D. definition 4

36. What is the speaker **most likely** asking in lines 28 and 29 when she says "And what has consciousness come to anyway, so far, / that is better than these light-filled bodies?"

A. Can flowers attract attention?
B. Are plants aware of their surroundings?
C. Is humanity superior to nature?
D. What is the purpose of common weeds?

Please go on to the next page.

37. Lines 30 through 33 **mainly** suggest that the goldenrod is

A. crooked.
B. flexible.
C. fragile.
D. hollow.

38. Line 33, "they bend as though it was natural and godly to bend," **mainly** suggests that the

A. hillsides are softly curved.
B. goldenrod is resisting the wind.
C. hillsides are examples of the holiness of nature.
D. goldenrod is yielding to something greater than itself.

39. In lines 35 and 36, the words "in the pure peace of giving / one's gold away" **best** suggest that the goldenrod is

A. generous with its beauty.
B. overvalued as a flower.
C. helpless in the wind.
D. free from disturbances.

40. The poet would **most likely** agree that goldenrod is

A. endangered.
B. praiseworthy.
C. priceless.
D. unnoticeable.

41. Which would be the **best** way to find more poems written by Mary Oliver?

A. looking through recent issues of *Poetry* magazine
B. searching by author on www.poemhunter.com
C. searching for nature poetry in a library
D. scanning the index of the *Anthology of Women Poets*

Please STOP. Do not go on to the next page.

Reading
Session 3

This test session includes reading selections, multiple-choice questions, and a question for which you must write out your answer. After you read each selection, answer the questions about it in the spaces provided in your Student Response Booklet. You may not use a dictionary or any other reference tool during this session.

Read Linda Hogan's memoir about her wild horse, Mystery. Then answer the questions that follow.

Mystery

Linda Hogan

I look out my window and see the wild horse. Mystery is her name, even her nature, but I usually call this Bureau of Land Management wild mustang Misty, for short. She stands in the red and gold of autumn leaves beside my older horse. She is sturdy, rock-solid. A wild horse, she is different from the other horses, who were bred for certain traits. Her eyes are set more broadly across, in order to see dangers and farther distances. Her lung capacity is stronger. She lives on less food than the other horses, and has hooves, as the Navajo say of their horses, made of agate.

Her black face is solid and it is haunting. She is so like earth that the large old trees standing nearby seem fragile. She matches the land. Blue roan* in color, she changes according to the season. At times her coat is snow, at other times the color of sky, earth, or shadows. Last winter she had longer belly hair, the red of water willows as they change toward spring.

2 Blending in is a desirable trait for an Indian horse. In the past, different kinds of horses were prized for their invisibility. Comanches and Apaches had great horsemanship and could ride unseen by a group of American soldiers by holding on and hanging their bodies on the other side of the horse, with only a hand visible.

For a long time out at the farm where I'd kept her, I watched Mystery stand and look at me with a slow, steady gaze, an occasional blink of the eyes. I tried to avoid her eyes. With them she seemed to claim me, but she belonged to another person, one who rarely came to visit. Occasionally I gave her carrots, placing them on the ground or in her feed so she did not think they came from my hand, so she wouldn't expect something from me.

Yet she began to grow on me. I had been trying not to love her, but failing. She was pregnant, and it wasn't long before I took out a folding chair, sat near the barn, and stayed around to watch the new foal move inside her, a turn, a light kick. Before long I knew, or felt, that she would, somehow, one day be living with me. So I began to brush her and feel her round, pregnant stomach.

I knew the owner hadn't paid the board on her, and I told the people who own the farm, Ted and Lori, that if her board was never paid, or if it happened that they would sell her, I'd pay it and buy her. The owners, as it happened, wanted her only for the foal, which they thought would be a black mustang. They called this Mystery ugly. But to me, she was most beautiful.

*roan: of a base color (as black, red, or brown) dulled and lightened by white hairs

Please go on to the next page.

I don't know if Mystery was like the Chickasaw ponies I'd heard of in our own history, but she greatly resembles a drawing of one of the ponies. Maybe it was because of this that we had an affinity for one another. When we walked together it was at the same pace and rhythm, as if we were the same animal.

Mark your answers in the section marked "Reading—Session 3" in your Student Response Booklet.

55. According to the memoir, Mystery's name refers to her

A. coat.
B. face.
C. personality.
D. swiftness.

56. According to the memoir, Mystery is **most** different from the other horses because she is a

A. Chickasaw horse.
B. lonely horse.
C. Navaho horse.
D. wild horse.

57. In paragraph 2, the sentence "She is so like earth that the large old trees standing nearby seem fragile" **best** suggests that Mystery is

A. beautiful.
B. strong.
C. threatening.
D. unpredictable.

58. In paragraph 2, the author includes the sentence "Last winter she had longer belly hair, the red of water willows as they change toward spring" **most likely** to

A. describe how Mystery's coat changes to match the seasons.
B. show that Mystery was pregnant.
C. show that Mystery is a typical mustang.
D. describe the predominant color in Mystery's blue roan coat.

59. The author suggests that Mystery would have been prized by the great Apache and Comanche riders of the past for her ability to

A. survive on little food.
B. run long distances.
C. blend in with the land.
D. see far ahead.

Please go on to the next page.

60. The author explains how she tried to avoid loving Mystery **most likely** to emphasize that the bond between them was

A. accidental.
B. favorable.
C. impractical.
D. inevitable.

61. The author **most likely** thinks Mystery is beautiful because Mystery is

A. about to have a baby.
B. a grateful, gentle horse.
C. a natural, native horse.
D. many different colors.

Please go on to the next page.

Read this article about a researcher's work with Kanzi, a bonobo ape who seems capable of communicating with humans. Then answer the questions that follow.

Speaking Bonobo

Paul Raffaele

Bonobos have an impressive vocabulary, especially when it comes to snacks.

To better understand bonobo intelligence, I traveled to Des Moines, Iowa, to meet Kanzi, a 26-year-old male bonobo reputedly able to converse with humans. When Kanzi was an infant, American psychologist Sue Savage-Rumbaugh tried to teach his mother, Matata, to communicate using a keyboard labeled with geometric symbols. Matata never really got the hang of it, but Kanzi—who usually played in the background, seemingly oblivious, during his mother's teaching sessions—picked up the language.

Savage-Rumbaugh and her colleagues kept adding symbols to Kanzi's keyboard and laminated sheets of paper. First Kanzi used 6 symbols, then 18, finally 348. The symbols refer to familiar objects (yogurt, key, tummy, bowl), favored activities (chase, tickle), and even some concepts considered fairly abstract (now, bad).

Kanzi learned to combine these symbols in regular ways, or in what linguists call "proto-grammar." Once, Savage-Rumbaugh says, on an outing in a forest by the Georgia State University laboratory where he was raised, Kanzi touched the symbols for "marshmallow" and "fire." Given matches and marshmallows, Kanzi snapped twigs for a fire, lit them with the matches, and toasted the marshmallows on a stick.

Savage-Rumbaugh claims that in addition to the symbols Kanzi uses, he knows the meaning of up to 3,000 spoken English words. She tests his comprehension in part by having someone in another room pronounce words that Kanzi hears through a set of headphones. Kanzi then points to the appropriate symbol on his keyboard. But Savage-Rumbaugh says Kanzi also understands words that aren't a part of his keyboard vocabulary; she says he can respond appropriately to commands such as "put the soap in the water" or "carry the TV outdoors."

About a year ago, Kanzi and his sister, mother, nephew, and four other bonobos moved into a $10 million, 18-room house and laboratory complex at the Great Ape Trust, North America's largest great ape sanctuary, five miles from downtown Des Moines. The bonobo compound boasts a 13,000-square-foot lab, drinking fountains, outdoor playgrounds, rooms linked by hydraulic doors that the animals operate themselves by pushing buttons, and a kitchen where they can use a microwave oven and get snacks from a vending machine (pressing the symbols for desired foods).

Kanzi and the other bonobos spend evenings sprawled on the floor, snacking on M&M's, blueberries, onions, and celery, as they watch DVDs they select by pressing buttons on a computer screen. Their favorites star apes and other creatures friendly with humans such as *Quest for Fire*, *Every Which Way But Loose*, *Greystoke: The Legend of Tarzan*, and *Babe*.

Through a glass panel, Savage-Rumbaugh asks Kanzi if it's OK for me to enter his enclosure. "The bonobos control who comes into their quarters," she explains. Kanzi, still the alpha male of this group in his middle age, has the mien of an aging patriarch—he's balding and paunchy with serious, deep-set eyes. Squealing apparent agreement, he pushes a button, and I walk inside. A wire barrier still separates us. "Kanzi can cause you serious damage if he wants," Savage-Rumbaugh adds.

Kanzi shows me his electronic lexigram touch pad, which is connected to a computer that displays—while a male voice speaks—the words

7

Please go on to the next page.

he selects. But Kanzi's finger slips off the keys. "We're trying to solve this problem," says Savage-Rumbaugh.

She and her colleagues have been testing the bonobos' ability to express their thoughts vocally, rather than by pushing buttons. In one experiment she described to me, she placed Kanzi and Panbanisha, his sister, in separate rooms where they could hear but not see each other. Through lexigrams, Savage-Rumbaugh explained to Kanzi that he would be given yogurt. He was then asked to communicate this information to Panbanisha. "Kanzi vocalized, then Panbanisha vocalized in return and selected 'yogurt' on the keyboard in front of her," Savage-Rumbaugh tells me.

With these and other ape-language experiments, says Savage-Rumbaugh, "The mythology of human
10 uniqueness is coming under challenge. If apes can learn language, which we once thought unique to humans, then it suggests that ability is not innate in just us."

But many linguists argue that these bonobos are simply very skilled at getting what they want, and that their abilities do not constitute language. "I
11 do not believe that there has ever been an example anywhere of a nonhuman expressing an opinion, or asking a question. Not ever," says Geoffrey Pullum, a linguist at the University of California at Santa Cruz. "It would be wonderful if animals could say things about the world, as opposed to just signaling a direct emotional state or need. But they just don't."

Whatever the dimension of Kanzi's abilities, he and I did manage to communicate. I'd told Savage-Rumbaugh about some of my adventures, and she invited me to perform a Maori war dance. I beat my chest, slapped my thighs, and hollered. The bonobos sat quiet and motionless for a few seconds, then all but Kanzi snapped into a frenzy, the noise deafening as they screamed, bared their teeth, and pounded on the walls and floor of their enclosure. Still calm, Kanzi waved an arm at Savage-Rumbaugh, as if asking her to come closer, then let loose with a stream of squeaks and squeals. "Kanzi says he knows you're not threatening them," Savage-Rumbaugh said to me, "and he'd like you to do it again just for him, in a room out back, so the others won't get upset."

I'm skeptical, but I follow the researcher through the complex, out of Kanzi's sight. I find him, all alone, standing behind protective bars. Seeing me, he slapped his chest and thighs, mimicking my war dance, as if inviting me to perform an encore. I obliged, of course, and Kanzi joined in with gusto.

Visit Smithsonian.com to see video of Kanzi.

Mark your answers in the section marked "Reading—Session 3" in your Student Response Booklet.

69. According to the article, why did the author want to meet Kanzi?

A. to learn more about how bonobos think
B. to disprove that bonobos can talk
C. to teach Kanzi some new words
D. to prove he can talk with Kanzi

70. In the first paragraph, the word reputedly means

A. secretly.
B. supposedly.
C. unimportantly.
D. unintelligibly.

Please go on to the next page.

71. What is Kanzi doing when he combines keyboard symbols into proto-grammar?

A. using symbols to spell new words
B. creating symbols to name unknown objects
C. choosing symbols to communicate an idea
D. rearranging symbols to ask questions

72. In paragraph 7, the word mien means

A. appearance.
B. personality.
C. sense.
D. size.

73. In paragraph 10, the word innate means

A. diverse.
B. inborn.
C. intense.
D. moral.

74. According to paragraph 11, what does the linguist Geoffrey Pullum believe about bonobos?

A. They ask too many questions.
B. They cannot express opinions.
C. They cannot signal needs.
D. They talk about the world.

75. In the last paragraph, what does Kanzi joining in "with gusto" **best** reveal about him?

A. Kanzi is making fun of the author.
B. Kanzi is feeling competitive.
C. Kanzi understands and wants to entertain.
D. Kanzi understands and wants to participate.

76. Where would the reader **most likely** find video of Kanzi?

A. in the *Des Moines Register*
B. in town animal registry files
C. at Georgia State University
D. at Smithsonian.com

77. Which statement from the article is an opinion?

A. "Savage-Rumbaugh and her colleagues kept adding symbols to Kanzi's keyboard and laminated sheets of paper."
B. "Kanzi learned to combine these symbols in regular ways, or in what linguists call 'proto-grammar.'"
C. "'Kanzi vocalized, then Panbanisha vocalized in return and selected "yogurt" on the keyboard in front of her,' Savage-Rumbaugh tells me."
D. "With these and other ape-language experiments, says Savage-Rumbaugh, 'The mythology of human uniqueness is coming under challenge.'"

Please go on to the next page.

78. Which statement would the author **most likely** agree with?

A. Only humans are able to communicate.
B. Humans and apes can communicate with one another.
C. Bonobos are the only apes that can communicate.
D. Only the bonobo Kanzi can communicate.

79. This article is **best** described as

A. a biographical essay.
B. an editorial.
C. an informational essay.
D. a memoir.

80. Which book would be **most** helpful in learning about proto-grammar?

A. *Using Symbols with Animals*
B. *Using Positive Reinforcement*
C. *How to House-Train an Ape*
D. *How to Solve Puzzles*

Write your answer in the space provided for it in your Student Response Booklet.

81. Explain the author's attitude toward the belief that bonobos can use language to communicate with humans. Use details from the article to support your answer.

Please STOP. Do not go on to the next page.

Mathematics
Session 1 (No Calculator)

This test session includes multiple-choice questions and questions for which you must show your work or write out your answers. You may NOT use a calculator during this session.

Mark your answers in the section marked "Mathematics—Session 1 (No Calculator)" in your Student Response Booklet.

10. What integer is closest to $3\sqrt{7}$?

    A. 4
    B. 6
    C. 8
    D. 10

12. The equation below relates the surface area, A, of a sphere to the radius, r, of the sphere.

    $$A = 4\pi r^2$$

    The radius of sphere P is 3 times the radius of sphere Q. How many times as great is the surface area of sphere P compared to the surface area of sphere Q?

    A. 6 times
    B. 9 times
    C. 27 times
    D. 36 times

13. Some scientists think Earth is about 4,300,000,000 years old. Which expression shows 4,300,000,000 written in scientific notation?

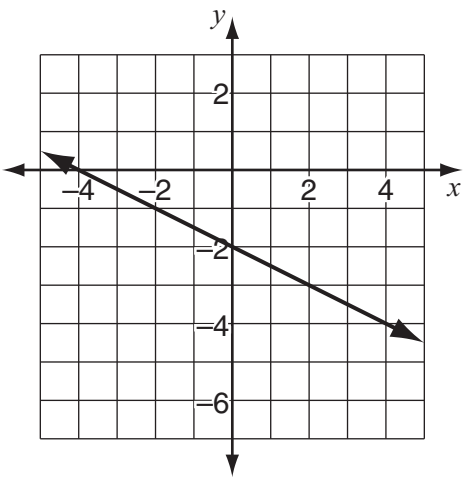
    A. 4.3×10^{10}
    B. 4.3×10^{9}
    C. 43×10^{8}
    D. 43×10^{6}

14. The lengths of the sides of a right triangle are 5 inches, 12 inches, and 13 inches. Which equation could be used to find the measure of the **smallest** angle in the triangle?

    A. $\sin x = \frac{5}{13}$
    B. $\sin x = \frac{12}{13}$
    C. $\tan x = \frac{5}{13}$
    D. $\tan x = \frac{12}{13}$

Please go on to the next page.

15. Which equation represents the graph below?



A. $y = -2x - 4$

B. $y = -2x - 2$

C. $y = -\frac{1}{2}x - 4$

D. $y = -\frac{1}{2}x - 2$

Write your answers in the spaces provided in your Student Response Booklet. Show all of your work.

18. Evaluate:

$4 + 6^2 \div 2 + 2$

19. Solve:

$4 - 5x = 20$

Please go on to the next page.

Write your answer in the space provided for it in your Student Response Booklet. Show all of your work.

23. Trash Gone garbage removal service provides a free garbage can and charges $20 a month to empty the can.

    a. Write an equation showing the relationship between the total fees charged, y, and the number of months, x, for Trash Gone garbage removal service.

    City Clean garbage removal service charges $30 for a garbage can and $18 a month to empty the can.

    b. Write an equation showing the relationship between the total fees charged, y, including the fee for the garbage can, and the number of months, x, for City Clean garbage removal service.

    c. After how many months will the total cost of Trash Gone be the same as the total cost of City Clean? Show or explain how you found your answer.

Please STOP. Do not go on to the next page.

Mathematics
Session 2 (Calculator)

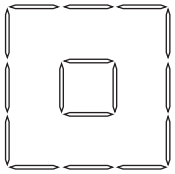
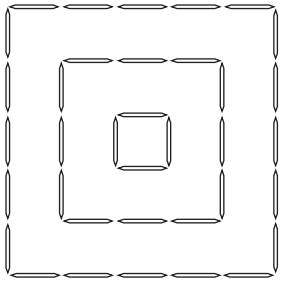
This test session includes multiple-choice questions. You may use a calculator during this session.

Mark your answers in the section marked "Mathematics—Session 2 (Calculator)" in your Student Response Booklet.

25. Last year the amount of rain in Fairview was 79% of the normal amount. The normal amount in a year is 12.2 inches. About how many inches of rain did Fairview have last year?

A. 15.4
B. 9.6
C. 6.5
D. 2.6

27. Ellen uses toothpicks to make this pattern.

Step	Figure	Number of Toothpicks
1		4
2		16
3		36

Ellen continues the pattern. How many toothpicks does she need for step 6?

A. 72
B. 96
C. 120
D. 144

Please go on to the next page.

28. A hockey player hits a hockey puck so it travels 40 feet in 0.25 second. What is the average speed of the puck to the nearest mile per hour?

A. 50 miles per hour

B. 109 miles per hour

C. 235 miles per hour

D. 800 miles per hour

30. The table below shows the results of the last 60 times Paul was at bat during baseball games.

Results of Paul's Turns At Bat

Outs	Singles	Doubles	Triples	Home Runs
36	12	10	2	0

Based on this information, what is the probability that Paul will hit a single, double, or triple during his next turn at bat?

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

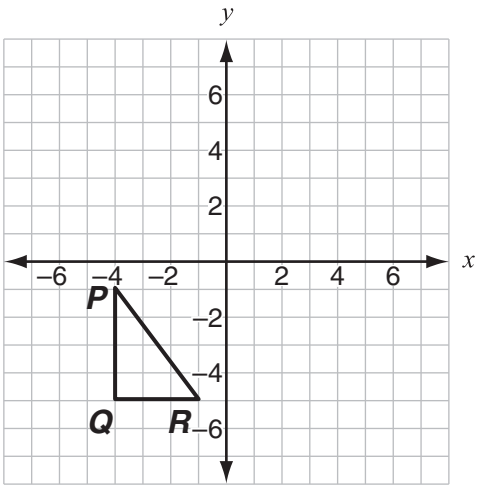
B. $\frac{1}{3}$

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

D. $\frac{3}{5}$

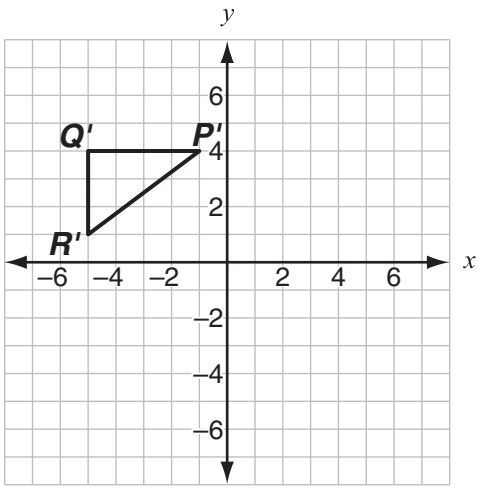
Please go on to the next page.

31. Study the triangle on the coordinate plane below.

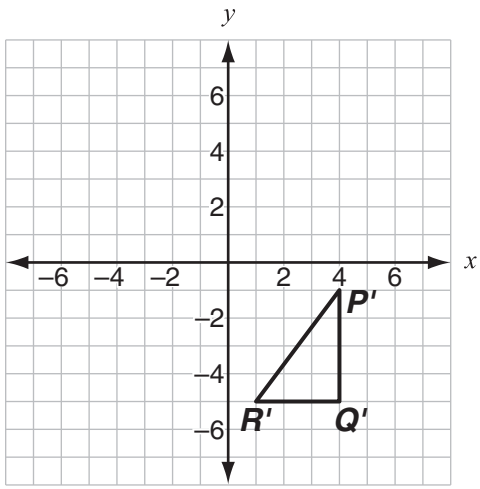


Which coordinate plane shows the image of $\triangle PQR$ after a 90° clockwise rotation about the origin?

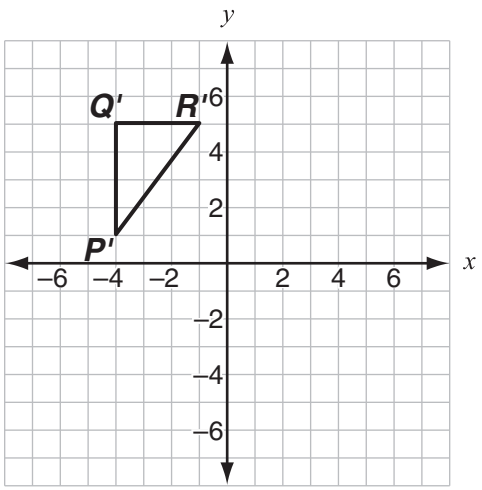
A.



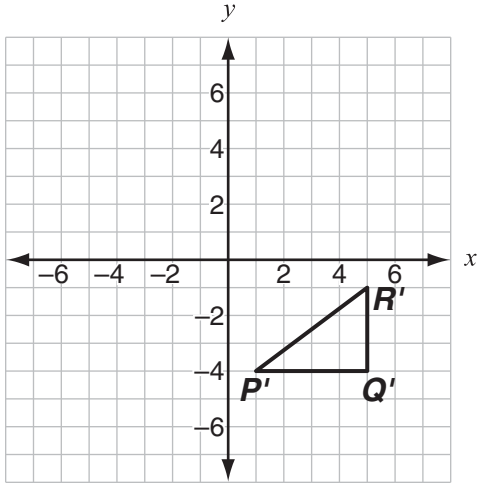
C.



B.



D.



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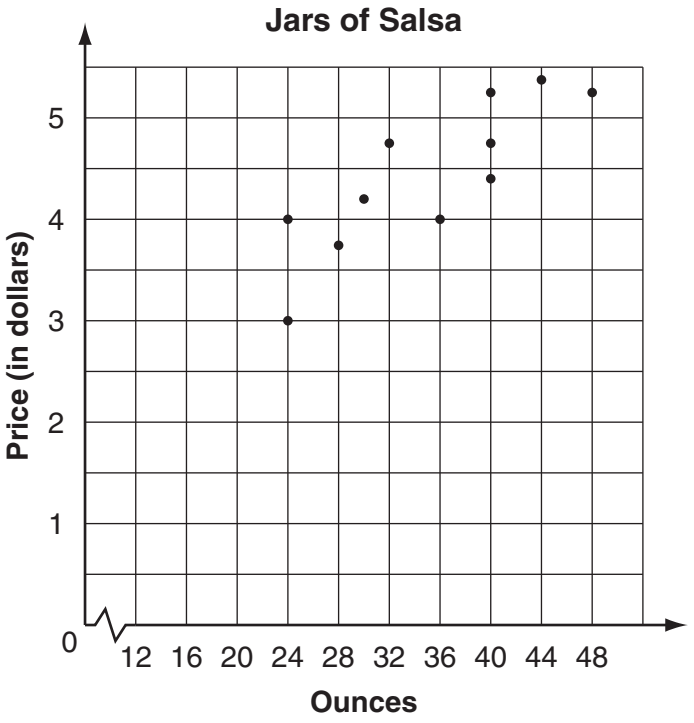
35. The scatter plot below shows the number of ounces in different jars of salsa and the price of each jar.



Based on this scatter plot, which is the **best** estimate for the price of a 16-ounce jar of salsa?

A. $1
B. $2
C. $3
D. $4

36. Triangle $R'S'T'$ is the image of triangle RST after a reflection over the x-axis. The coordinates of point T are (3, –5). What are the coordinates of point T'?

A. (3, 5)
B. (–5, 3)
C. (–3, –5)
D. (–5, –3)

Please go on to the next page.

43. Mr. Levy created a data set of the heights, in inches, of the 22 students in his math class.

- The mean of the data is 63.
- The median of the data is 64.
- The mode of the data is 62.
- The range of the data is 14.

Mr. Levy is 75 inches tall. If his height is included in the data set, which measure **must** change?

A. mean
B. median
C. mode
D. range

45. In a shipment of calculators, $\frac{1}{10}$ were chosen randomly.

- Of the chosen calculators, $\frac{2}{9}$ had defects.
- 8 of the chosen calculators had defects.

What is the total number of calculators in the shipment?

A. 36
B. 90
C. 360
D. 720

Please STOP. Do not go on to the next page.

Mathematics
Session 3 (Calculator)

This test session includes multiple-choice questions. You may use a calculator during this session.

Mark your answers in the section marked "Mathematics—Session 3 (Calculator)" in your Student Response Booklet.

49. Lily wants to know what percent of the students who drive to her school have taken a driver training class. Which group of students would be **best** for Lily to survey?

A. 50 random students who are in after-school activities

B. 50 random students who walk into the cafeteria one day

C. 50 random students on the attendance list in the office

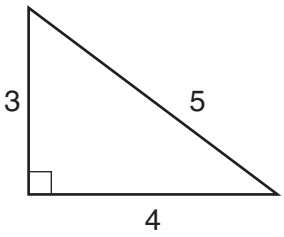
D. 50 random students who drive into the student parking lot one day

53. Read the statement below.

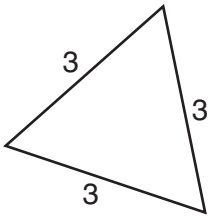
> All right triangles are scalene.

Which figure provides a counterexample to this statement?

A.



B.



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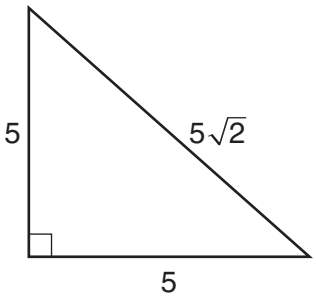

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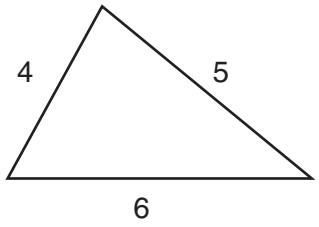

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56. Point L has the coordinates (–3, 5). Point N has the coordinates (1, –2). What are the coordinates of the midpoint of $\overline{LN}$?

A. $(2, -\frac{7}{2})$

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

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

D. $(-4, \frac{3}{2})$

58. The list below shows the prices of office chairs from a catalog with the outlier **removed**.

$85	$127	$99	$109
$112	$110	$89	$79
$89	$120	$135	$129

The range of these prices without the outlier is half the range of the prices with the outlier. Which price could be the missing outlier?

A. $112

B. $173

C. $191

D. $247

61. In which table do x and y have a non-linear relationship?

A.

x	y
2	10
4	7
6	4
8	1

B.

x	y
2	1
4	4
6	10
8	19

C.

x	y
2	10
4	10
6	10
8	10

D.

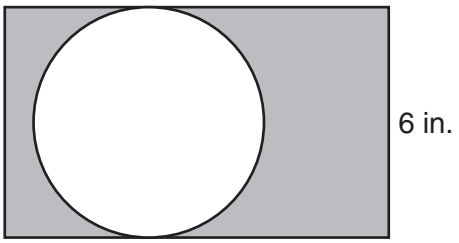
x	y
2	2
4	4
6	6
8	8

Please go on to the next page.

62. An object is traveling 90 miles per hour. How many **feet** does the object travel in 5 minutes?

A. 660 feet
B. 7,920 feet
C. 39,600 feet
D. 475,200 feet

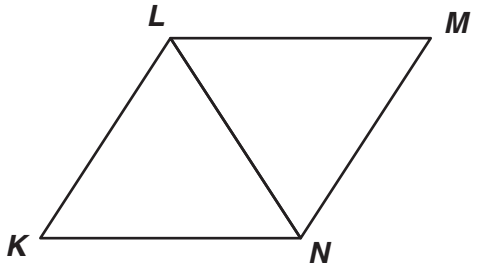
65. The figure below is a circle inside a rectangle.



What is the area, to the nearest square inch, of the shaded region of the figure?

A. 32 square inches
B. 41 square inches
C. 51 square inches
D. 88 square inches

66. Study the figure below.



$\angle K \cong \angle M$

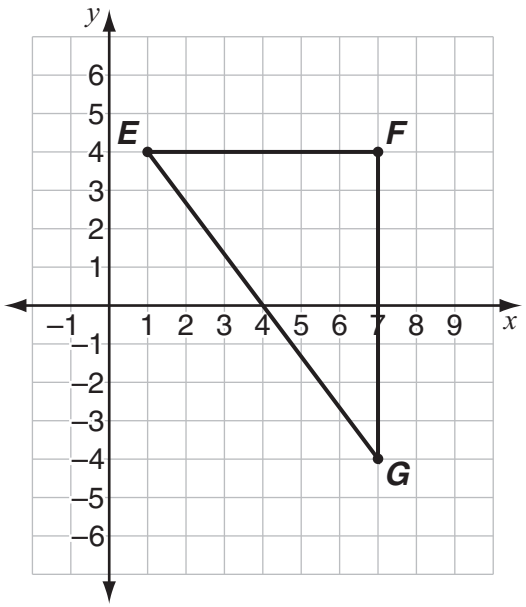
$\overline{LM} \parallel \overline{KN}$

Which theorem can be used to prove that $\Delta KLN \cong \Delta MNL$?

A. Side-Side-Side
B. Side-Side-Angle
C. Hypotenuse-Leg
D. Angle-Angle-Side

Please go on to the next page.

68. Study the triangle below.



Point H is on $\overline{EG}$ so that $\overline{FH}$ is perpendicular to $\overline{EG}$. What is the slope of $\overline{FH}$?

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

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

C. $-\frac{4}{3}$

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

69. There are 20 students in Mrs. Watson's math class. She will divide her class into 2 equal groups by the distance they live from school. Each student determines how far he or she lives from school, to the nearest tenth of a mile. No two students live the same distance from school. Which measure of this data can Mrs. Watson use to divide her class into 2 groups of 10 students?

A. mean

B. median

C. mode

D. range

70. The three-digit number below is **prime**.

14_?_

Which digit could be in the ones place?

A. 1

B. 5

C. 6

D. 9

Please STOP. Do not go on to the next page.

Science
Session 1

This test session includes multiple-choice questions and a question for which you must write out your answer. Be sure to answer all parts of the question.

Mark your answers in the section marked "Science—Session 1" in your Student Response Booklet.

1. The fossils of tropical plants and corals have been found in Antarctica. Which conclusion does this fossil evidence support?

   A. Earth's tilt has decreased over time.
   B. Ancient life adapted to cold and snowy climates.
   C. Fossils can be used to date the relative age of Earth.
   D. Earth's climate has changed over time.

2. In the 1800s, Gregor Mendel grew thousands of pea plants to investigate the inheritance of traits. Which present-day activity depends **most** on the results of Mendel's investigations?

   A. breeding livestock
   B. mining minerals
   C. preventing infectious diseases
   D. protecting the environment

3. Alfred Wegener proposed the theory of continental drift based on evidence from many different areas of investigation. The evidence suggested the continents had once been attached and moved apart over time. However, Wegener did not know how the continents moved. Which statement illustrates the **best** view of Wegener's work?

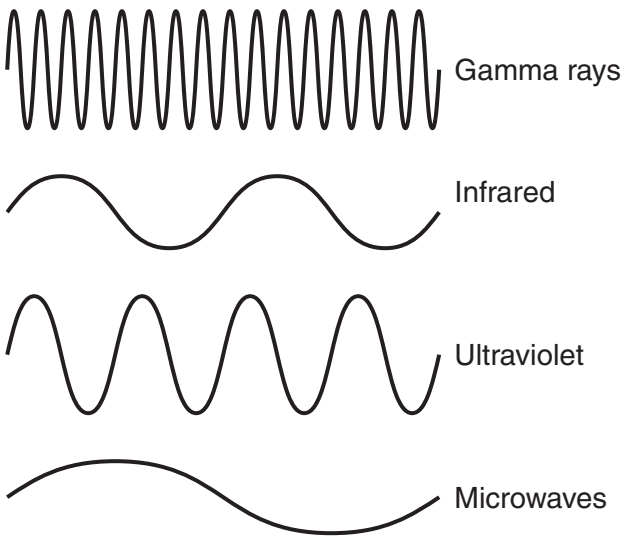
   A. The theory of continental drift was wrong.
   B. The theory of continental drift had no evidence.
   C. Further investigations were needed to support Wegener's work.
   D. Wegener should not have proposed his work until he understood how the continents moved.

4. What is ATP's purpose in a cell?

   A. to provide energy
   B. to provide oxygen
   C. to provide vitamins
   D. to provide genetic information

Please go on to the next page.

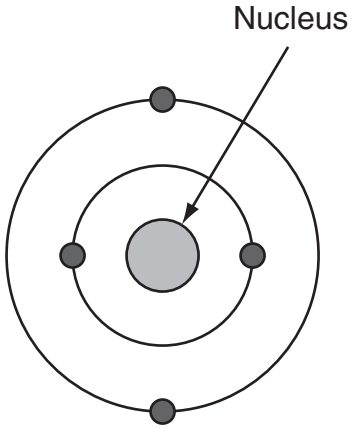
5. The diagram below shows four waves that represent four different types of electromagnetic radiation: gamma, infrared, ultraviolet rays, and microwaves. The wavelengths shown below are relative but not to scale.



Which kind of wave has the greatest frequency?

A. gamma rays
B. infrared
C. ultraviolet
D. microwaves

8. Look at the Bohr model below.



What neutral element's atomic structure is described by this Bohr model?

A. beryllium (atomic number 4)
B. carbon (atomic number 6)
C. helium (atomic number 2)
D. magnesium (atomic number 12)

9. In fruit flies, the brown eye allele is recessive to the red eye allele. Students place 25 fruit flies with brown eyes and 25 fruit flies with red eyes in a container. The fruit flies reproduce. Which question is **best** answered by this experimental design?

A. Is the brown eye trait dominant to the red eye trait in fruit flies?
B. Can fruit flies with brown eyes see better than fruit flies with red eyes?
C. How many fruit flies in the next generation will have brown eyes?
D. How many fruit flies in the next generation with brown eyes will carry the red eye allele?

Please go on to the next page.

10. Soap breaks apart fats and oils. Which type of biological molecule is **most** quickly broken down by soap?

A. carbohydrate
B. lipid
C. nucleic acid
D. protein

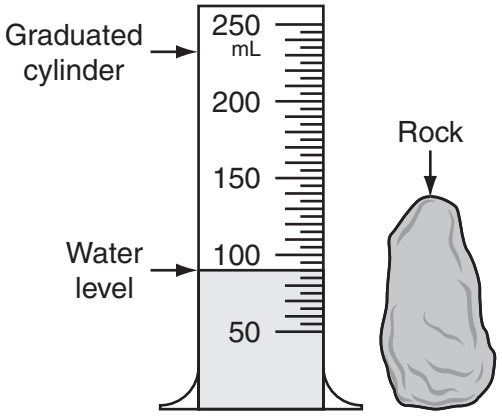
11. Read the formulas in the box below.

Force = Mass × Acceleration
$1\ N = 1\ kg \times 1\ m/s^2$

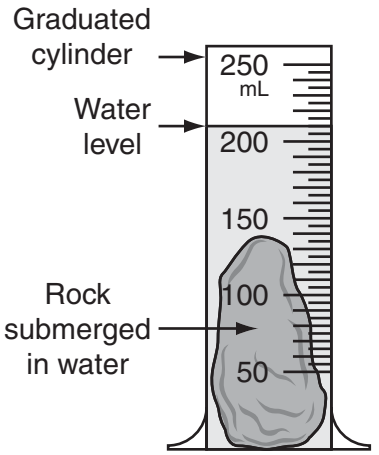
A person with a mass of 60 kg weighs 600 N on Earth. The acceleration due to gravity on the Moon is approximately 2 m/s^2. About how much would a 60-kg person weigh on the Moon?

A. 30 N
B. 60 N
C. 120 N
D. 600 N

15. The diagram below shows the water-displacement method used to measure the volume of a rock.



Before displacement



After displacement

Based on the diagram, what is the volume of the rock?

A. 90 mL
B. 120 mL
C. 210 mL
D. 300 mL

Please go on to the next page.

16. Which example is a chemical reaction?

A. mixing drink crystals with water to make lemonade

B. melting broken glass to make containers

C. chopping pieces of wood to make wood chips to burn

D. mixing yeast with sugar to make bread dough rise

17. Which ocean characteristic moderates Earth's climate?

A. algae

B. currents

C. tides

D. waves

18. When a hot piece of iron is placed in cool water, the temperature of the iron decreases and the temperature of the water increases. Why does this happen?

A. Heat always flows from hot objects to cold objects.

B. Heat always flows from solids to liquids.

C. Iron is a poor thermal conductor.

D. Potential energy is converted into kinetic energy.

19. A student is mixing different substances with 100 mL of water and measuring the increase in temperature of the solution after each substance has dissolved. Which question is this student **most likely** investigating?

A. How fast do different substances react with water?

B. Which substances dissolve best in water?

C. How much heat does 100 mL of water absorb?

D. Which substances release heat when mixed with water?

Please go on to the next page.

23. A scientist conducts an experiment to see the effect of a particular nutrient on plant height. He expects to see a difference between his experimental and control groups. He conducts the experiment and all the plants grow to the same height. Based on good scientific procedure, which is the **best** way for the scientist to confirm these unexpected results?

A. trying the same experiment with a different kind of plant

B. trying the same experiment with a different kind of nutrient

C. repeating the experiment with a different procedure

D. repeating the experiment with exactly the same procedure

24. The classification system for the black-backed woodpecker *Picoides arcticus* is shown in the box below.

Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Piciformes
Family	Picidae
Genus	*Picoides*
Species	*Picoides arcticus*

Which group is most likely the largest group to **only** contain woodpeckers?

A. Chordata

B. Aves

C. Picidae

D. *Picoides arcticus*

25. Which human action has the **most** impact on global climatic patterns?

A. using solar-powered hot-water heaters in homes

B. cutting down thousands of trees in tropical rain forests

C. collecting rainwater for people in large cities to drink

D. harvesting seaweed for people on some Pacific islands to eat

26. Which chemical reaction is balanced?

A. $SO_2 + H_2O \rightarrow H_2SO_4$

B. $CO_2 + H_2O \rightarrow H_2CO_3$

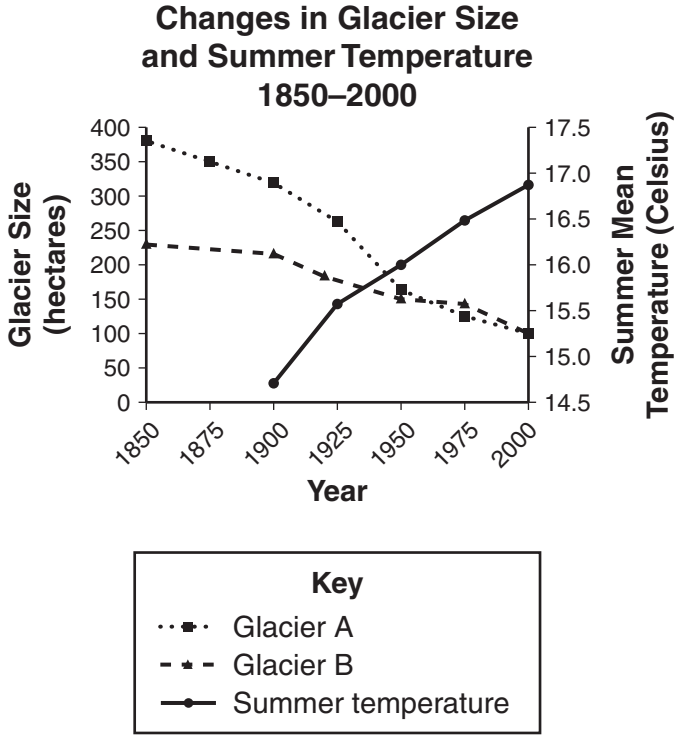
C. $Mg + HCl \rightarrow MgCl_2 + H_2$

D. $Li + HCl \rightarrow LiCl + H_2$

Please go on to the next page.

Write your answer in the space provided for it in your Student Response Booklet.

27. The graph below shows the sizes of two different glaciers in Glacier National Park, Montana, from 1850 to 2000, and the summer mean temperature for the past century.



The changes in these two glaciers reflect what is happening to most of the glaciers in the park.

a. Describe how the summer mean temperatures have changed in the past century according to the graph.

b. Explain how the sizes of the two glaciers have changed over the past 150 years.

c. Describe **two** ways the trends shown in the graph could affect weather in this area of Montana.

Please STOP. Do not go on to the next page.

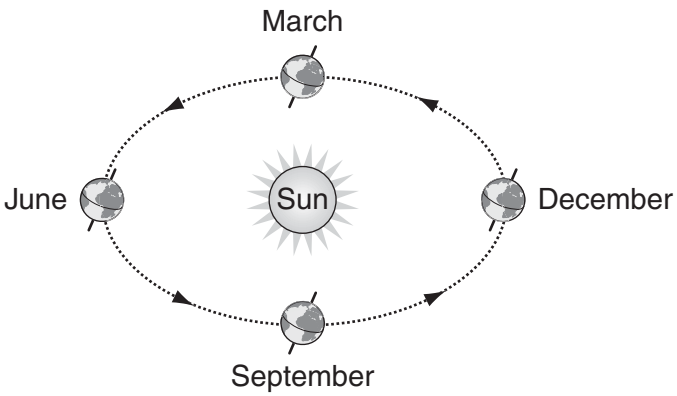
STOP

Science
Session 2

This test session includes multiple-choice questions.

Mark your answers in the section marked "Science—Session 2" in your Student Response Booklet.

28. Students used the model shown below to investigate the seasons on Earth.



According to the model, which factor remains the same as the seasons change?

A. the tilt of Earth on its axis
B. the length of daytime at the North Pole
C. the path of the Sun in the sky at the South Pole
D. the angle of the Sun's rays when striking the equator

29. Why does chopping wood into small pieces help it burn more quickly?

A. Chopping produces more wood.
B. Chopping produces friction that heats the wood.
C. Chopping creates smaller pieces that are catalysts.
D. Chopping creates more surface area.

30. In pea plants, the purple (P) flower trait is dominant over the white (*p*) flower trait. The table below shows the results of a cross between two pea plants heterozygous for purple flowers.

$$Pp \times Pp$$

	P	*p*
P	PP	P*p*
p	P*p*	*pp*

Which ratio of flower colors results from this cross?

A. 100% purple
B. 50% purple and 50% white
C. 75% purple and 25% white
D. 100% white

31. How are mountain ranges such as the Rocky Mountains and the Himalayas formed?

A. Igneous rock pushes up while the surrounding sedimentary rock sinks.
B. Plates of Earth's crust collide and force large amounts of rock upward.
C. A string of volcanoes produces tall cones of cooled lava that become weathered.
D. Metamorphic rock is left behind after softer sedimentary rock is carried away by large rivers.

Please go on to the next page.

35. Which phrase **best** describes how stars are distributed throughout the known universe?

A. in a single dense cluster
B. in very long rows
C. in billions of separate clusters
D. evenly throughout space

36. Scientists have recently found that increases in nitric oxide might lead to increased numbers of mitochondria in some cells. How would an increase in mitochondria **most** directly impact these cells?

A. by producing more energy
B. by increasing the DNA molecule size
C. by producing more digestive enzymes to better break down food
D. by changing the cell membrane to allow nerve impulses to travel faster

37. When heat energy is added to an object, its temperature increases. Which property of the object is uniquely determined by its temperature?

A. its mass
B. its number of covalent bonds
C. the average potential energy of its molecules
D. the average kinetic energy of its molecules

38. Scientists in Montana are studying the effects of fires in coniferous forests. The three types of coniferous forest areas they are studying are summarized in the box below.

> Control: Forests where fire has not been allowed to burn
>
> Natural: Forests where frequent, low-intensity fires have occurred naturally
>
> Treated: Forests where logging and/or controlled burning has modeled conditions similar to natural forests

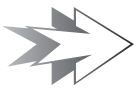
The table below shows data for five species of birds found in these three forest areas.

Bird Species	Number of Birds		
	Control Area	Natural Area	Treated Area
Northern flicker	7	16	17
Hammond's flycatcher	14	23	66
Mountain chickadee	23	36	48
Dark-eyed junco	54	77	81
Pine siskin	24	27	80

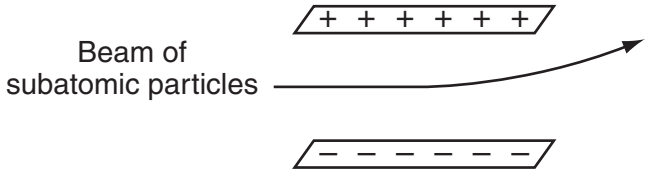
Which method for managing coniferous forest fires is supported by these data?

A. The fires should not be allowed to burn, because they are harmful to bird populations.
B. The fires should not be allowed to burn, because they are harmful to coniferous trees.
C. The fires should be allowed to burn, because they are beneficial to bird populations.
D. The fires should be allowed to burn, because they are beneficial to coniferous trees.

Please go on to the next page.



42. The picture on a television screen is produced when a beam of subatomic particles is released from a hot filament. The direction of the particles can be affected by charged electric fields. The diagram below shows how these particles move in an electric field.



Which subatomic particles are released from the hot filament and why?

A. electrons, because they are negative
B. electrons, because they are positive
C. protons, because they are negative
D. protons, because they are positive

43. Which recent technological advance has **most** improved scientists' model of the universe?

A. the electron microscope
B. the Hubble space telescope
C. lasers
D. sonar

44. How is the storage of DNA in eukaryotic cells different from in prokaryotic cells?

A. Prokaryotic cells have a capsule around the DNA.
B. Eukaryotic cells have DNA stored in the nucleus.
C. Prokaryotic cells have DNA stored in a central vacuole.
D. Eukaryotic cells have DNA free-floating in the cytoplasm of the cell.

45. A student is given four different rocks to identify. She collects the data shown in the table below.

Rock Characteristic	Rock Sample			
	A	B	C	D
Hardness	Hard	Hard	Hard	Soft
Color	Gray	Light brown	Light gray	Dark gray
Rock size	Large	Small	Small	Small
Grain size	Fine	Coarse	Coarse	Fine

Which statement identifies a weakness in the student's investigation?

A. The student has too few rocks.
B. The table has too many rock characteristics.
C. The rock size is not helpful information.
D. The grain size is not helpful information.

46. Lime (CaO) is produced by heating limestone ($CaCO_3$) to 825°C, according to the following reaction:

$$CaCO_3 \rightarrow CaO + CO_2$$

If heating 50 kg of limestone produces 22 kg of carbon dioxide (CO_2), how much lime is produced?

A. 22 kg
B. 28 kg
C. 50 kg
D. 72 kg

Please go on to the next page.

50. The same number of particles of gases A and B are stored in two identical containers under the same conditions. The container of gas A is twice as heavy as that of gas B. Which sentence **best** explains the difference in the mass of the two containers of gas?

A. Gas B has a higher pressure than gas A.

B. Gas A has a lower temperature than gas B.

C. The containers are made of different materials.

D. The particles of each gas have different masses.

51. Which present-day activity causes the **most** controversy about scientific ethics within the general public and the scientific community?

A. transplanting human organs

B. manufacturing fossil fuel alternatives

C. developing AIDS vaccines

D. genetically engineering life-forms

52. An experiment is designed to test whether the mass of a spherical object can be used to determine the time it takes the object to fall two meters. Which would be a dependent, or responding, variable?

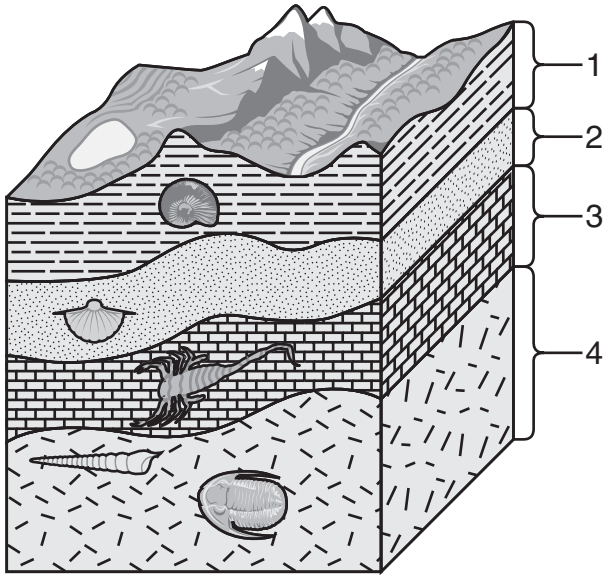
A. the mass of the object

B. the shape of the object

C. the distance the object falls

D. the time the object takes to fall

53. The diagram below shows four layers of sedimentary rock.



Geologists discovered that each layer contains a unique set of fossils. Which conclusion is **best** supported by these rock layers?

A. The fossils in layer 1 are from the most recent forms of life.

B. The fossils in layer 2 are from animals that lived in a terrestrial environment.

C. The fossils in layer 3 evolved from the fossils in layer 2.

D. The fossils in layer 4 are from the most complex forms of life.

Please STOP. Do not go on to the next page.

STOP

Science
Session 3

This test session includes multiple-choice questions and a question for which you must write out your answer. Be sure to answer all parts of the question.

Mark your answers in the section marked "Science—Session 3" in your Student Response Booklet.

55. A student is using a microscope to view an animal cell, but the cell looks too small to see any details. How can the student make the cell appear larger?

    A. by rotating the eyepiece to the right
    B. by moving the objective lens to a higher power
    C. by moving the slide around on the stage
    D. by increasing the brightness of the light

56. People once believed that Earth's continents were permanently fixed in their current positions. Which twentieth-century scientific idea changed this belief?

    A. Earth has tectonic plates.
    B. Earth's axis is tilted.
    C. Earth's atmosphere is layered.
    D. Earth has magnetic poles.

57. How many atoms of hydrogen (H) are found in ammonium sulfate $(NH_4)_2SO_4$?

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

58. Which statement **best** describes the relationship between ADP and ATP?

    A. When ADP releases energy, it becomes ATP.
    B. When ATP releases energy, it becomes ADP.
    C. When ATP and ADP are joined together, energy is stored.
    D. When ATP and ADP are joined together, energy is released.

59. Students are investigating a hypothesis that salt water evaporates more slowly than freshwater. Their data is shown in the table below.

Type of Water	Start Volume (mL)	End Volume (mL)
Fresh	100	11.1
Salt	200	23.6

Which method is **best** for comparing this data?

    A. finding the difference in amount evaporated (87.5 mL)
    B. calculating the average amount evaporated (132.65 mL)
    C. presenting the range of amount evaporated (88.9 mL–176.4 mL)
    D. calculating the percent difference in amount evaporated (0.7%)

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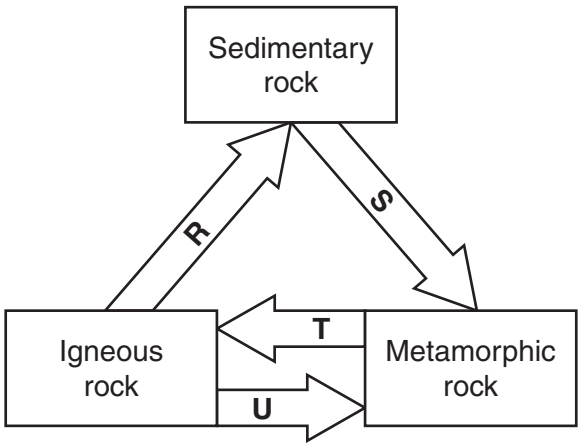
62. A diagram of the rock cycle is shown below.



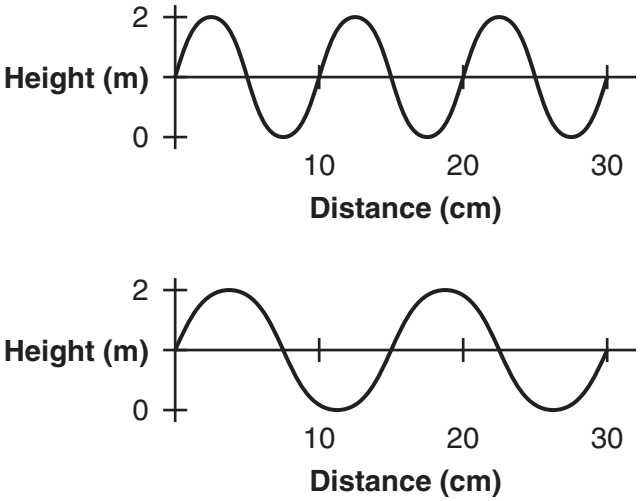
Where should the label "Weathering" be placed?

A. on arrow R
B. on arrow S
C. on arrow T
D. on arrow U

63. How has the Internet **most** significantly impacted the scientific process over the past 20 years?

A. by increasing the accuracy of scientific data collection
B. by increasing the speed at which data are shared among scientists
C. by decreasing the need for long periods of scientific data collection
D. by decreasing the need for sharing data in scientific journals

64. The diagram below represents two waves produced in the same medium and moving at the same speed.



What other property do the waves have in common?

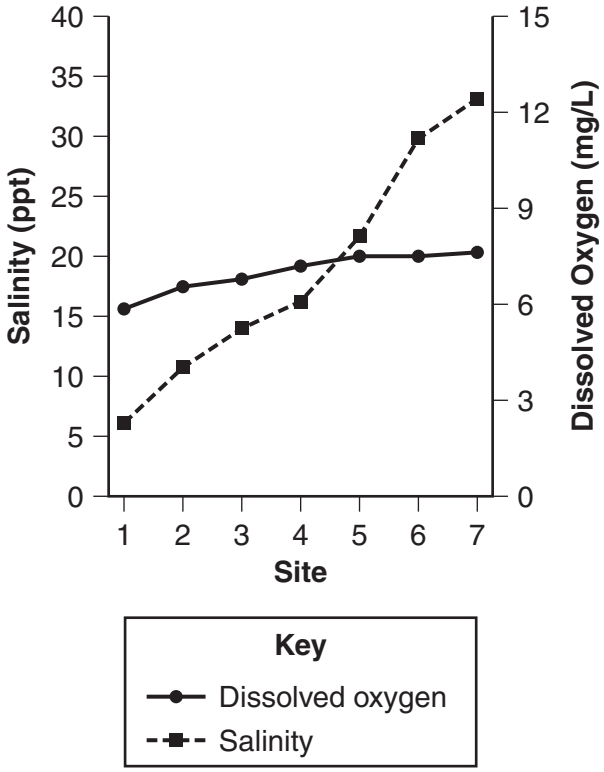
A. amplitude
B. frequency
C. period
D. wavelength

65. A student wants to measure the average length of oak tree leaves in late summer every year for five years to see if the average length of the leaves changes. Which method would be **best** for the student to follow?

A. measuring leaves from the same tree on the same date each year
B. measuring leaves from many oak trees on the same date each year
C. measuring leaves from many kinds of trees on the same date each year
D. measuring leaves from many oak trees throughout the year

Please go on to the next page.

69. Salinity is the measurement of dissolved salts in water. The ocean has an average salinity of 35 ppt (parts per thousand). The graph below shows the salinity and amount of dissolved oxygen recorded at seven data-collection sites on a river.



The river empties into an ocean. Which conclusion can be drawn from the graph?

A. Site 7 is closest to the ocean.
B. Site 1 is closest to the ocean.
C. Site 7 has the lowest salinity.
D. Site 1 has the highest oxygen concentration.

70. In which group are organisms more closely related?

A. kingdom
B. class
C. family
D. species

71. Read the formulas in the box below.

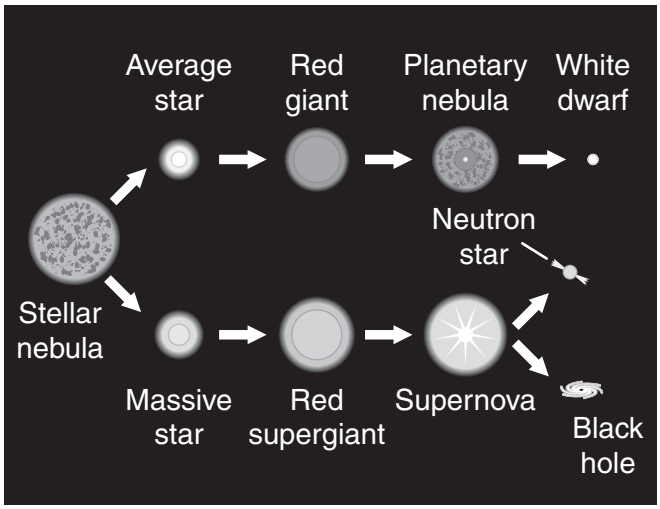
Net Force = Mass × Acceleration
$1\ N = 1\ kg \times 1\ m/s^2$

A crate has a mass of 50 kg. A student pushes the crate along the floor by exerting a 500 N force to the left on it. The floor exerts a rightward 200 N frictional force on the crate. What is the acceleration and direction of the crate?

A. 6 m/s^2 to the left
B. 10 m/s^2 to the left
C. 14 m/s^2 to the left
D. 50 m/s^2 to the left

Please go on to the next page.

72. The diagram below illustrates the different stages in the life cycle of stars.



Which stage do all stars go through after they have formed?

A. supernova explosion
B. collapse into a black hole
C. expansion into a type of red giant
D. collapse into a white dwarf

73. Hair is mostly protein. Which organelle would be much more abundant in an animal cell that produces hair than in an animal cell that stores fat?

A. chloroplast
B. mitochondrion
C. nucleus
D. ribosome

77. The table below lists three U.S. government agencies and the years when Congress established them.

Agency	Year Established by Congress
National Weather Service (NWS)	1870
Food and Drug Administration (FDA)	1906
Environmental Protection Agency (EPA)	1970

Why did Congress **mainly** establish these U.S. government agencies?

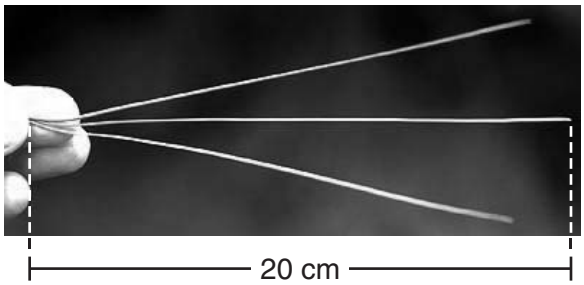
A. to conserve renewable resources
B. to design new technologies for manufacturers
C. to safeguard public health and safety
D. to improve conditions in the workplace

78. The attractive force between water molecules is very strong. Which characteristic of water **best** displays the result of this attraction between water molecules?

A. Pure water has a pH of 7.
B. Water covers 71% of the surface of Earth.
C. Some insects can walk on the surface of water.
D. Water is found as a solid, a liquid, and a gas on Earth.

Please go on to the next page.

79. The diagram below shows needles and a cone from the same tree in Montana.



A student is asked to identify this tree by using the dichotomous key in the box below.

1. a. Needles in clusters of 2 or 3 (go to 2)
b. Needles in clusters of 5 (go to 3)
2. a. Needles in clusters of 2 and 2–5 cm long; cones 2–3 cm long: pinyon pine
b. Needles 4–25 cm long (go to 4)
3. a. Cones 8–25 cm long: limber pine
b. Cones 6–9 cm long: foxtail pine
4. a. Needles in clusters of 2 and 4–7 cm long; cones 4–5 cm long: lodgepole pine
b. Needles in clusters of 3 and 7–25 cm long; cones 6–15 cm long: ponderosa pine

According to the key, from which tree did the needles and cone come?

A. pinyon pine
B. limber pine
C. lodgepole pine
D. ponderosa pine

80. The Taj Mahal in India is a memorial that was built over 400 years ago. It is made of a metamorphic rock that is very hard and highly polished. Which type of rock was **most likely** used to build the Taj Mahal?

A. limestone
B. marble
C. sandstone
D. shale

Please go on to the next page.

Write your answer in the space provided for it in your Student Response Booklet.

81. Forest fires are part of the natural cycle of coniferous forests in the Rocky Mountain range.

    a. Describe **two** ways natural populations can benefit from a forest fire.

    b. Explain **two** ways a forest fire can contribute to the evolution of a local population through natural selection.

Please STOP. STOP

Acknowledgments

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