XVII. Science and Technology/Engineering, Grade 8

Grade 8 Science and Technology/Engineering Test

The spring 2016 grade 8 Science and Technology/Engineering test was based on learning standards in the four major content strands in the *Massachusetts Science and Technology/Engineering Curriculum Framework* (2006) listed below. Page numbers for the grades 6–8 learning standards appear in parentheses.

- Earth and Space Science (*Framework*, pages 32–33)
- Life Science (Biology) (*Framework*, pages 51–53)
- Physical Sciences (Chemistry and Physics) (*Framework*, pages 67–68)
- Technology/Engineering (*Framework*, pages 87–89)

The *Massachusetts Science and Technology/Engineering Curriculum Framework* is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Science and Technology/Engineering test results are reported under four MCAS reporting categories, which are identical to the four framework content strands listed above.

The tables at the conclusion of this chapter indicate each released and unreleased common item's reporting category and the framework learning standard it assesses. The correct answers for released multiple-choice questions are also displayed in the released item table.

Test Sessions

The grade 8 Science and Technology/Engineering test included two separate test sessions. Each session included multiple-choice and open-response questions. Approximately half of the common test items are shown on the following pages as they appeared in test booklets.

Reference Materials and Tools

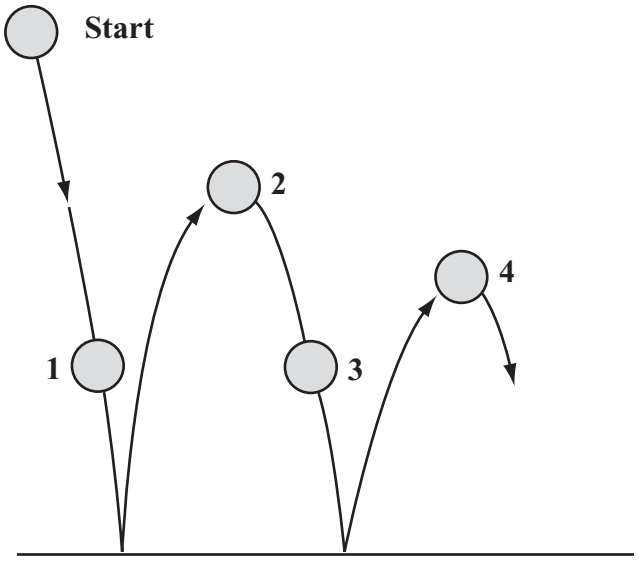
During both Science and Technology/Engineering test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only. No other reference tools or materials were allowed.

Grade 8 Science and Technology/Engineering
Session 1

DIRECTIONS

This session contains ten multiple-choice questions and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

1 The diagram below shows the path of a ball bouncing on the ground. Four locations in the path are identified with numbers.



At which location does the ball have the **greatest** amount of kinetic energy?

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

2 A company is creating an advertisement for its custom-made guitars. Which of the following statements should be in the advertisement to **best** emphasize the company's custom production processes?

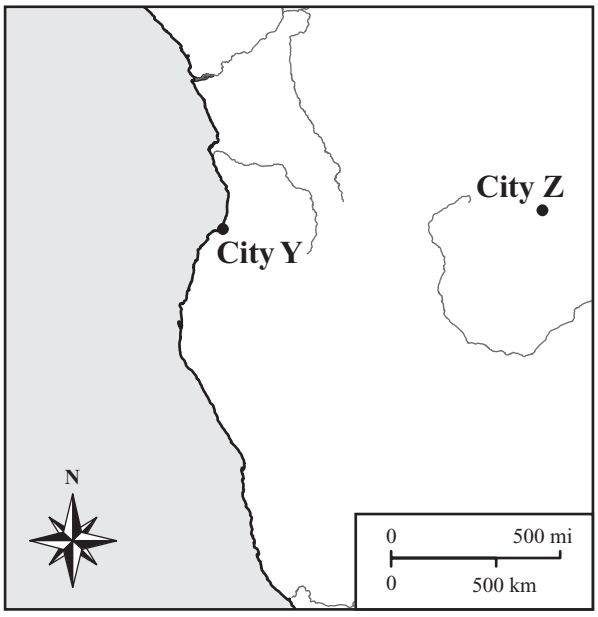
A. Our guitars are made using hand tools.
B. We make our guitars to your specifications.
C. We produce and sell thousands of guitars each year.
D. Our guitars are the best quality your money can buy.

3 A substance with a mass of 10 g is heated to produce two new substances. The mass of the first new substance is 9.3 g and the mass of the second new substance is 0.7 g.

Which of the following is **best** demonstrated by this example?

A. heat transfer
B. physical change
C. law of conservation of mass
D. law of conservation of energy

4 The map below shows the locations of two cities. City Y is near the coast, and city Z is near the middle of a continent. The cities have the same elevation.



Based on the map, which of the following statements describes how the climates of the two cities are **most likely** different?

A. City Y receives less rain than city Z.

B. City Y has colder winters than city Z.

C. City Y has cooler summers than city Z.

D. City Y receives more sunlight than city Z.

5 An engineer constructs a prototype from wood. Which of the following is the **best** tool for the engineer to use to make the prototype's surface smooth?

A. band saw

B. chisel

C. drill

D. sandpaper

6 The diagrams below represent different ways heat is transferred. The arrows in the diagrams show the direction of heat transfer.

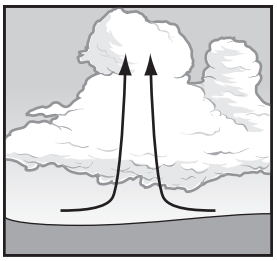


Diagram X

Diagram Y

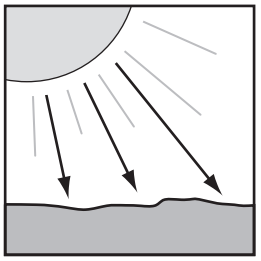


Diagram Z

Which table shows the **primary** way heat is transferred in each diagram?

A.

Diagram	How Heat Is Transferred
X	conduction
Y	convection
Z	radiation

C.

Diagram	How Heat Is Transferred
X	convection
Y	conduction
Z	radiation

B.

Diagram	How Heat Is Transferred
X	convection
Y	radiation
Z	conduction

D.

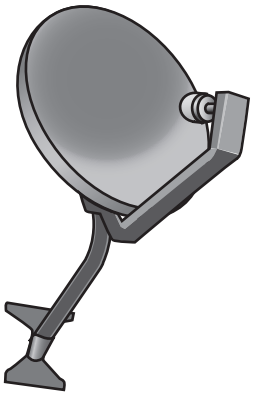
Diagram	How Heat Is Transferred
X	radiation
Y	conduction
Z	convection

7 Many natural rock formations change color over time. In Utah, for example, iron oxidized and formed red, orange, and yellow rock.

Which of the following is the cause of this change?

A. chemical weathering
B. mechanical weathering
C. water erosion
D. wind erosion

8 The picture below shows a television satellite dish.



The satellite dish is an example of which of the following components of a television communications system?

A. decoder
B. encoder
C. receiver
D. transmitter

9 Which of the following is a cause of the ocean levels periodically rising and then falling?

A. the slight tilt of the Moon
B. the force of gravity from the Moon
C. the convection within Earth's mantle
D. the revolution of Earth around the Sun

10 A crop of corn plants is genetically modified so that the plants produce a natural pesticide. People are concerned that these corn plants might transfer modified genetic material to other plants.

Which of the following is the **best** way to further modify the plants to prevent them from transferring their genetic materials to other plants?

A. changing the plants so they do not make pollen
B. changing the plants so they do not harm insects
C. changing the plants so they cannot produce nutrients
D. changing the plants so they cannot be easily identified

Question 11 is an open-response question.

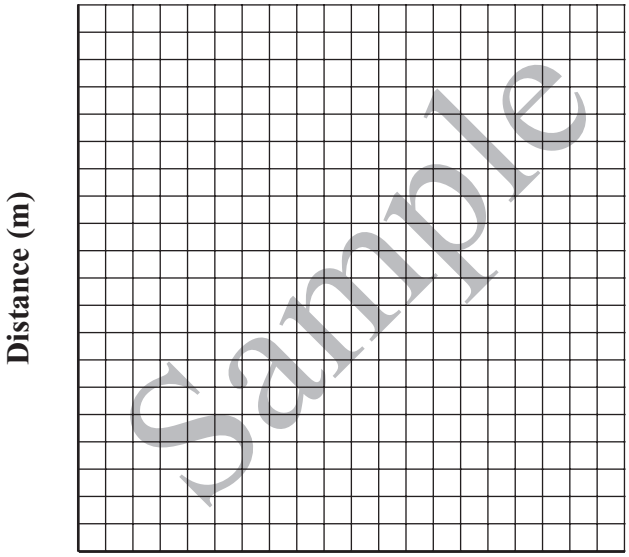
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 11 in the space provided in your Student Answer Booklet.

11 A student takes part in a 400 m race. The table below shows the distance the student traveled over time.

Time (s)	Distance (m)
0	0
30	100
60	200
90	300
120	400
150	400
180	400

a. On the grid in your Student Answer Booklet, copy the *x*-axis and *y*-axis labels as shown below **and** use the information from the table to make a proper scale by adding numbers to each axis on your graph.



b. Draw a line on your graph to represent the motion of the student from 0 s to 120 s.

c. Calculate the average speed of the student from 0 s to 120 s. Be sure to show your calculations and include units in your answer.

d. Is the student moving from 120 s to 180 s? Explain your answer.

Grade 8 Science and Technology/Engineering
Session 2

DIRECTIONS

This session contains nine multiple-choice questions and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

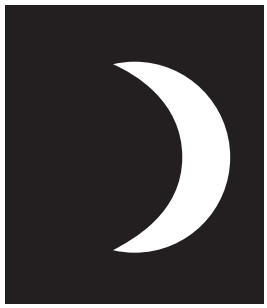
12 Wolves kill many elk every year and often attack old, sick, and injured members of a herd. Which of the following **best** describes the role of the wolves in the wolf-elk relationship?

A. competitor
B. host
C. parasite
D. predator

13 Earth's core is **primarily** composed of which of the following materials?

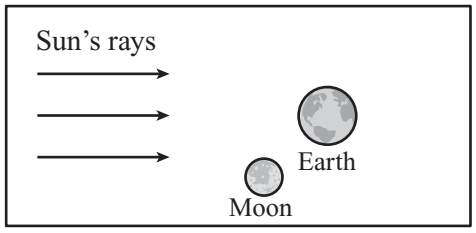
A. basalt
B. iron
C. magma
D. quartz

14 The following diagram illustrates the appearance of the Moon from Earth.

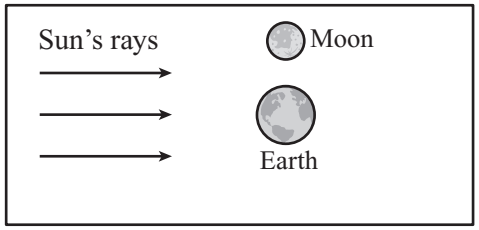


Which of the following arrangements of the Sun, the Moon, and Earth will cause the Moon to appear as it does above?

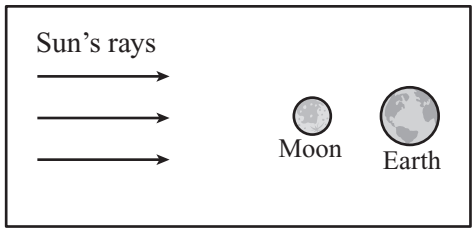
A.



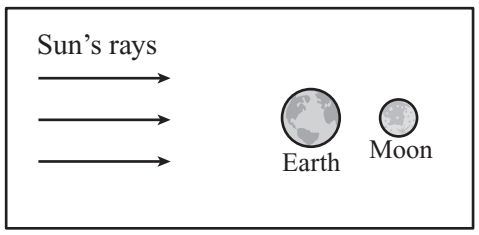
B.



C.



D.



15 A college campus has so few parking spaces that cars are often lined up waiting to park during class hours. Which of the following describes how the college could **best** solve the need for more parking spaces using the universal systems model?

A. The college could build an additional parking lot, gather parking data, and then receive input from community meetings.

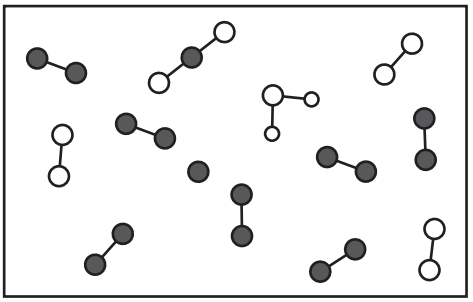
B. The college could limit access to parking lots during busy hours, hire security officers to help restrict parking, and then gather parking data.

C. The college could gather parking data, receive input from community meetings, build an additional parking lot, and then gather more parking data.

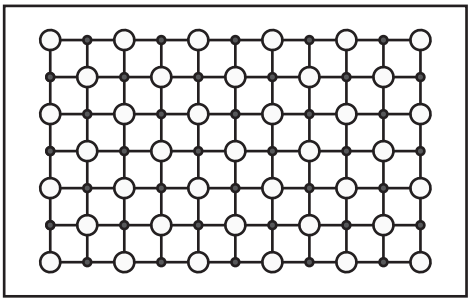
D. The college could hire security officers to help restrict parking, gather parking data, receive input from community meetings, and then gather more data.

16 Which of the following diagrams best represents a mixture?

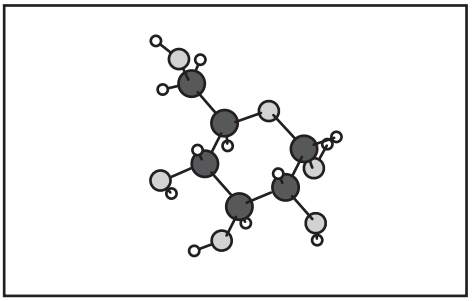
A.



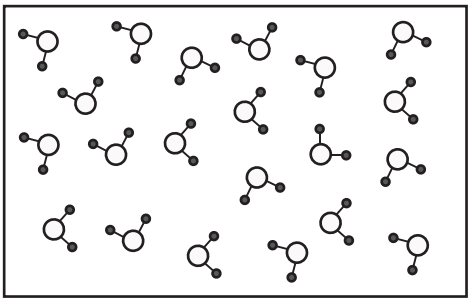
B.



C.



D.



17 Which of the following correctly orders part of a fish's respiratory system from the least complex to most complex?

A. cells → gills → tissues

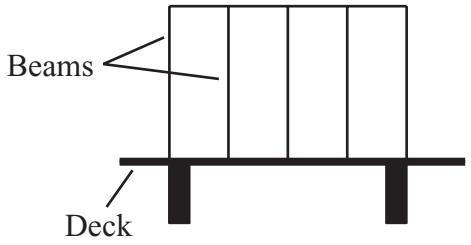
B. cells → tissues → gills

C. gills → tissues → cells

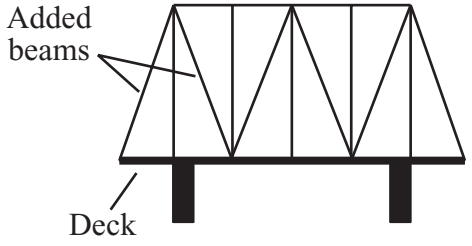
D. tissues → gills → cells

18 The diagrams below show a section of a bridge before and after more beams were added.

Before



After



What is the **main** reason more beams were added to the bridge?

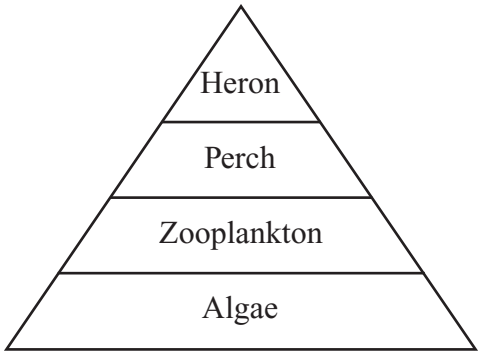
A. to reduce shear forces

B. to increase tension forces

C. to spread tension and compression forces over a wider area

D. to create torsion forces in the vertical and diagonal directions

19 The diagram below shows an energy pyramid for a lake ecosystem.



Which of the following **best** describes the role of the perch in this energy pyramid?

A. producer

B. decomposer

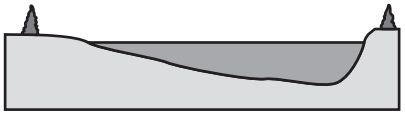
C. primary consumer

D. secondary consumer

20 Students measured the water depth at several locations across the channel of a river. They plan to show the data they collected to their class.

Which of the following is the **most** appropriate representation to show the river's depth across the channel?

A.

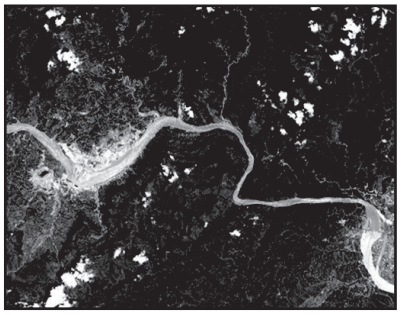


Cross section

B.

Flat map

C.



Relief map

D.

Photograph

Question 21 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 21 in the space provided in your Student Answer Booklet.

21 In cats, a single gene codes for hair length. The form of the gene for short hair (**H**) is dominant to the form of the gene for long hair (**h**).

a. Identify the structures where the gene for hair length is stored in the nucleus of a cell.

b. What percentage of a mother cat's genetic information is inherited by her offspring?

A cat that has long hair (**hh**) is crossed with a cat that has short hair (**Hh**). The Punnett square below represents this cross.

	H	**h**
h	Hh	hh
h	Hh	hh

c. Use the Punnett square to determine the probability that an offspring of these two cats will have long hair.

d. Explain how you determined your answer to part (c).

Grade 8 Science and Technology/Engineering
Spring 2016 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC)*
1	280	*Physical Sciences*	13	A
2	280	*Technology/Engineering*	4.1	B
3	280	*Physical Sciences*	4	C
4	281	*Earth and Space Science*	4	C
5	281	*Technology/Engineering*	2.4	D
6	282	*Earth and Space Science*	3	C
7	283	*Earth and Space Science*	6	A
8	283	*Technology/Engineering*	3.1	C
9	283	*Earth and Space Science*	8	B
10	283	*Technology/Engineering*	7.2	A
11	284	*Physical Sciences*	12	
12	285	*Life Science*	13	D
13	285	*Earth and Space Science*	2	B
14	286	*Earth and Space Science*	9	A
15	286	*Technology/Engineering*	6.2	C
16	287	*Physical Sciences*	8	A
17	287	*Life Science*	5	B
18	288	*Technology/Engineering*	5.4	C
19	288	*Life Science*	14	D
20	289	*Earth and Space Science*	1	A
21	290	*Life Science*	7	

* Answers are provided here for multiple-choice items only. Sample responses and scoring guidelines for open-response items, which are indicated by the shaded cells, will be posted to the Department's website later this year.

Grade 8 Science and Technology/Engineering
Spring 2016 Unreleased Common Items:
Reporting Categories and Standards

Item No.	Reporting Category	Standard
22	*Technology/Engineering*	1.3
23	*Physical Sciences*	1
24	*Earth and Space Science*	11
25	*Life Science*	15
26	*Life Science*	4
27	*Physical Sciences*	14
28	*Physical Sciences*	7
29	*Technology/Engineering*	4.3
30	*Life Science*	16
31	*Physical Sciences*	3
32	*Life Science*	12
33	*Technology/Engineering*	4.4
34	*Physical Sciences*	9
35	*Life Science*	18
36	*Technology/Engineering*	6.1
37	*Physical Sciences*	15
38	*Life Science*	2
39	*Earth and Space Science*	5
40	*Technology/Engineering*	2.3
41	*Physical Sciences*	5
42	*Earth and Space Science*	12