
XVII. Science and Technology/Engineering,
Grade 8

Grade 8 Science and Technology/Engineering Test

The spring 2017 grade 8 Science and Technology/Engineering test was based on learning standards in the four major content strands in the October 2006 version of the *Massachusetts Science and Technology/Engineering Curriculum Framework*. The four content strands are listed below, with page numbers for the grades 6–8 learning standards shown in parentheses.

- Earth and Space Science (2006 framework, pages 32–33)
- Life Science (Biology) (2006 framework, pages 51–53)
- Physical Sciences (Chemistry and Physics) (2006 framework, pages 67–68)
- Technology/Engineering (2006 framework, pages 87–89)

The 2006 *Massachusetts Science and Technology/Engineering Curriculum Framework* is available on the Department website at www.doe.mass.edu/frameworks/archive.html. Massachusetts adopted a new curriculum framework in science and technology/engineering in 2016. A plan for transitioning the MCAS assessments to the new framework is available at www.doe.mass.edu/mcas/tdd/sci.html?section=resources.

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

- 1 A medical company designs a new device to measure a person's vital signs, including heart rate and blood pressure. During the design process, the company produces several prototypes.

During which of the following steps is it **most** appropriate to use a prototype?

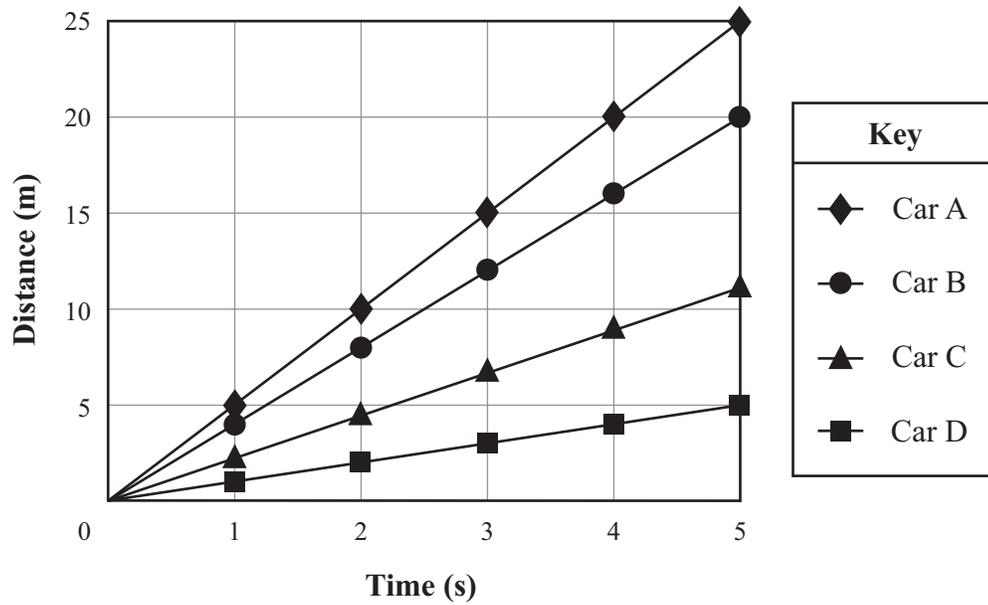
- A. distributing information about the device
- B. researching how vital signs are measured
- C. testing whether the device works properly
- D. determining which vital signs are most important

- 2 A student removes a pitcher of chilled lemonade from a 5°C refrigerator and leaves the pitcher in a 20°C room for several hours. Which of the following statements **best** describes the flow of energy during this time?

- A. Cold energy flows from the lemonade to the room until the room is colder than the lemonade.
- B. Heat energy flows from the room to the lemonade until the lemonade is warmer than the room.
- C. Cold energy flows from the lemonade to the room until the lemonade and the room are the same temperature.
- D. Heat energy flows from the room to the lemonade until the lemonade and the room are the same temperature.

3 The graph below shows the motion of four different cars over a period of 5 s.

Motion of Four Cars



Which car had an average speed of 4 m/s?

- A. car A
- B. car B
- C. car C
- D. car D

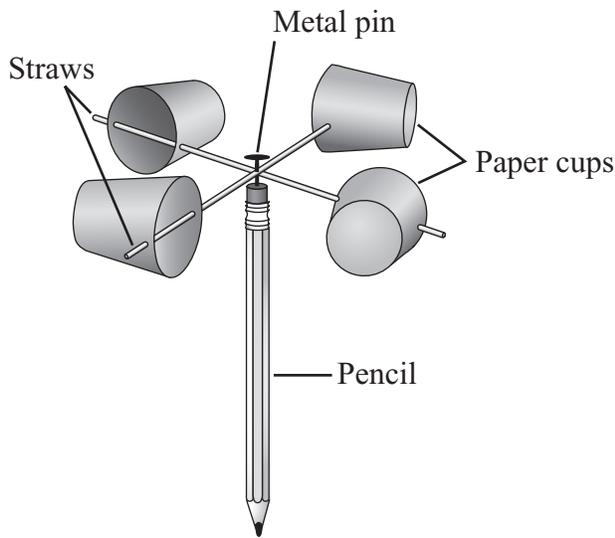
4 Which of the following is most similar to the number of stars in a galaxy?

- A. the number of galaxies in the universe
- B. the number of layers that make up Earth
- C. the number of stars in our solar system
- D. the number of planets in our solar system

5 Which of the following was **directly** caused by the first photosynthetic organisms on Earth?

- A. a decrease in the amount of soil being made
- B. a decrease in the amount of salt in the ocean
- C. an increase in the percentage of oxygen in the atmosphere
- D. an increase in the average global temperature of the atmosphere

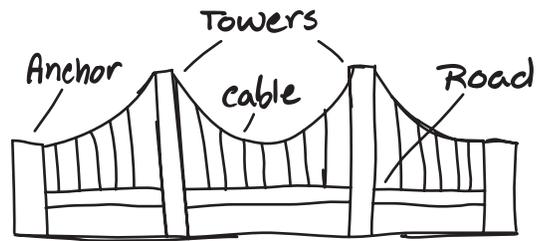
- 6 An anemometer measures wind speed. The diagram below shows an anemometer that a student built.



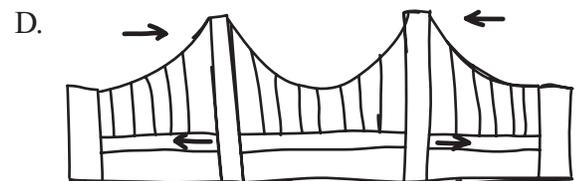
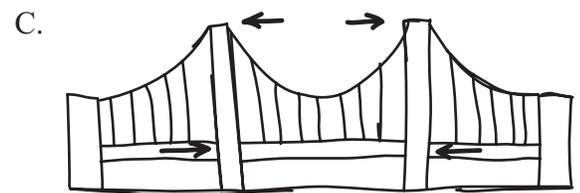
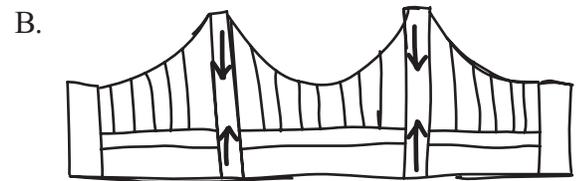
Which of the following statements **best** explains why the student used a metal pin to hold the straws in place?

- A. The pin is thin and strong.
- B. The pin can be magnetized.
- C. The pin is flexible and shiny.
- D. The pin can conduct heat energy.

- 7 A student drew the model of a bridge shown below.



Which diagram shows how the student should draw arrows to represent the compression forces acting on the bridge's towers?



8 White blood cells help protect the human body from disease. This is an example of which two body systems working together?

- A. muscular system and immune system
- B. muscular system and digestive system
- C. circulatory system and immune system
- D. circulatory system and digestive system

9 An apple falls off a tree onto the ground. Which of the following **best** describes what eventually happens to the material that makes up the apple?

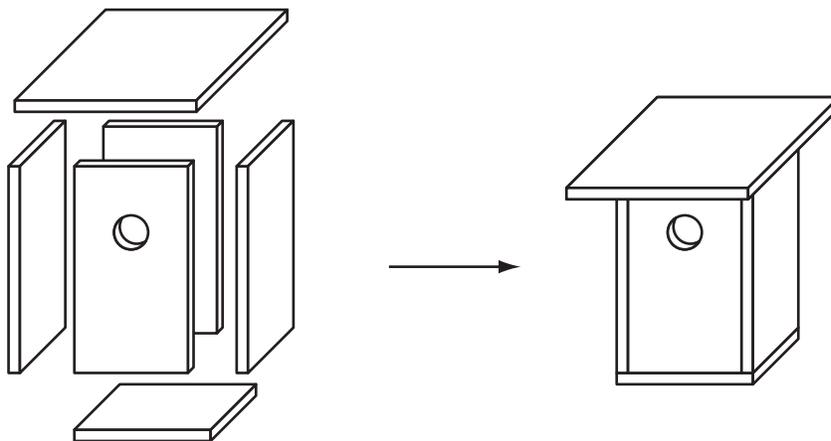
- A. Water softens the apple and its material dissolves into the ground.
- B. Sunlight decomposes the apple and recycles its material into the soil.
- C. Weather conditions rot the apple until all its material disappears and no longer exists.
- D. Microscopic organisms break down the apple and release its material into the soil and air.

Question 10 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 10 in the space provided in your Student Answer Booklet.

- 10** A student designs a birdhouse to be used outside for wild birds. A diagram of the birdhouse is shown below.



- Identify **two** materials the student will need to build the birdhouse.
- Identify **two** tools or machines the student will need to build the birdhouse.
- Describe how both the materials **and** the tools you identified in parts (a) and (b) would be used to build the birdhouse.

Grade 8 Science and Technology/Engineering

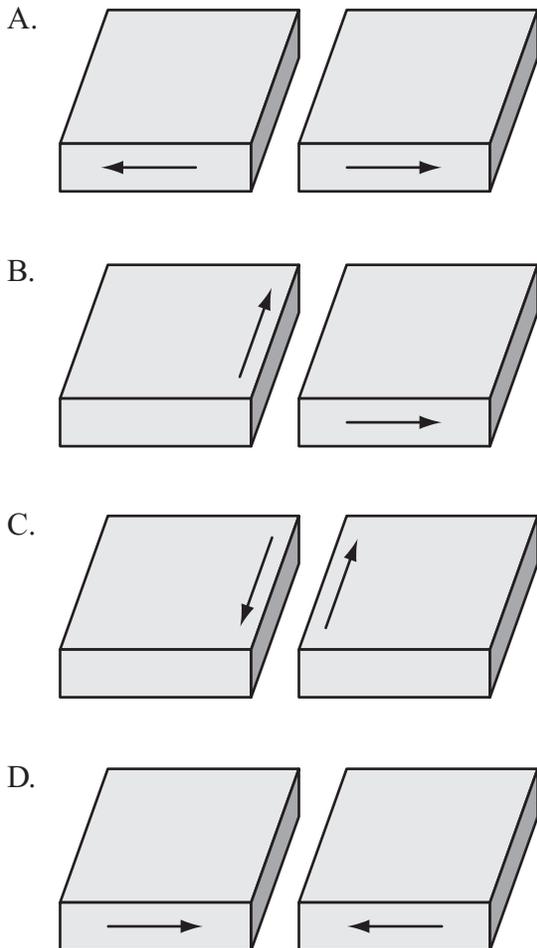
SESSION 2

DIRECTIONS

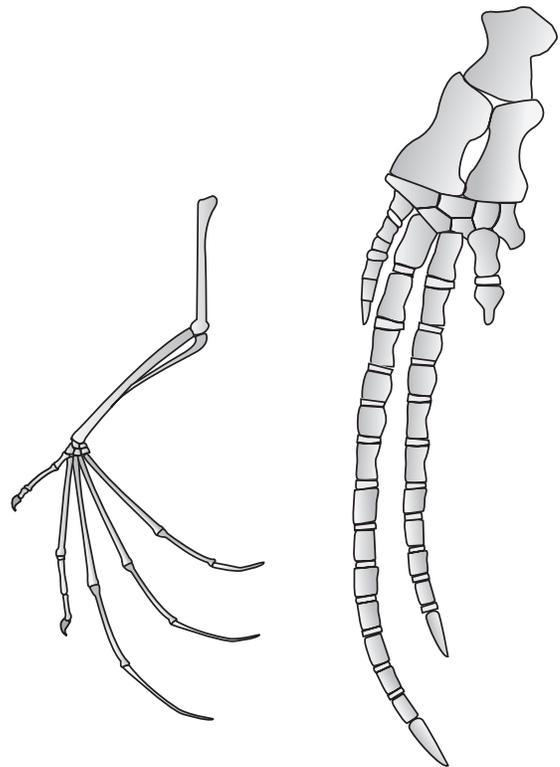
This session contains eleven multiple-choice questions and one open-response question.

Mark your answers to these questions in the spaces provided in your Student Answer Booklet.

- 11 Which of the following diagrams shows the motion of two continental plates that will **most likely** form a mountain range over time?



- 12 The bone structures in a bat wing and a whale flipper are shown below.



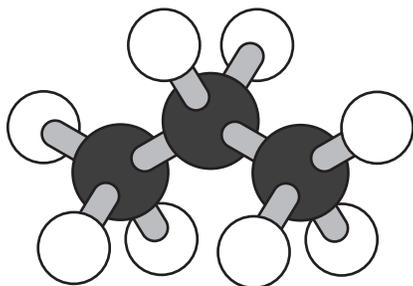
Bat wing

Whale flipper

Which of the following statements **best** explains the similarity between the bone structures in the bat wing and the whale flipper?

- A. Both animals evolved from a common ancestor.
- B. Organisms that flew evolved into organisms that swim.
- C. All organisms evolve following the same basic pattern.
- D. All animal parts used for motion evolve in the same way.

- 13 A student makes a ball-and-stick model of a propane molecule, as shown below. The black balls represent carbon atoms, and the white balls represent hydrogen atoms.



Based on the model, what is the chemical formula of propane?

- A. C_3H_8
 - B. C_3H_{10}
 - C. $3CH$
 - D. $3CH_8$
- 14 Which of the following statements describes what most likely occurs when thermal energy is removed from a liquid?
- A. The mass of the liquid decreases.
 - B. The temperature of the liquid decreases.
 - C. The molecules of the liquid move faster.
 - D. The molecules of the liquid stop moving.

- 15 Humans inherit only 46 chromosomes but show thousands of different genetic traits. Which of the following **best** explains how humans can show thousands of traits?
- A. Every cell in a human contains a copy of all the chromosomes.
 - B. The body duplicates chromosomes each time it needs to express a trait.
 - C. Each chromosome has hundreds to thousands of genes that store information for specific traits.
 - D. The body produces thousands of new cells with different combinations of chromosomes as a human grows.

- 16 The table below shows the length of a year on Mercury and on Earth.

Planet	Approximate Length of Year (Earth days)
Mercury	88
Earth	365

Which of the following statements **best** explains why Mercury has a shorter year than Earth?

- A. Mercury is closer to the Sun.
- B. Mercury's climate is warmer.
- C. Mercury's axis has a greater tilt.
- D. Mercury rotates slower on its axis.

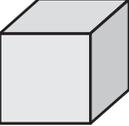
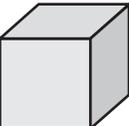
17 The table below lists some of the cell structures present in four different cells.

Cell Structure	Cell 1	Cell 2	Cell 3	Cell 4
cell membrane	✓	✓	✓	✓
nucleus		✓	✓	✓
chloroplasts		✓		
cell wall	✓	✓	✓	
mitochondria		✓	✓	✓

Based on the information in the table, which cell is **most likely** an animal cell?

- A. cell 1
- B. cell 2
- C. cell 3
- D. cell 4

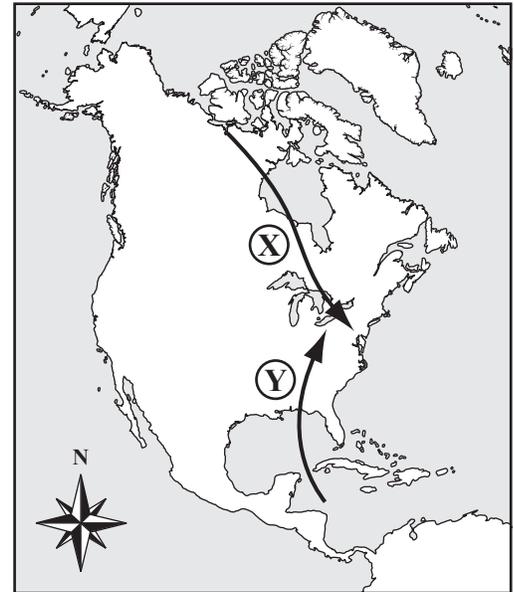
- 18 The table below shows the masses and volumes of four cubes made of different materials.

	Mass (g)	Volume (cm ³)
Cube 1 	8.0	1.0
Cube 2 	1.0	8.0
Cube 3 	1.0	1.0
Cube 4 	8.0	8.0

Which cube has the **greatest** density?

- A. cube 1
- B. cube 2
- C. cube 3
- D. cube 4

- 19 The paths of two air masses, X and Y, are shown in the diagram below.



Air mass X is a cold air mass. Air mass Y is a warm air mass. When the air masses meet, winter storms may be produced.

Which of the following **most likely** contributes to the formation of these storms?

- A. Cold air mass X moves over warm air mass Y, and evaporation occurs.
- B. Warm air mass Y moves over cold air mass X, and condensation occurs.
- C. Cold air mass X mixes with warm air mass Y, and the overall temperature increases.
- D. Warm air mass Y mixes with cold air mass X, and the overall temperature decreases.

- 20 Sucrose ($C_{12}H_{22}O_{11}$) is also known as table sugar. What is the **smallest** unit of sugar that maintains the chemical characteristics of sugar?
- A. an atom
 - B. an element
 - C. a grain
 - D. a molecule
- 21 Which of the following statements describes a characteristic that is common to bacteria, mushrooms, insects, and plants?
- A. Each type of organism makes its own food.
 - B. Each type of organism is made of one or more cells.
 - C. Each type of organism has one or more organ systems.
 - D. Each type of organism requires carbon dioxide to breathe.

Question 22 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 22 in the space provided in your Student Answer Booklet.

- 22** On an ice-covered island in the Arctic, scientists discovered fossils of deciduous trees, such as oak, birch, sycamore, and walnut. Scientists determined that these fossils were formed about 50 million years ago.
- a. Describe **two** steps in the process that formed these fossils (after the trees had died).
 - b. Describe what these fossils indicate about the island's past climate **and** explain how they indicate this.

**Grade 8 Science and Technology/Engineering
Spring 2017 Released Items:
Reporting Categories, Standards, and Correct Answers***

Item No.	Page No.	Reporting Category	2006 Standard	Correct Answer (MC)*
1	243	<i>Technology/Engineering</i>	2.1	C
2	243	<i>Physical Science</i>	16	D
3	244	<i>Physical Science</i>	12	B
4	245	<i>Earth and Space Science</i>	12	A
5	245	<i>Life Science</i>	17	C
6	246	<i>Technology/Engineering</i>	1.1	A
7	246	<i>Technology/Engineering</i>	5.3	B
8	247	<i>Life Science</i>	6	C
9	247	<i>Life Science</i>	15	D
10	248	<i>Technology/Engineering</i>	2.4	
11	249	<i>Earth and Space Science</i>	5	D
12	249	<i>Life Science</i>	11	A
13	250	<i>Physical Science</i>	7	A
14	250	<i>Physical Science</i>	14	B
15	250	<i>Life Science</i>	8	C
16	250	<i>Earth and Space Science</i>	10	A
17	251	<i>Life Science</i>	3	D
18	252	<i>Physical Science</i>	2	A
19	252	<i>Earth and Space Science</i>	4	B
20	253	<i>Physical Science</i>	6	D
21	253	<i>Life Science</i>	2	B
22	254	<i>Earth and Space Science</i>	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 2017 Unreleased Common Items:
Reporting Categories and Standards**

Item No.	Reporting Category	2006 Standard
23	<i>Earth and Space Science</i>	2
24	<i>Physical Science</i>	4
25	<i>Technology/Engineering</i>	6.2
26	<i>Earth and Space Science</i>	11
27	<i>Technology/Engineering</i>	6.3
28	<i>Technology/Engineering</i>	5.1
29	<i>Earth and Space Science</i>	9
30	<i>Technology/Engineering</i>	4.2
31	<i>Physical Science</i>	9
32	<i>Technology/Engineering</i>	3.1
33	<i>Earth and Space Science</i>	6
34	<i>Physical Science</i>	8
35	<i>Life Science</i>	7
36	<i>Life Science</i>	4
37	<i>Technology/Engineering</i>	3.2
38	<i>Physical Science</i>	13
39	<i>Life Science</i>	10
40	<i>Earth and Space Science</i>	8
41	<i>Earth and Space Science</i>	3
42	<i>Life Science</i>	18