XVI. Science and Technology/Engineering, Grade 5

Grade 5 Science and Technology/Engineering Test

The spring 2017 grade 5 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 3–5 learning standards shown in parentheses.

- Earth and Space Science (2006 framework, pages 26–29)
- Life Science (Biology) (2006 framework, pages 46–49)
- Physical Sciences (Chemistry and Physics) (2006 framework, pages 64–66)
- Technology/Engineering (2006 framework, page 86)

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 5 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 5 Science and Technology/Engineering

Session 1

DIRECTIONS

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

1 Katydids are insects that live on plants. Their bodies are adapted to look like leaves.

Which of the following best explains why katydids adapted this trait?

A. Katydids with this trait were better able to make their own food.

B. Katydids with this trait were better able to store nutrients and hibernate.

C. Katydids with this trait were better able to blend into their environment and survive.

D. Katydids with this trait were better able to communicate with other insects around them.

2 Which of the following objects would reflect the **greatest** amount of light from a flashlight?

A. a brick wall

B. a glass window

C. a bathroom mirror

D. a sheet of black paper

3 Sandstone is a sedimentary rock. Which of the following statements **best** describes how sandstone is formed?

A. Minerals left behind by dripping water harden and form rock over time.

B. Weathered rock particles form layers and are cemented over time.

C. Volcanic eruptions force molten rock to the surface, where it cools and solidifies.

D. Underground heat and pressure cause existing rock to change and form new rock.

4 The map below shows the Grand Banks area off the coast of Newfoundland, Canada.

The Grand Banks area has over 200 foggy days a year. Which of the following conditions produce the fog in the Grand Banks area?

A. dry air and fast ocean currents

B. cold air masses and high clouds

C. moist air and cold temperatures near the ocean surface

D. high air temperatures and high air pressure near the coast

5 Which of the following properties **must** be the same for two tables made from the same sample of wood?

A. hardness
B. shape
C. size
D. weight

6 Some students are trying to determine whether a material is a mineral. They ask the questions shown in the table below.

Questions
1. Does the material occur naturally?
2. Will the material break if hit with a hammer?
3. Does the material have a crystal structure?
4. How much does the material weigh?

Which two questions would **most** help the students determine whether the material is a mineral?

A. questions 1 and 2
B. questions 1 and 3
C. questions 2 and 4
D. questions 3 and 4

7 Which of the following animal behaviors **most likely** helps to change an open meadow area into an area with many trees?

A. deer feeding on new plant growth in the area each spring
B. beavers creating ponds in the area by damming up streams
C. rabbits digging burrows underground and loosening up hard soil
D. squirrels burying seeds for winter and leaving them in the ground

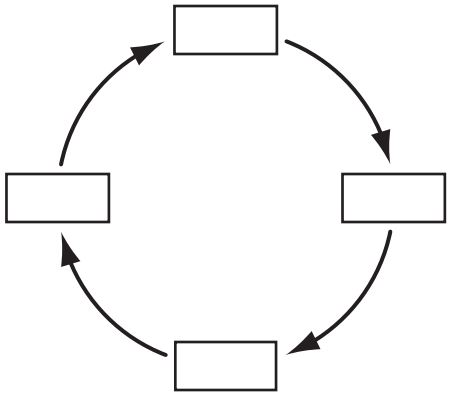
Question 8 is an open-response question.

- **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 8 in the space provided in your Student Answer Booklet.

8 In their life cycles, butterflies go through a process called metamorphosis.

a. Copy the diagram below into your Student Answer Booklet.



b. In your Student Answer Booklet, complete your diagram with the butterfly life cycle stages (larva, adult, egg, pupa) in the order that they occur.

c. Identify **two** physical characteristics of butterflies that are different in the adult stage than in the larval stage.

d. Explain why it is necessary for butterflies to have an adult stage.

Grade 5 Science and Technology/Engineering

Session 2

DIRECTIONS

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

9 Which of the following statements **best** describes the climate of an area rather than its weather conditions?

A. The summers are hot and humid.

B. The temperature at noon was 86°F.

C. Total rainfall on April 9 was 2 inches.

D. Strong winds are expected tomorrow evening.

10 A student has two plants of the same type, plant X and plant Y. Each plant is in its own pot outside in a sunny location. The student gives both plants the same amount of water and nutrients. The table below shows the student's notes about both plants.

	Plant X	**Plant Y**
Soil	moist	moist
Number of Roots	many	many
Number of Leaves	12	4
Appearance of Leaves	green	yellow and wilted
Number of Flowers	4	1
Amount of Fruit	1	0
Stem	thick and green	brown spots, small holes, bent
Other Notes	growing quickly	small insects near plant, some dry leaves fell off

Based on the student's notes, what is the **most likely** reason for the differences between the two plants?

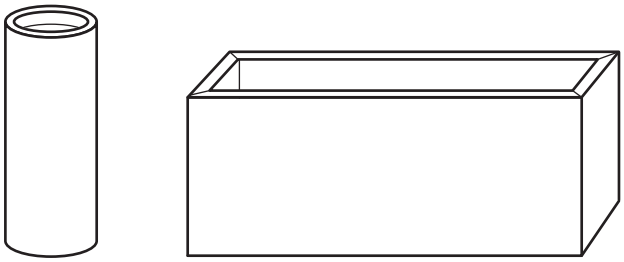
A. Plant Y's roots were damaged by insects, so it cannot make as much food as plant X can.

B. Plant Y's flowers were damaged by insects, so it cannot store as many minerals as plant X can.

C. Plant Y's fruit was damaged by insects, so it cannot attract pollinating insects as well as plant X can.

D. Plant Y's stem was damaged by insects, so it cannot move as much water to its leaves as plant X can.

11 A student uses the two containers shown below to investigate the properties of a liquid.



Container 1 **Container 2**

The student fills container 1 with a liquid and then pours all the liquid from container 1 into container 2. Based on the student's investigation, which of the following statements **best** describes a property of a liquid?

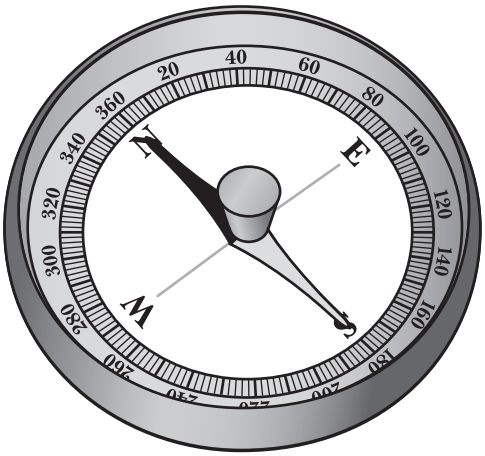
A. It takes the shape of its container.

B. It expands to completely fill its container.

C. It stays the same shape in different containers.

D. It has different weights in different containers.

12 The needle of a compass is a magnet that usually points to magnetic north, as shown below.



The compass is brought close to several objects. Which of the following objects is most likely to make the needle of the compass point in a direction other than magnetic north?

A. a wooden picnic table

B. a steel swing set

C. a glass window

D. a plastic chair

13 A student wants to model what causes day and night on Earth. The student uses a globe to represent Earth and a light bulb to represent the Sun. Pictures of the globe and light bulb are shown below.

Globe

Light bulb

How can the student use the globe and light bulb to show what causes day and night on Earth?

A. by rotating the globe near the light bulb

B. by tilting the globe and rotating the light bulb

C. by turning the light bulb on and off near the globe

D. by moving the light bulb in a circle around the globe

14 Which of the following examples **best** describes one type of energy changing into another?

A. a magnet sticking to a refrigerator

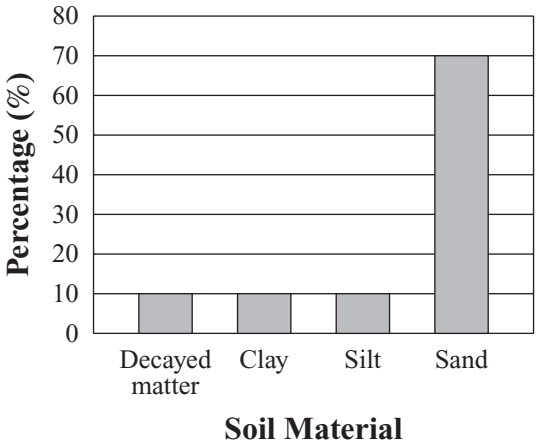
B. sound traveling through a solid wall

C. an electric heater warming up a cold room

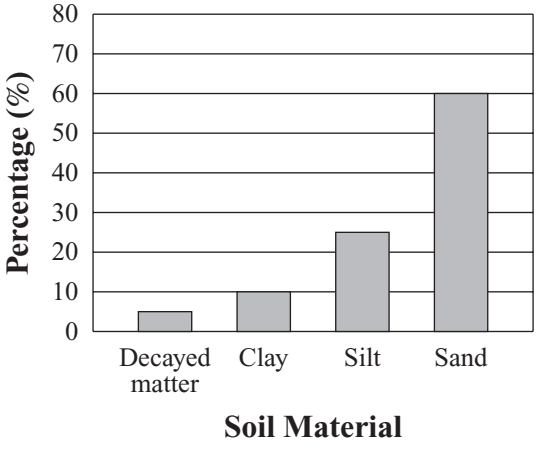
D. light rays bending as they pass through glass

15 Soil often contains different amounts of decayed matter, clay, silt, and sand. Which of the following graphs shows the best soil for growing bean plants?

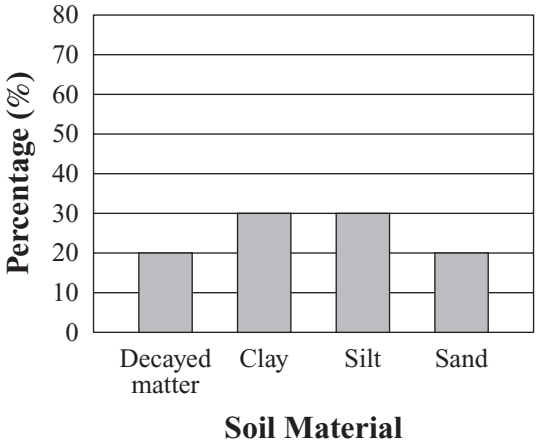
A.



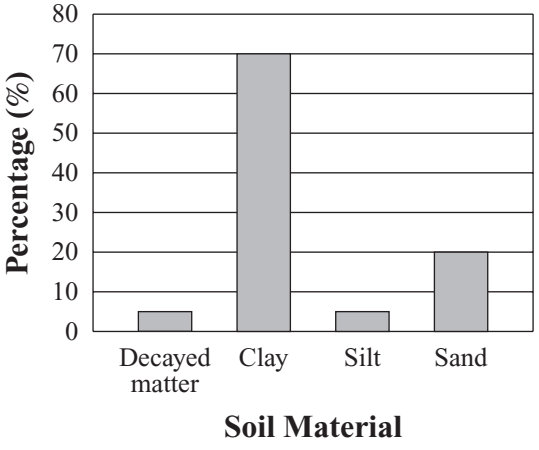
C.



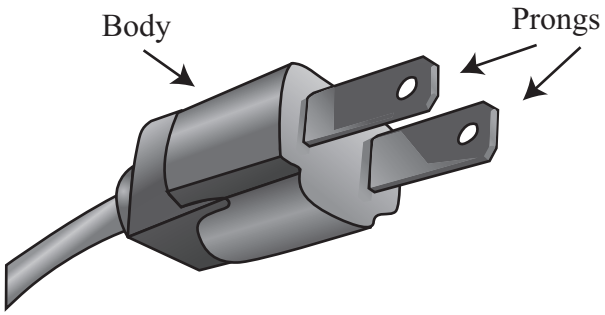
B.



D.



16 The picture below shows an electrical plug with a plastic body and metal prongs.



Which of the following **best** explains why the body of the plug is made out of plastic?

A. Plastic is a conductor.

B. Plastic is an insulator.

C. Plastic is slow to melt.

D. Plastic is easy to break.

17 How many objects in our solar system can be classified as a star?

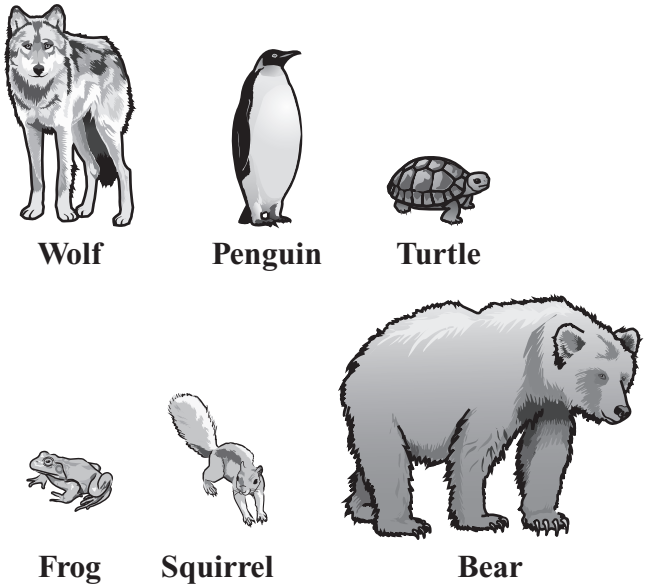
A. 0

B. 1

C. 3

D. 9

18 The pictures below show six animals.



Which chart shows these animals correctly sorted into two groups based on how they reproduce?

A.

Lay Eggs	Live Birth
penguin squirrel	wolf turtle frog bear

B.

Lay Eggs	Live Birth
penguin frog turtle	wolf squirrel bear

C.

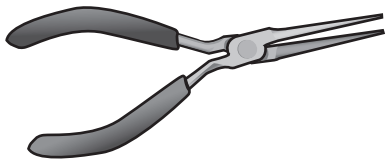
Lay Eggs	Live Birth
turtle frog	wolf penguin squirrel bear

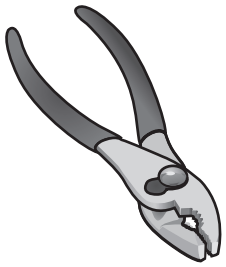
D.

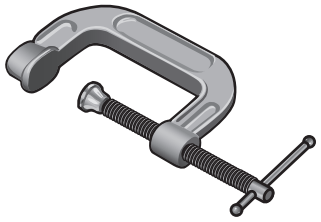
Lay Eggs	Live Birth
penguin turtle squirrel	wolf frog bear

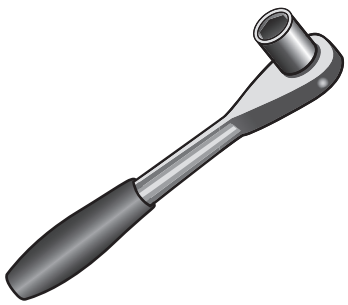
19 A student glued two pieces of wood together. The student needs to hold the two pieces of wood together tightly until the glue is fully dry the next day.

Which of the following tools is **best** for holding the two pieces of wood together until the glue is dry?

A. 

B. 

C. 

D. 

20 A scientist conducted hardness tests for four different minerals: calcite, feldspar, fluorite, and quartz. The list below shows the results of the hardness tests.

Results of Hardness Tests

1. Glass scratches fluorite and calcite.
2. Fluorite scratches calcite.
3. Feldspar and quartz scratch glass.
4. Quartz scratches feldspar.

Based on the results of the hardness tests, which mineral is the hardest?

A. calcite
B. feldspar
C. fluorite
D. quartz

Question 21 is an open-response question.

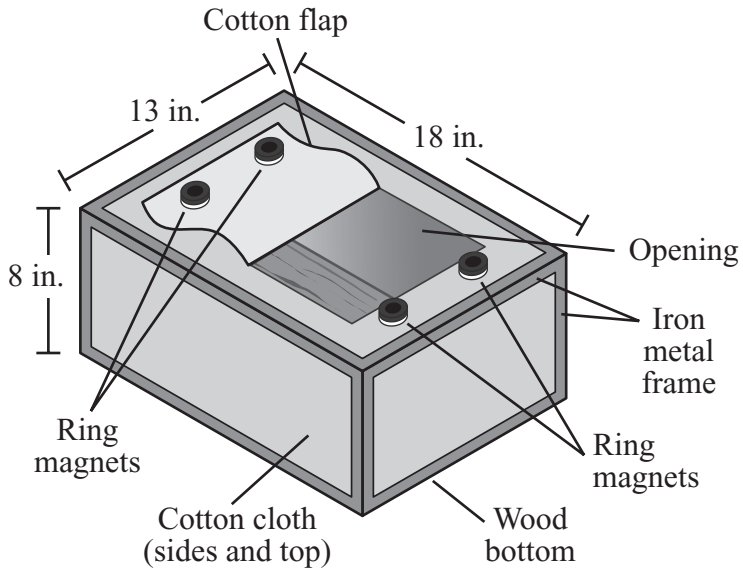
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

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

21 A student is designing a cat carrier that can be placed under a seat on an airplane. The carrier must meet the following requirements:

- The maximum carrier size is 18 in. long by 13 in. wide by 8 in. high.
- The carrier must be lightweight.
- Air must be able to flow easily through the carrier.
- The carrier must have soft sides.
- The bottom of the carrier must be waterproof.
- The carrier must be able to be folded for storage.
- The carrier must have space for the cat to turn around and lie down.

The diagram below shows the design features of a prototype that the student built.



a. Identify **two** requirements the student was trying to meet by using cotton cloth for the sides and top of the carrier.

b. Identify **two** design features (characteristics) of the prototype that do **not** meet the requirements. Explain how you know **each** feature does not meet the requirements.

The student included a flap in the prototype so a cat could be easily moved in and out. When the flap is closed, the magnets on the flap should be attracted to the magnets on the top of the carrier. However, when the student tried to close the flap, the magnets on the top of the carrier pushed the flap away.

c. Explain why the magnets pushed the flap away **and** how the magnets could be fixed.

Grade 5 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	226	*Life Science*	6	C
2	226	*Physical Science*	12	C
3	227	*Earth and Space Science*	3	B
4	227	*Earth and Space Science*	11	C
5	228	*Physical Science*	1	A
6	228	*Earth and Space Science*	1	B
7	228	*Life Science*	10	D
8	229	*Life Science*	4	
9	230	*Earth and Space Science*	9	A
10	231	*Life Science*	2	D
11	232	*Physical Science*	2	A
12	232	*Physical Science*	10	B
13	233	*Earth and Space Science*	14	A
14	233	*Physical Science*	5	C
15	234	*Earth and Space Science*	5	B
16	235	*Physical Science*	7	B
17	235	*Earth and Space Science*	13	B
18	236	*Life Science*	1	B
19	237	*Technology/Engineering*	1.2	C
20	237	*Earth and Space Science*	2	D
21	238	*Technology/Engineering*	2.3	

* 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 5 Science and Technology/Engineering
Spring 2017 Unreleased Common Items:
Reporting Categories and Standards

Item No.	Reporting Category	2006 Standard
22	*Earth and Space Science*	7
23	*Physical Science*	2
24	*Technology/Engineering*	1.1
25	*Earth and Space Science*	12
26	*Earth and Space Science*	4
27	*Life Science*	5
28	*Earth and Space Science*	10
29	*Technology/Engineering*	2.3
30	*Physical Science*	8
31	*Physical Science*	4
32	*Earth and Space Science*	6
33	*Life Science*	6
34	*Life Science*	11
35	*Life Science*	8
36	*Life Science*	7
37	*Physical Science*	4
38	*Life Science*	3
39	*Technology/Engineering*	2.2
40	*Life Science*	7
41	*Life Science*	9
42	*Physical Science*	3