XI. Science and Technology/Engineering, Grade 8

Grade 8 Science and Technology/Engineering Test

The spring 2004 Grade 8 MCAS Science and Technology/Engineering Test was based on learning standards in the Massachusetts *Science and Technology/Engineering Curriculum Framework* (2001). The *Framework* identifies the four major content strands listed below. Page numbers for the grade 6–8 learning standards appear in parentheses.

- Earth and Space Science (*Framework*, pages 29–30)
- Life Science (Biology) (*Framework*, pages 46–48)
- Physical Sciences (Chemistry and Physics) (*Framework*, pages 60–62)
- Technology/Engineering (*Framework*, pages 76–79)

The *Science and Technology/Engineering Curriculum Framework* is available on the Department website at www.doe.mass.edu/frameworks/scitech/2001/0501.pdf.

In *Test Item Analysis Reports* and on the *Subject Area Subscore* pages of the MCAS *School Reports* and *District Reports*, Science and Technology/Engineering test results are reported under four MCAS reporting categories, which are identical to the four *Science and Technology/Engineering Curriculum Framework* content strands listed above.

Test Sessions and Content Overview

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

Reference Materials and Tools

No reference tools or materials were allowed during any grade 8 Science and Technology/Engineering test session, with the exception of bilingual word-to-word dictionaries used by limited English proficient students.

Cross-Reference Information

The table at the conclusion of this chapter indicates each item's reporting category and the *Framework* learning standard it assesses. The correct answers for multiple-choice questions are also displayed in the table.

HOW TO ANSWER OPEN-RESPONSE QUESTIONS

Be sure to

- read all parts of each question carefully.
- make each response as clear, complete, and accurate as you can.
- check your answers.

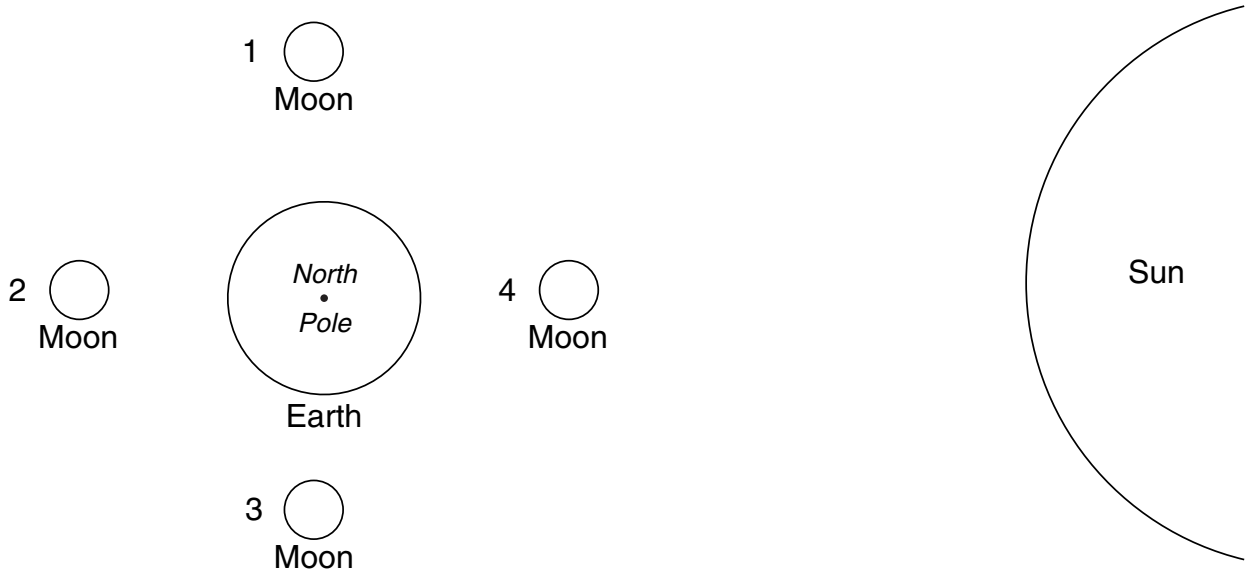
Science and Technology/Engineering

SESSION 1

DIRECTIONS

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

1 The diagram below shows a polar projection of Earth, the Sun, and four positions of the Moon.



Which position of the Moon could cause a solar eclipse?

A. 1

B. 2

C. 3

D. 4

2 In an effort to preserve wildlife on his farm in Massachusetts, a farmer decides to stop using a 10-acre field. The farmer fences off the area, stops cutting the grass, and stops allowing livestock to graze on it.

After twenty years, the area would **most likely**

A. be covered with moss and rocks.

B. be a mature hardwood forest.

C. be grown over with bushes and small trees.

D. be barren due to lack of maintenance.

3 What division of a furniture company is **most** responsible for getting the furniture to the retail stores?

A. distribution

B. marketing

C. quality control

D. research

4 In making a pizza, which process involves a chemical change?

A. mixing spices for the sauce

B. slicing pepperoni for the topping

C. spreading cheese on the pizza

D. baking the dough to form the crust

5 An earthquake is caused by sudden shifts in which of the following layers of Earth?

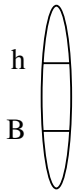
A. outer core

B. crust

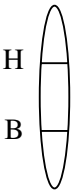
C. inner core

D. mesosphere

6 The figures below represent two chromosomes from an animal.



Chromosome #6 from father



Chromosome #6 from mother

Using the table below that describes the traits carried on Chromosome #6, which trait can the animal inherit **only** from its mother?

Genes on Chromosome #6	Trait
H	long hair
h	short hair
B	black hair
b	white hair

A. long hair

B. black hair

C. white hair

D. short hair

7 Several students are entering a bridge building contest that requires using ice cream sticks and glue to construct the strongest bridge possible. The bridges must be 5 in. wide and span a length of 18 in.

Which of the following tests is the **most** accurate way to determine the strongest span design for these bridges?

A. roll toy cars across each bridge until it collapses

B. place concrete construction blocks on top of each bridge until it collapses

C. stack coins on both ends of each bridge until it collapses

D. place D-cell batteries at the center of each bridge until it collapses

8 Which body system's primary function is the continuation of the species?

A. digestive

B. nervous

C. excretory

D. reproductive

9 What is the smallest particle of the element gold (Au) that can still be classified as gold?

A. atom

B. molecule

C. neutron

D. proton

10 Many areas of Massachusetts have small deep ponds called kettle ponds. Which of the following **best** explains the formation of these ponds?

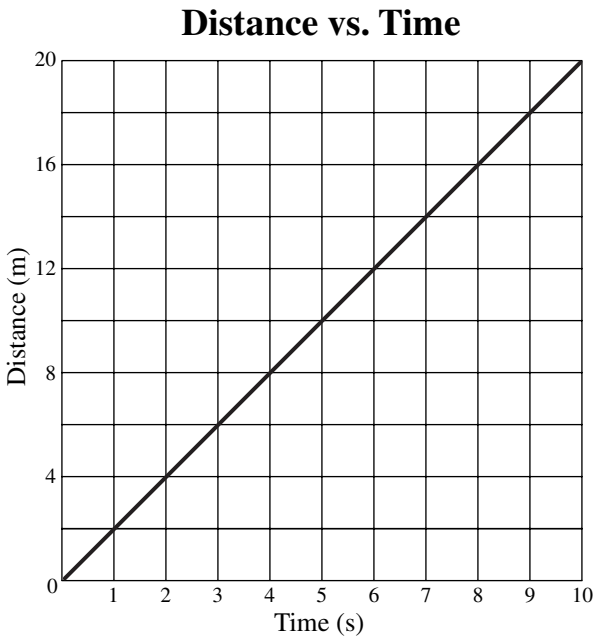
A. avalanche

B. wind erosion

C. glacial depression

D. sediment deposition

11 The graph below relates distance and time for a moving object.



What is the speed of the object represented by the graph above?

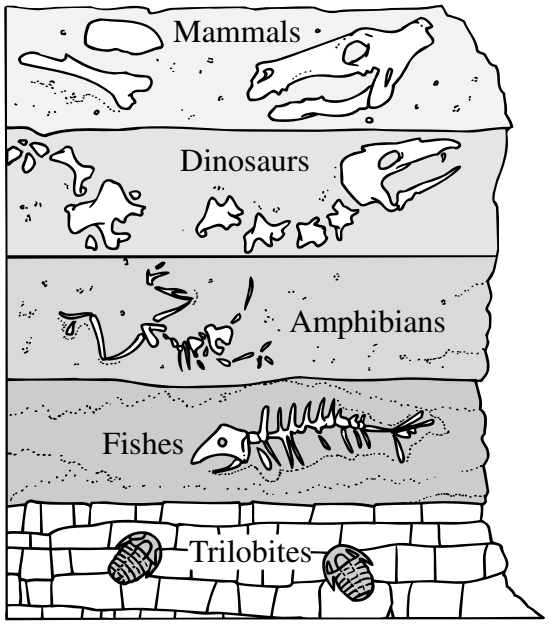
A. 0.5 m/s

B. 2 m/s

C. 10 m/s

D. 20 m/s

12 The diagram below represents a cross-section of a cliff. It shows several rock layers containing fossils.



Which of the following layers of rock is **most likely** the youngest?

A. the layer containing trilobites

B. the layer containing fishes

C. the layer containing amphibians

D. the layer containing dinosaurs

13 When a balloon is filled with air and suddenly released, it will fly around the room as the air escapes. If compared to space transportation, the escaping air is **most** similar to what subsystem of a spacecraft?

A. guidance

B. propulsion

C. support

D. suspension

14 In the process of photosynthesis, green plants use energy from sunlight to make which product?

A. carbon dioxide

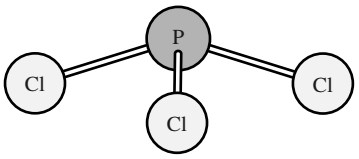
B. chlorophyll

C. sugar

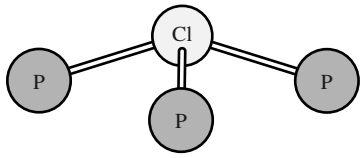
D. DNA

15 Which of the following models correctly represents the compound phosphorus trichloride (PCl_3)?

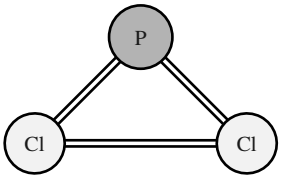
A.



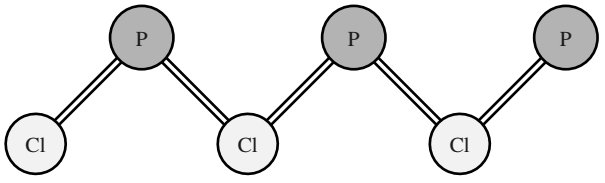
B.



C.



D.



16 The starch and water molecules in potato cells are stored in what organelle?

A. mitochondrion

B. nucleus

C. ribosome

D. vacuole

17 In which situation would it be an advantage to ship a product by plane rather than by truck?

A. The product is very heavy and relatively large.

B. The product is sensitive to changes in pressure.

C. The product must be delivered a long distance soon after it is made.

D. The product must be delivered to several sites located within a radius of 50 miles.

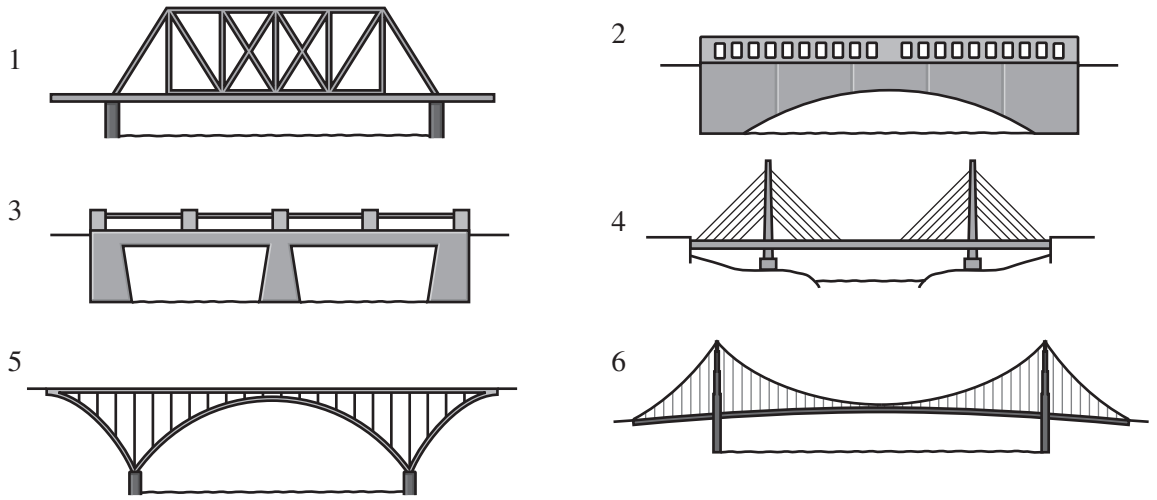
DIRECTIONS

Questions 18 and 19 are open-response questions.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH 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 18 in the space provided in your Student Answer Booklet.

18 The figure below shows examples of bridges numbered 1 through 6.



a. Identify **one** example from the figure that represents a type of arch bridge.

b. Explain how an arch bridge is different from a beam bridge.

c. Identify **one** example from the figure that represents a type of beam bridge.

d. Explain how a beam bridge is different from a suspension bridge.

Write your answer to question 19 in the space provided in your Student Answer Booklet.

19 The process of removing salt from ocean water is called desalination. Some coastal cities use this process to obtain fresh water.

a. Describe a simple process that can be performed in the laboratory to separate the salt from the water. Be sure to include an explanation of how each substance can be collected into its own separate container.

b. What makes it possible to separate the solution into fresh water and salt?

Science and Technology/Engineering

SESSION 2

DIRECTIONS

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

20 A class conducts an experiment to determine the best color to paint a solar water heater that they plan to build.

For their experimental test, the students have four identical cans. They paint one black, one green, one red, and one white. Each can is filled with 500 mL of 22°C water, and is allowed to sit in the sun for two hours.

Which color can will have the **greatest** increase in water temperature?

A. black

B. green

C. red

D. white

21 Of the following symbols, which represents a biological hazard?

A. 

B. 

C. 

D. 

22 The heath hen, an extinct small wild fowl, was a relative of the prairie chicken. Which of the following **most likely** caused extinction of the heath hen?

A. overhunting

B. stable climate

C. plentiful food supply

D. abundant nesting sites

23 An airplane takes off from Boston for the 980 km trip to Detroit. The plane lands two hours later. Which of the following **best** describes the average speed and direction of the airplane's flight?

A. 325 km/h W

B. 490 km/h W

C. 980 km/h W

D. 1960 km/h W

24 Support cables in a suspension bridge are **most** stressed by which of the following forces?

A. shear

B. torsion

C. tension

D. compression

25 In a laboratory, a sealed container with 100 g of steam is cooled until all the steam becomes a liquid. The container is then cooled further until all the water becomes a solid.

Which of the following remains constant during both of these changes?

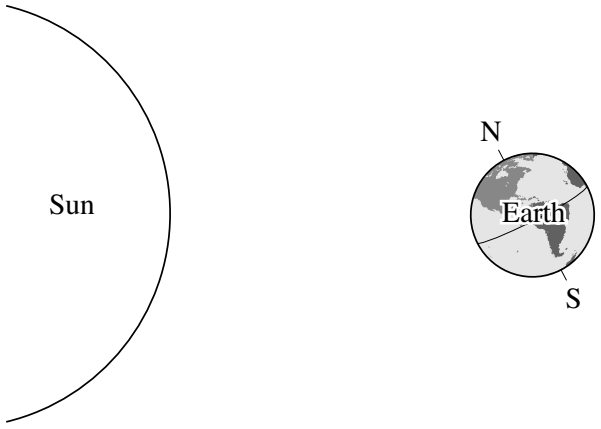
A. the mass of the water

B. the pressure in the container

C. the total energy of the water

D. the position of the atoms in the container

26 The illustration below shows Earth and the Sun.



(Not to scale)

What season does the Southern Hemisphere experience when Earth and the Sun are in the positions shown?

A. fall

B. spring

C. summer

D. winter

27 Which of the following is an example of an assistive device?

A. contact lens

B. motorcycle

C. raincoat

D. coffee pot

28 How would the measurable properties of a golf ball change if it were moved from Earth to the Moon?

A. It would have the same mass, but a different weight.

B. It would have the same weight, but a different mass.

C. It would have the same density, but a different mass.

D. It would have the same mass, but a different density.

29 About how many Earth days does it take the Moon to travel around Earth?

A. 1

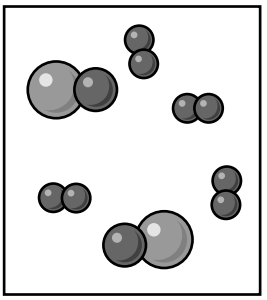
B. 27

C. 180

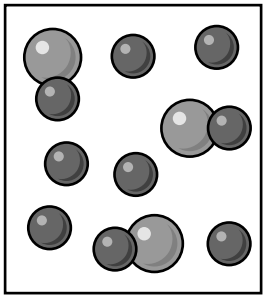
D. 365

30 Which of the following illustrations represents a pure substance?

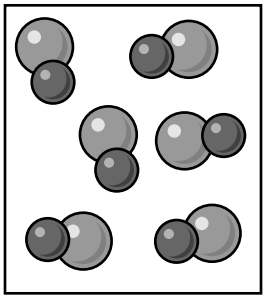
A.



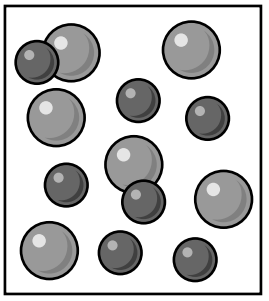
B.



C.



D.



31 Which of the following is **most** responsible for the decay of dead organisms?

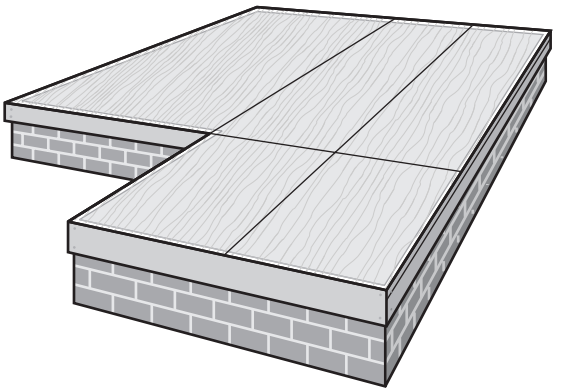
A. water

B. mammals

C. microorganisms

D. nitrogen

32 The illustration below shows sheets of plywood that are nailed to floor joists.



The sheets of plywood are called the

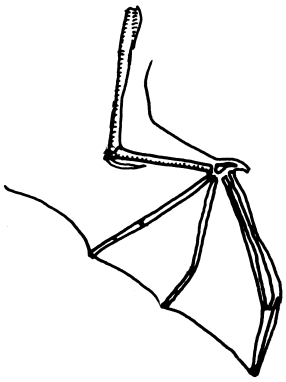
A. beam.

B. decking.

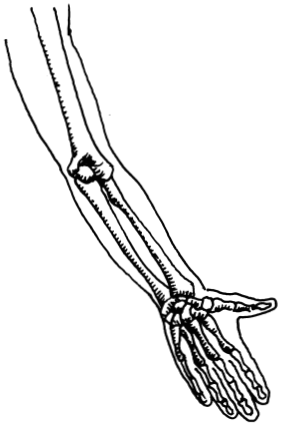
C. truss.

D. foundation.

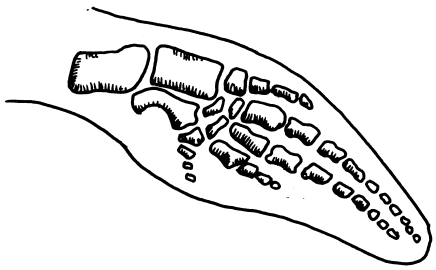
33 The pictures below show bone structures in three animals.



Bat Wing



Human Arm



Dolphin Flipper

The similarity in structure of the bones of these animals suggests that

A. the size of these bones is the same.

B. these species share common ancestors.

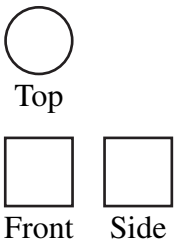
C. these species developed at the same time and location.

D. the chemical make-up of these animals is exactly the same.

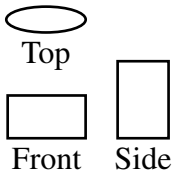
34 The following illustration shows a design shape.

Which of the following is an accurate orthographic projection of the design shown above?

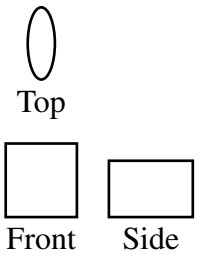
A.



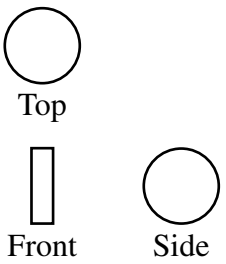
B.



C.



D.



35 Which of the following planets has the shortest orbit around the Sun?

A. Earth

B. Mars

C. Mercury

D. Venus

36 A flowing stream contains water at 18ºC. Cans of soft drinks at 28ºC are lowered into the stream. Which of the following will **most likely** occur?

A. The soft drink cans will absorb cold energy from the stream's water.

B. The cans will cool until their temperature is the same as the stream's.

C. The temperature of the soft drinks will not change since the cans are sealed.

D. The temperature of the cans will decrease to freezing as long as the stream is flowing.

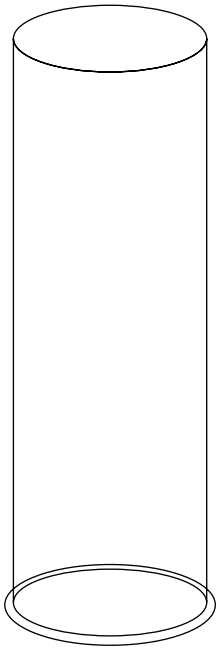
DIRECTIONS

Questions 37 through 39 are open-response questions.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH 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 37 in the space provided in your Student Answer Booklet.

37 The picture below shows a large cylinder.



At a science museum, a demonstration is performed using this cylinder, a small iron ball, and the liquids mercury, turpentine, and water. Liquid mercury with a density of 13.6 g/mL, turpentine with a density of 0.8 g/mL, and water with a density of 1.0 g/mL are poured into the cylinder.

a. Draw the cylinder shown above in your Student Answer Booklet. Draw and label the arrangement of these three liquids within the cylinder. Explain the reasons for your arrangement of the liquids.

b. The small iron ball with a density of 7.9 g/mL is dropped into the cylinder you have drawn. Describe where the ball will stop. Explain your answer.

Write your answer to question 38 in the space provided in your Student Answer Booklet.

38 A mushroom is a member of the Kingdom Fungi. Members of Kingdom Fungi are unique because they digest their food outside their bodies and then absorb the nutrients.

You may organize your answer for parts a, b, and c in a chart.

a. Name **two** other Kingdoms of living organisms.

b. Give **one** example of an organism that is classified into each Kingdom you described in part a.

c. For each Kingdom that you selected, describe **two** characteristics that are used to classify organisms into that Kingdom.

Write your answer to question 39 in the space provided in your Student Answer Booklet.

39 Earth's crust and rigid upper mantle are broken into enormous slabs called tectonic plates that interact at plate boundaries. The three types of plate boundaries are transform, divergent, and convergent.

a. Describe the plate movements at **two** of these boundaries.

b. Give one example of a formation created at **each** of the boundaries that you described in part a.

Grade 8 Science and Technology/Engineering
Spring 2004 Released Items:
Reporting Categories, Standards, and Correct Answers

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC)*
1	256	*Earth and Space Science*	9	D
2	257	*Life Science (Biology)*	17	C
3	257	*Technology/Engineering*	4.3	A
4	257	*Physical Sciences (Chemistry and Physics)*	10	D
5	257	*Earth and Space Science*	5	B
6	258	*Life Science (Biology)*	7	A
7	258	*Technology/Engineering*	2.1	D
8	258	*Life Science (Biology)*	6	D
9	259	*Physical Sciences (Chemistry and Physics)*	6	A
10	259	*Earth and Space Science*	6	C
11	259	*Physical Sciences (Chemistry and Physics)*	12	B
12	260	*Earth and Space Science*	7	D
13	260	*Technology/Engineering*	6.3	B
14	260	*Life Science (Biology)*	16	C
15	261	*Physical Sciences (Chemistry and Physics)*	5	A
16	261	*Life Science (Biology)*	4	D
17	261	*Technology/Engineering*	6.1	C
18	262	*Technology/Engineering*	5.2	
19	263	*Physical Sciences (Chemistry and Physics)*	8	
20	264	*Earth and Space Science*	3	A
21	264	*Technology/Engineering*	3.4	D
22	265	*Life Science (Biology)*	12	A
23	265	*Physical Sciences (Chemistry and Physics)*	11	B
24	265	*Technology/Engineering*	5.3	C
25	265	*Physical Sciences (Chemistry and Physics)*	4	A
26	266	*Earth and Space Science*	11	D
27	266	*Technology/Engineering*	7.1	A
28	266	*Physical Sciences (Chemistry and Physics)*	1	A
29	267	*Earth and Space Science*	10	B
30	267	*Physical Sciences (Chemistry and Physics)*	8	C
31	268	*Life Science (Biology)*	15	C
32	268	*Technology/Engineering*	5.1	B
33	269	*Life Science (Biology)*	11	B
34	270	*Technology/Engineering*	2.2	A
35	270	*Earth and Space Science*	10	C
36	270	*Physical Sciences (Chemistry and Physics)*	16	B
37	271	*Physical Sciences (Chemistry and Physics)*	2	
38	272	*Life Science (Biology)*	1	
39	272	*Earth and Space Science*	5	

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