

# **SCIENCE FULL-LENGTH PRACTICE TESTS 4**

**SCIENCE TEST***40 Minutes–40 Questions*

**Directions:** There are six passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

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**Passage I**

Two ways to measure the quality of soil are *bulk density* and the *soil organic matter test*, SOM (a measure of the active organic content). High quality soil provides structure to plants and moves water and nutrients, so plants grow in larger quantities, leading to higher crop yields at harvest.

Bulk density is measured as the dry weight of a sample of soil divided by the volume of the sample. A bulk density measure above  $1.33 \text{ g/cm}^3$  can negatively affect soil quality. Figure 1 shows the bulk density levels for 5 different years at Fields A and B.

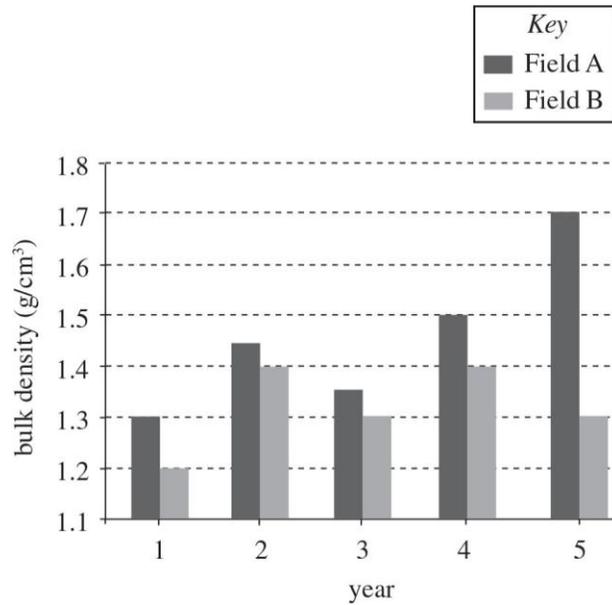


Figure 1

Table 1 shows how soil quality varies with SOM. Table 2 shows the average SOM of each field for each of the 5 years.

Table 1	
SOM	Soil quality rating
< 0.25	poor
0.25 to 0.50	fair
0.51 to 0.75	good
> 0.75	excellent

Table 2	
Field	Average SOM
A	0.89
B	0.28

Figure 2 shows the total crop yield at each field at the end of the 5 years.

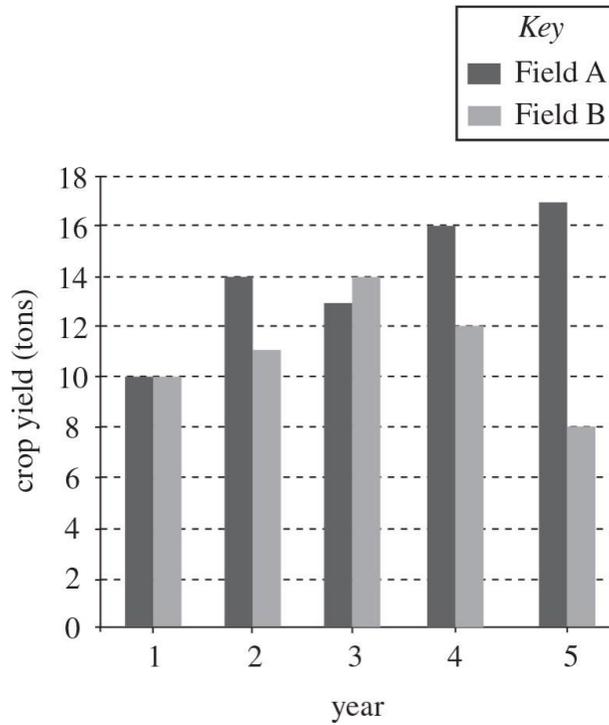


Figure 2

**1.** Which set of data best supports the claim that Field A has *lower* soil quality than Field B ?

- A. Figure 1
- B. Figure 2
- C. Table 1
- D. Table 2

**2.** If 8 tons or fewer in crop yields were considered a failed harvest, in which year and in which field would there have been a failed harvest?

- Z. Field A in Year 1
- G. Field A in Year 3
- H. Field B in Year 4

## J. Field B in Year 5

- 3.** Suppose a new crop rotation for Field B included legumes and other deep-rooted and high-residue crops. The SOM of this field will most likely change in which of the following ways? The SOM will:
- A.** decrease, because soil quality is likely to increase.
  - B.** decrease, because soil quality is likely to decrease.
  - C.** increase, because soil quality is likely to increase.
  - D.** increase, because soil quality is likely to decrease.
- 4.** Based on Figures 1 and 2, consider the average bulk density and the average crop yields for Fields A and B over the study period. Which site had the lower average crop yield, and which site had the lower average bulk density?
- F.** lower crop yield: Field A, lower bulk density: Field A
  - G.** lower crop yield: Field B, lower bulk density: Field B
  - H.** lower crop yield: Field A, lower bulk density: Field B
  - J.** lower crop yield: Field B, lower bulk density: Field A
- 5.** As soil quality improves, the number of earthworms increases. Students hypothesized that more earthworms would be found in Field B than in Field A. Are the data presented in Table 2 consistent with this hypothesis?
- A.** Yes; based on SOM, Field B had a soil quality rating of excellent and Field A had a soil quality rating of fair.
  - B.** Yes; based on SOM, Field B had a soil quality rating of fair and Field A had a soil quality rating of poor.
  - C.** No; based on SOM, Field B had a soil quality rating of fair and Field A had a soil quality rating of excellent.

D. No; based on SOM, Field B had a soil quality rating of poor and Field A had a soil quality rating of fair.

6. The restrictive bulk-density threshold of a soil is the maximum bulk density under which plants roots can still grow effectively. The restrictive bulk-density threshold for two types of soil is shown below.

Soil type	Restrictive threshold (g/cm <sup>3</sup> )
Sand	1.80
Clay	1.55

Based on the table above and the information in the Figures 1 and 2, is the soil in Field A more likely primarily sand or clay?

- F. Sand, because in Year 3 the bulk density of Field A was less than 1.55 and the crop yield was high.
- G. Sand, because in Year 5 the bulk density of Field A was greater than 1.55 and the crop yield was high.
- H. Clay, because in Year 3 the bulk density of Field A was less than 1.55 and the crop yield was high.
- J. Clay, because in Year 5 the bulk density of Field A was greater than 1.55 and the crop yield was high.

## Passage II

*Ferric oxide* (Fe<sub>2</sub>O<sub>3</sub>) is more commonly known as rust. This is produced in a reaction between iron, a common metal, and water, H<sub>2</sub>O.



Table 1 shows the amount of Fe<sub>2</sub>O<sub>3</sub>, in grams, produced over time in various salt solutions at 20°C. In 3 separate trials, 15 grams of Fe were

added to 100 mL of a salt solution. Solutions A–C were identical except for the difference in salt concentration, which was measured in mass percent.

Solution	Salt concentration	Mass of Fe <sub>2</sub> O <sub>3</sub> (g) produced by:			
		Day 1	Day 2	Day 3	Day 4
A	0.5%	0.11	0.23	0.51	0.73
B	1.5%	0.46	0.81	1.21	1.74
C	4.5%	0.76	2.03	2.65	3.21

The Solution C trial was repeated 4 times, but in each trial, an equal amount of 1 of 4 rust inhibitors was added to the solution (see Figure 1).

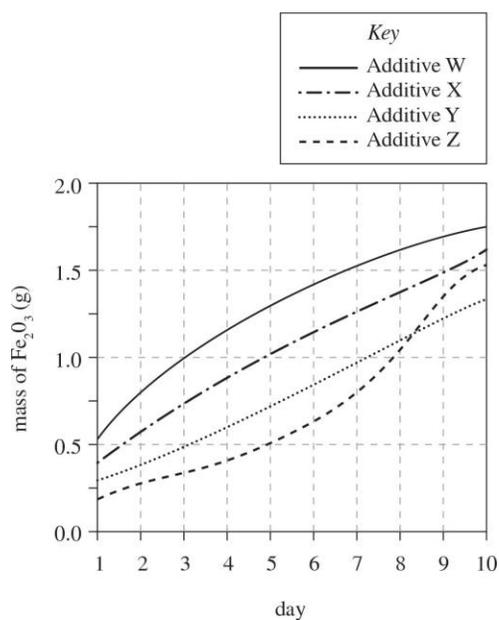


Figure 1

7. Which of the following rust inhibitors was *most* effective at inhibiting rust over the first 5 days?

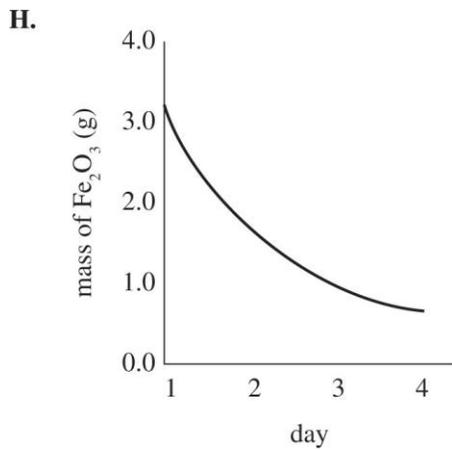
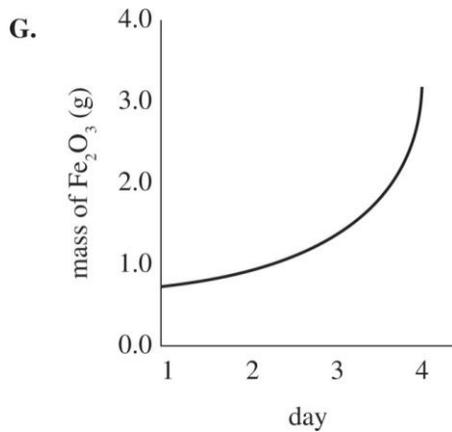
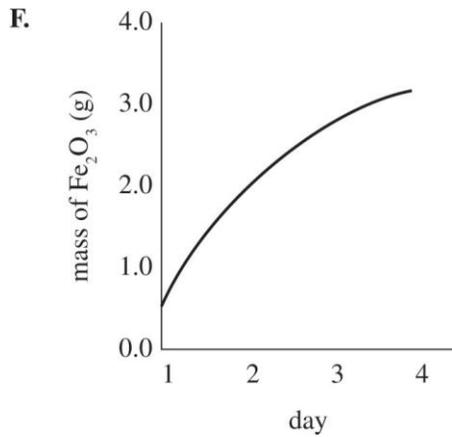
- A. Additive W
- B. Additive X
- C. Additive Y

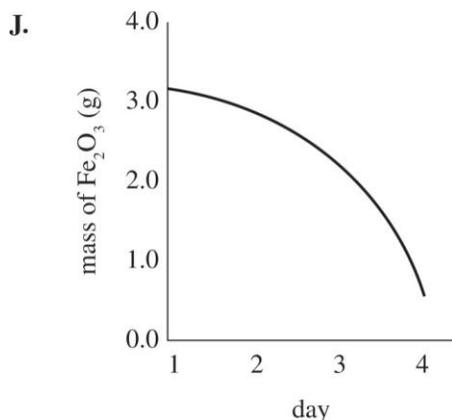
**D. Additive Z**

- 8.** Based on Table 1, if the amount of  $\text{Fe}_2\text{O}_3$  produced by Day 5 had been measured for Solution B, it would most likely have been:
- F.** less than 1.21 g.
  - G.** between 1.21 g and 1.74 g.
  - H.** between 1.74 g and 2.65 g.
  - J.** greater than 2.65 g.
- 9.** In the experiments shown in Table 1 and Figure 1, by measuring the amount of  $\text{Fe}_2\text{O}_3$ , the experimenters could also determine the rate at which:
- A.**  $\text{H}_2$  was converted into  $\text{H}_2\text{O}$ .
  - B.**  $\text{H}_2\text{O}$  was converted into  $\text{H}_2$ .
  - C.** Fe was converted into  $\text{H}_2\text{O}$ .
  - D.**  $\text{H}_2\text{O}$  was converted into Fe.
- 10.** Consider the amount of  $\text{Fe}_2\text{O}_3$  produced by Solution C without any added inhibitors on Day 1. Based on Table 1 and Figure 1, the Solution C sample with Additive X produced approximately the same amount of  $\text{Fe}_2\text{O}_3$  by which of the following days?
- F.** Day 1
  - G.** Day 3
  - H.** Day 6
  - J.** Day 10
- 11.** According to Table 1, what was the amount of  $\text{Fe}_2\text{O}_3$  produced by Solution A from the time the amount was measured on Day 2 until the time the amount was measured on Day 3 ?
- A.** 0.23 g
  - B.** 0.28 g

- C. 0.51 g
- D. 0.74 g

12. Based on Table 1, which graph best shows how the amount of  $\text{Fe}_2\text{O}_3$  produced by Solution C without any additives changed over time?





### Passage III

Some physics students conducted experiments to study forces and springs. They used several identical springs attached to a horizontal board, shown below in Figure 1.

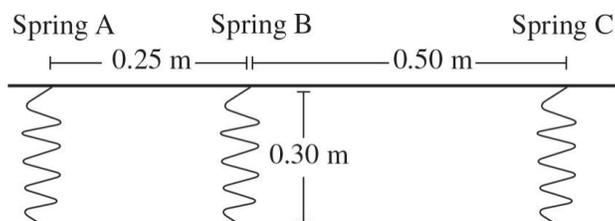


Figure 1

The length of each spring was 0.30 m when there were no weights attached. The springs had identical spring constants. When weights were attached, the length of the springs increased as the force of the weights stretched the springs downwards. The length the springs stretched was proportional to the force of the weight.

#### *Experiment 1*

The students attached different weights to two springs at once. When the springs stopped oscillating and came to a rest, the students measured their length. In Trial 1, a 10.0 N weight was attached to Spring A and Spring B, which were attached 0.25 m apart on the board. In Trial 2, a 15.0 N weight was attached to Spring A and Spring B. In Trial 3, a 20.0 N weight

was attached to Spring A and Spring B. The effects of the weights on Springs A and B for the three trials are shown below in Figure 2.

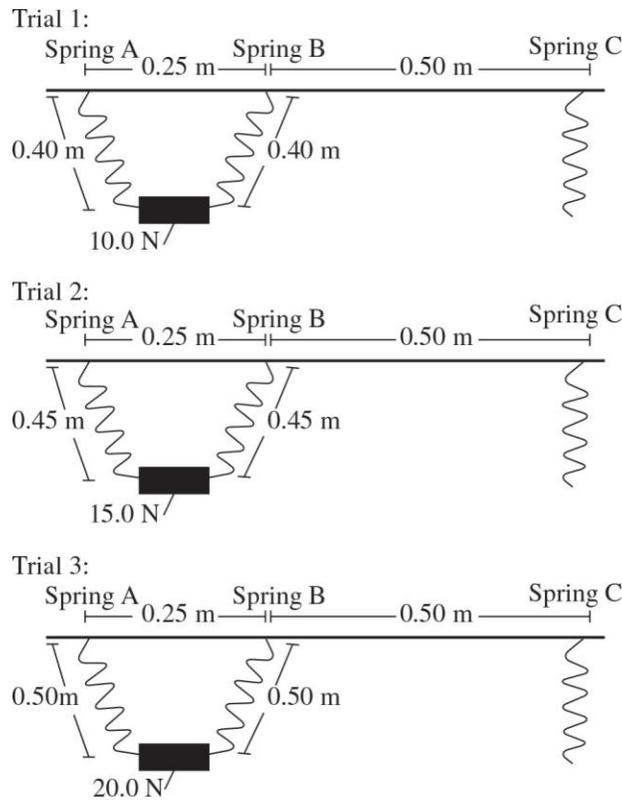


Figure 2

### Experiment 2

The students attached a 0.25 m board with a high friction surface to Spring B and Spring C (see Figure 3). The students then placed a 5.0 N weight at different locations along the board. Because of the high friction surface, the weights stayed in place when the board was at an angle.

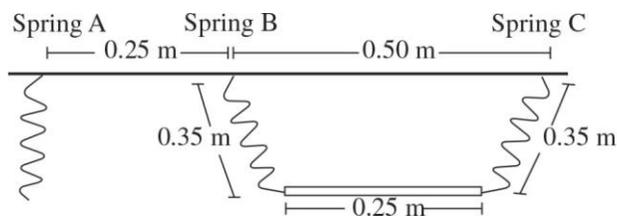
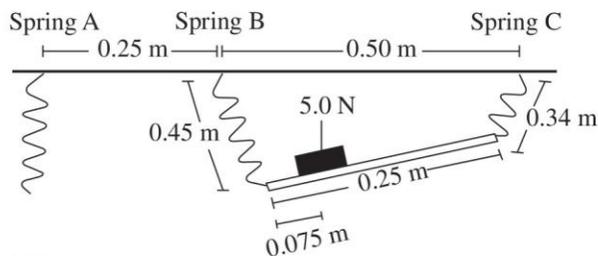


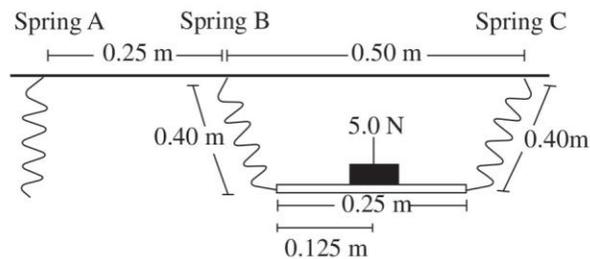
Figure 3

In each of these 3 trials, a 5.0 N weight was placed at various distances along the board from the attachment with Spring B (see Figure 4). In Trial 4, the weight was placed so its center was 0.075 m along the board from the attachment with Spring B. In Trial 5, the weight was placed so its center was 0.125 m along the board from the attachment with Spring B. In Trial 6, the weight was placed so its center was 0.200 m along the board from the attachment with Spring B. The effects of the weight position on the lengths of Springs B and C for the 3 trials are also shown in Figure 4.

Trial 4:



Trial 5:



Trial 6:

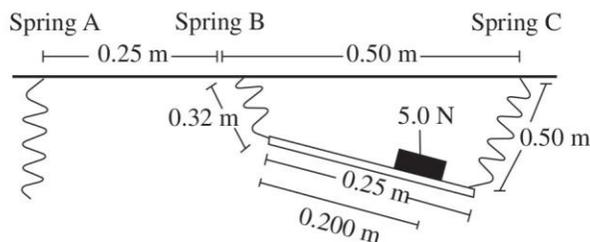
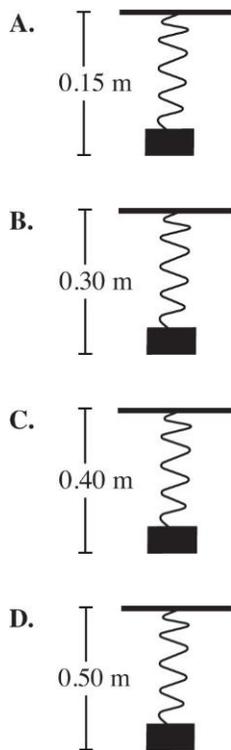


Figure 4

- 13.** In a new study, suppose the students had placed a 10.0 N weight on Spring A only. Which of the following drawings most likely represents the results of this experiment?



**14.** In Experiment 2, as the distance between the 5.0 N weight and the attachment of the board to Spring B increased, the force exerted on Spring B:

- F. increased only.
- G. decreased only.
- H. increased, then decreased.
- J. decreased, then increased.

**15.** Which of the following statements best describes the most likely reason that the students used identical springs in Trials 1–3 ?

- A. To ensure that the springs stretched similarly when a weight was attached
- B. To ensure that the springs did not share the weight evenly
- C. To compensate for the effects of oscillation on the results of the experiment
- D. To compensate for the weight of the board exerted on each of the springs

- 16.** Based on the results of Trials 1 and 5, the weight of the board used in Experiment 2 was:
- F.** 0 N.
  - G.** 2.5 N.
  - H.** 5.0 N.
  - J.** 10.0 N.
- 17.** In which of the following trials in Experiment 2, if any, was the force exerted by the weight and the board equally distributed between Springs B and C ?
- A.** Trial 4
  - B.** Trial 5
  - C.** Trial 6
  - D.** None of the trials
- 18.** The elastic potential energy of a spring is determined by both the spring constant and the amount of deformation the spring is experiencing. Assume that the spring constant is the same in all of the trials in Experiment 2. Was the elastic potential energy of Spring C higher in Trial 5 or Trial 6 ?
- F.** In Trial 5, because the force of the weight on Spring C was greater in Trial 5.
  - G.** In Trial 5, because the force of the weight on Spring C was less in Trial 5.
  - H.** In Trial 6, because the force of the weight on Spring C was greater in Trial 6.
  - J.** In Trial 6, because the force of the weight on Spring C was less in Trial 6.
- 19.** Suppose another trial had been conducted in Experiment 2 in which the same weight had been placed 0.150 m from the attachment of the board to Spring B. Spring B would most likely have extended:

- A. less than 0.32 m.
- B. between 0.32 m and 0.40 m.
- C. between 0.40 and 0.45 m.
- D. more than 0.45 m.

**Passage IV**

Sodium chloride, or salt, is used to de-ice roads and sidewalks during the winter because it lowers the freezing point of water. Water with sodium chloride freezes at a lower temperature than water alone, so putting sodium chloride on icy sidewalks and roads can cause the ice to melt. Sodium chloride is highly effective as a de-icer and is given a *de-icer proficiency rating* of 100. Distilled water is ineffective as a de-icer and is given a de-icer proficiency rating of 0.

Different proportions of sodium chloride and distilled water were combined to create mixtures with de-icer proficiency ratings between 0 and 100.

Table 1		
De-icer proficiency rating	Volume of distilled water	Volume of sodium chloride
100	0 ml	50 ml
80	10 ml	40 ml
60	20 ml	30 ml
40	30 ml	20 ml
20	40 ml	10 ml
0	50 ml	0 ml

*Experiment 1*

A 5 g cube of ice, frozen from distilled water, was submerged in 50 mL of each de-icing mixture listed in Table 1. After 300 seconds, the portion of the cube that had not been melted was removed and weighed. The de-icing

rate was calculated by determining the weight of ice melted per second. By doing this, it was possible to determine the de-icer proficiency rating for a solution based on the rate at which ice was melted.

### *Experiment 2*

The addition of magnesium chloride to a de-icer changes its de-icer proficiency rating. Different amounts of magnesium chloride were added to 50 mL samples of sodium chloride. Each de-icing mixture was tested under the same conditions as Experiment 1, and the measured de-icing rate was used to calculate the de-icer proficiency rating. The results are shown in Figure 1.

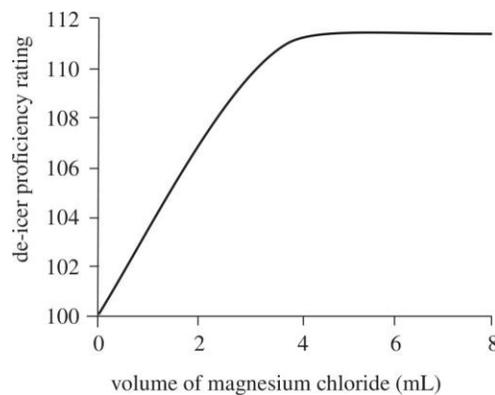


Figure 1

### *Experiment 3*

The *temperature de-icing minimum* (TDM) is the minimum de-icer proficiency rating necessary for a de-icing solution to have any effect on ice at a given temperature. Four 50 mL samples were prepared of each De-icers A and B and a 5 g of cube of ice was placed into each sample. The samples were then placed in freezers at four different temperatures. Table 2 shows the de-icer proficiency rating determined for each de-icer at each freezer temperature and the known TDM for that temperature.

Table 2
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Freezer temperature	TDM	Proficiency rating of:	
		De-icer A	De-icer B
-10°C	24.1	90.3	70.1
-25°C	36.9	78.9	64.9
-50°C	49.7	68.8	59.7
-75°C	52.3	56.6	51.7

**20.** Suppose a mechanic wants to produce a sodium chloride and magnesium chloride de-icing solution with a proficiency rating of 106. If the mechanic includes 5 *liters* of sodium chloride in the solution, based on Figure 1 and the information in the passage, how many *milliliters* of magnesium chloride should be included?

- F. 0.20
- G. 200
- H. 2,000
- J. 20,000

**21.** Suppose a trial had been performed in Experiment 3 with a freezer temperature of -30°C. At this temperature, which of the following sets of proficiency ratings would most likely have been determined for De-icer A and De-icer B ?

- A. De-icer A: 68.8, De-icer B: 59.7
- B. De-icer A: 70.1, De-icer B: 70.5
- C. De-icer A: 75.5, De-icer B: 61.8
- D. De-icer A: 78.9, De-icer B: 64.9

**22.** Based on Table 1, if 3 mL distilled water were added to 7 mL sodium chloride, the proficiency rating of this mixture would be:

- F. 3.
- G. 7.
- H. 30.
- J. 70.

**23.** Based on Experiment 3, as temperature decreases, the minimum proficiency rating for a de-icer to be effective:

- A. increases only.
- B. decreases only.
- C. increases, then decreases.
- D. decreases, then increases.

**24.** Which of the following expressions is equal to the proficiency rating for each de-icer mixture listed in Table 1 ?

F. 
$$\frac{\text{volume of sodium chloride}}{\text{volume of water}}$$

G. 
$$\frac{\text{volume of water}}{\text{volume of sodium chloride}}$$

H. 
$$\frac{\text{volume of sodium chloride}}{(\text{volume of water} + \text{volume of sodium chloride})}$$

J. 
$$\frac{\text{volume of water}}{(\text{volume of water} + \text{volume of sodium chloride})}$$

**25.** Based on Table 1 and Experiment 2, if 6 mL magnesium chloride were added to a mixture of 10 mL distilled water and 40 mL sodium chloride, the proficiency rating of the resulting de-icer would most likely be:

- A. less than 60.

- B. between 60 and 80.
- C. between 80 and 112.
- D. greater than 112.

26. Which of the 2 de-icers from Experiment 3 would be better to use to melt ice if the temperature were between  $-10^{\circ}\text{C}$  and  $-75^{\circ}\text{C}$  ?

- F. De-icer A, because its proficiency rating was lower than the TDM at each temperature tested.
- G. De-icer A, because its proficiency rating was higher than the TDM at each temperature tested.
- H. De-icer B, because its proficiency rating was lower than the TDM at each temperature tested.
- J. De-icer B, because its proficiency rating was higher than the TDM at each temperature tested.

#### Passage V

Comets originate from regions of our solar system that are very far from the Sun. The comets are formed from debris thrown from objects in the solar system: they have a nucleus of ice surrounded by dust and frozen gases. When comets are pulled into the Earth's atmosphere by gravitational forces and become visible, they are called *meteors*. Meteors become visible about 50 to 85 km above the surface of Earth as air friction causes them to glow. Most meteors vaporize completely before they come within 50 km of the surface of Earth.

Recently, images taken by two instruments, UVA and VIS, revealed dark spots and streaks in the Earth's atmosphere. The significance of these dark spots and streaks is not fully understood. The Small Comet Theory asserts that these spots and streaks are due to a constant rain of small ice comets, but some scientists argue that the spots are just random technological noise.

UVA and VIS technologies provide images of energy that cannot be seen by the human eye. Both instruments take images in the magnetosphere, in which they orbit. The layers of Earth's atmosphere are shown in Figure 1.

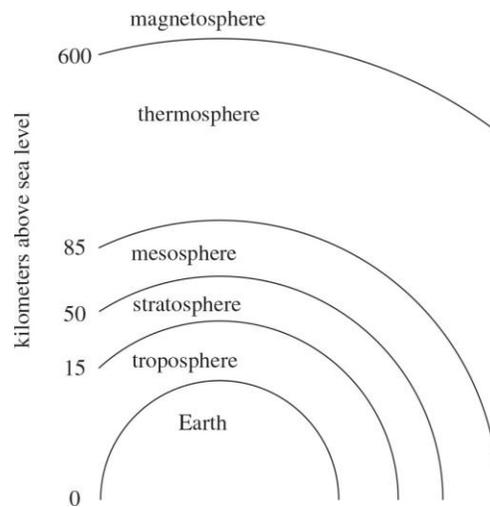


Figure 1

Two scientists debate whether there is a constant rain of comets burning up in Earth's magnetosphere.

*Scientist 1*

Small comets are pulled into Earth's atmosphere by gravitational effects and burn up in the magnetosphere. Small comets are about 20 to 30 feet in diameter and burn up in the magnetosphere because they are much smaller than the comets that become meteors. Comets with larger diameters will burn up in portions of the atmosphere much closer to Earth. About 30,000 small comets enter the Earth's magnetosphere every day. The dark spots and streaks on UVA and VIS images occur when the small comets begin to boil in the magnetosphere, releasing krypton and argon and creating gaseous  $\text{H}_2\text{O}$ , which interacts with hydroxyl,  $\text{OH}^-$ , radicals. Images taken by these instruments at different points in time show the same frequency of dark spots and streaks and give conclusive evidence in favor of the Small Comet Theory. If the spots and streaks were due to random technological noise, then the frequency of their appearance would fluctuate.

*Scientist 2*

The dark spots and streaks in the UVA and VIS images are due to technological noise, not small comets. If the Small Comet Theory were true, and 20 small comets bombarded Earth's atmosphere per minute, there would be a visible bright object at least twice every five minutes. This is because, as objects enter the Earth's mesosphere, they burn up, creating large clouds of ice particles. As the ice particles vaporize, they become approximately as bright in the sky as Venus. Because comets rarely enter Earth's atmosphere, such bright flashes are rare, occurring far less than two times every five minutes. Therefore, the Small Comet Theory cannot be correct. Further, since comets originate from regions of space beyond the orbit of the farthest planet, they contain argon and krypton. If the Small Comet Theory were true and Earth were bombarded by 30,000 comets per day, there would be 500 times as much krypton in the atmosphere as there actually is.

**27.** According to Scientist 2, which of the following planets in our solar system is most likely the closest to the region of space where comets originate?

- A. Jupiter
- B. Neptune
- C. Saturn
- D. Venus

**28.** Based on Scientist 1's viewpoint, a comet that burns up in the thermosphere would have a diameter of:

- F. 5–10 ft.
- G. 10–20 ft.
- H. 20–30 ft.
- J. greater than 30 ft.

**29.** Which of the following generalizations about small comets is most consistent with Scientist 1's viewpoint?

- A. No small comet ever becomes a meteor.
  - B. Some small comets become meteors.
  - C. Small comets become meteors twice every five minutes.
  - D. All small comets become meteors.
- 30.** During the *Perseids*, an annual meteor shower, more than 1 object visibly burns up in the atmosphere per minute. According to the information provided, Scientist 2 would classify the Perseids as:
- F. typical comet frequency in the magnetosphere.
  - G. unusual comet frequency in the magnetosphere.
  - H. typical meteor frequency in the mesosphere.
  - J. unusual meteor frequency in the mesosphere.
- 31.** Given the information about meteors in the introduction, at which of the following altitudes above the sea level on Earth would a meteor NOT be visibly glowing?
- A. 55 km
  - B. 70 km
  - C. 85 km
  - D. 100 km
- 32.** Suppose that a study of meteors of various sizes revealed that a large meteor observed during the study period was visible in the stratosphere before it vaporized completely. How would the findings of this study most likely affect the scientists' viewpoints, if at all?
- F. It would not affect either scientist's viewpoint.
  - G. It would strengthen Scientist 1's viewpoint only.
  - H. It would strengthen Scientist 2's viewpoint only.
  - J. It would weaken both scientists' viewpoints.
- 33.** Scientist 1 would most likely suggest that astronomers attempting to take pictures of small comets in the atmosphere should use enhanced imaging technology to look in which region?

- A. The region between 15 km above sea level and 50 km above sea level
- B. The region between 50 km above sea level and 85 km above sea level
- C. The region between 85 km above sea level and 600 km above sea level
- D. The region above 600 km above sea level

## Passage VI

A cotton fiber is composed of one very long cell with two cell walls. During a one-to three-week period of cell life called elongation, cotton fibers grow 3 to 6 cm. The level of hydrogen peroxide in cotton fiber cells during elongation is very high. Scientists wanted to study whether the level of hydrogen peroxide affected the length of the cotton fiber.

The amount of hydrogen peroxide is controlled by an enzyme called *superoxide dismutase* (SOD). This enzyme turns superoxide into hydrogen peroxide. Four identical strains of cotton fiber plants were created. Three of the strains were then manipulated such that each was able to express only one of three types of superoxide dismutase. The gene for SOD1 was active in S1, the gene for SOD2 was active in S2, and the gene for SOD3 was active in S3.

### *Experiment*

Five cotton plants of each strain were grown in a nutrient solution until cotton fibers completed the elongation period. The average length of cotton fibers and the average concentration of hydrogen peroxide were determined on each day. Table 1 shows the data gathered on the first day.

Table 1
---------

Strain	On the first day of elongation period:		
	Day of elongation period	Average amount of hydrogen peroxide ( $\mu\text{mol}/\text{mg}$ )	Average cotton fiber length (cm)
S1	1	1.2	0.2
S2	1	6.0	0.5
S3	1	5.7	0.1
S4	1	1.9	0.2

Next, the scientists used the average elongation period length to determine the midpoint of elongation for each strain. Table 2 shows the average amount of hydrogen peroxide and average cotton fiber length for each strain at the midpoint of its elongation period.

Table 2			
Strain	At the midpoint of elongation period:		
	Day of elongation period	Average amount of hydrogen peroxide ( $\mu\text{mol}/\text{mg}$ )	Average cotton fiber length (cm)
S1	4	4.1	2.7
S2	2	5.3	1.0
S3	10	12.4	2.0
S4	6	8.7	3.2

Finally, Table 3 shows the average elongation period, the average amount of hydrogen peroxide, and the average cotton fiber length for all four strains at the end of the elongation period.

Table 3			
Strain	At the end of elongation period:		
	Average elongation period length (days)	Average amount of hydrogen peroxide ( $\mu\text{mol}/\text{mg}$ )	Average cotton fiber length (cm)
S1	8	2.1	3.6

S2	4	0.2	1.4
S3	20	5.6	5.9
S4	12	2.3	4.5

**34.** For S2, as the elongation period moved from the first day to the end, the amount of hydrogen peroxide:

- F. increased only.
- G. decreased only.
- H. increased, then decreased.
- J. decreased, then increased.

**35.** Which of the following is a dependent variable in the experiment?

- A. The length of the cotton fiber
- B. The type of superoxide dismutase the plant could express
- C. The point in time during the elongation period
- D. The type of cotton plant

**36.** A cotton fiber contains both a primary and a secondary cell wall. Which one of the following cell types does NOT have a cell wall?

- F. Animal
- G. Fungal
- H. Bacterial
- J. Algal

**37.** One plant had an average cotton fiber length of 0.6 cm, and the average amount of hydrogen peroxide in its fibers was 5.9  $\mu\text{mol}/\text{mg}$ . Which of the following most likely describes this plant?

- A. It was from S1 and at the midpoint of its elongation period.
- B. It was from S1 and at the end of its elongation period.
- C. It was from S2 and at the beginning of its elongation period.
- D. It was from S2 and at the end of its elongation period.

**38.** The scientists used one of the four strains of cotton plants as a control. Which strain was most likely the control?

- F. S1
- G. S2
- H. S3
- J. S4

**39.** Suppose the data for all the plants were plotted on a graph with the time of the elongation period on the  $x$ -axis and the average length of the cotton fiber on the  $y$ -axis. Suppose also that the best-fit line for these data was determined. Which of the following would most likely characterize the slope of this line?

- A. The slope would be positive.
- B. The slope would be negative.
- C. The slope would be zero.
- D. The slope would be undefined because the line would be vertical.

**40.** Consider the average cotton fiber length and the average amount of hydrogen peroxide 4 days into the elongation period for S1 and S2 shown in Tables 1 and 2. After 4 days, which strain had more hydrogen peroxide and which strain had a longer average cotton fiber length?

- F. more hydrogen peroxide: S1, longer fiber length: S1
- G. more hydrogen peroxide: S1, longer fiber length: S2

**H.** more hydrogen peroxide: S2, longer fiber length: S1

**J.** more hydrogen peroxide: S2, longer fiber length: S2

**END OF TEST.**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.**

# Answers and Explanations

# SCIENCE PRACTICE TEST 4 EXPLANATIONS

## Passage I

1. A

The question asks which data set shows Field A as having *lower* soil quality than Field B. Use POE and check each set of data. Figure 1 shows the bulk density of the two fields. The passage states that *a bulk density measure above 1.33 g/cm<sup>3</sup> can negatively affect soil quality*. Figure 1 shows Field A as having a higher bulk density than Field B each year, with most years measuring above 1.33 g/cm<sup>3</sup>. Therefore, Figure 1 shows Field A as having lower soil quality than Field B. Keep (A). Figure 2 shows the crop yield for the two fields. For most years, Field A has a higher crop yield than Field B, which doesn't indicate a lower soil quality. Eliminate (B). Table 1 does not include any data regarding Field A or Field B, so eliminate (C). Table 2 shows Field A as having a higher SOM than Field B. Based on Table 1, a higher SOM indicates a higher rather than lower soil quality, so eliminate (D). The correct answer is (A).

2. J

The question asks which field in which year had a failed harvest. Based on the information given in the question, a failed harvest is a harvest of *8 tons or fewer in crop yields*. Figure 2 shows the crop yields for each field. Look at each year to find when there was a harvest of 8 tons or fewer. In Year 5, Field B had a crop yield of 8 tons, thus making it a failed harvest. Eliminate (F), (G), and (H), as those years and fields all show a crop yield of greater than 8 tons. The correct answer is (J).

3. C

The question asks how a new crop rotation in Field B would affect the SOM. Use POE and check each answer choice. Based on Table 1, a higher SOM indicates higher soil quality. Eliminate (A) and (D) because they indicate the opposite relationship. A crop rotation of *legumes and other deep-rooted and high-residue crops* would likely increase the organic content of the soil, thus increasing the SOM and soil quality. Eliminate (B) because it states that the SOM will decrease. The correct answer is (C).

4. **G**

The question asks which site had the lower average crop yield and the lower average bulk density. The first part of the answers refers to Figure 2, so refer to Figure 2 to find the site that had the lower average crop yield. For most of the years, Field B had a lower crop yield than Field A; therefore, Field B had a lower average crop yield. Eliminate (F) and (H) because they incorrectly state that Field A had a lower average crop yield. Next, use Figure 1 to find the site that had the lower average bulk density. For each year, Field B had a lower bulk density than Field A; therefore, Field B had a lower average bulk density. Eliminate (J) because it incorrectly states that Field A had a lower average bulk density. The correct answer is (G).

5. **C**

The question asks if Table 2 supports the hypothesis that Field B has more earthworms, given that as the number of earthworms increases, the soil quality also increases. Compare the SOM values of Fields A and B in Table 2 to the ranges of soil quality in Table 1 to determine the soil quality of Fields A and B. Field A has a SOM of 0.89, which is a soil quality rating of excellent according to Table 1. Field B has a SOM of 0.28, which is a soil quality rating of fair. Since Field B has a lower soil quality than Field A, Field B would have fewer earthworms, and the hypothesis is not supported. Eliminate (A) and

(B) because they incorrectly state that the hypothesis is supported. Eliminate (D) because it incorrectly states the soil quality ratings for Fields A and B. The correct answer is (C).

6. **G**

The question asks whether the soil in Field A is more likely primarily sand or clay. Use POE and check each answer choice. The answer choices focus on the bulk density and crop yield of Field A in Years 3 and 5. Start with the easiest piece of information, which is the crop yield. Crop yield is shown in Figure 2. The crop yield of Field A in Year 5 was the second lowest crop yield for Field A in those five years, while the crop yield of Field A in Year 3 was the highest. Eliminate (F) and (H) because they both incorrectly state that the crop yield in Year 3 was high. Both of the remaining answers reference Year 5, so look at Figure 1 to find the bulk density of Field A in Year 5. Figure 1 shows the bulk density of Field A in Year 5 was  $1.70 \text{ g/cm}^3$ . Based on the table given in the question, the *restrictive bulk density threshold*, which is the *maximum bulk density under which plants roots can still grow effectively*, is  $1.80 \text{ g/cm}^3$  for sand and  $1.55 \text{ g/cm}^3$  for clay. The high crop yield in Field A in Year 5 indicates that the plant roots were still able to grow effectively at a bulk density above  $1.55 \text{ g/cm}^3$ . Therefore, the soil in Field A is likely not primarily clay. Eliminate (J). The correct answer is (G).

## Passage II

7. **D**

The question asks for the most effective rust inhibitor over the first five days. Figure 1 shows the amount of rust,  $\text{Fe}_2\text{O}_3$ , produced in the presence of each of the rust inhibitors. Look for the rust inhibitor that had the lowest mass of  $\text{Fe}_2\text{O}_3$  over the first five days. The dashed line

representing Additive Z had the lowest amount of rust over the first five days. The correct answer is (D).

8. **H**

The question asks for the mass of  $\text{Fe}_2\text{O}_3$  in Solution B if it had been measured on Day 5. The mass of  $\text{Fe}_2\text{O}_3$  in the solutions is shown in Table 1. Look in the second row for the relationship between the mass of  $\text{Fe}_2\text{O}_3$  in Solution B and time from Day 1 to Day 4. The mass of  $\text{Fe}_2\text{O}_3$  in Solution B increases from 0.46 g to 1.74 g over the first 4 days. The mass of  $\text{Fe}_2\text{O}_3$  in Solution B will likely continue to increase after Day 4, so the amount of  $\text{Fe}_2\text{O}_3$  in Solution B on Day 5 would most likely be greater than 1.74 g. Eliminate (F) and (G), as these have values less than 1.74 g. To choose between the remaining answers, look at the mass of  $\text{Fe}_2\text{O}_3$  each day to estimate the rate of increase. The daily increases in mass were 0.35, 0.40, and 0.53. In order to reach above 2.65 g by Day 5, as in (J), the increase from Day 4 to Day 5 would have to be over 0.90. This is too big of an increase given the trend from the first four days, so eliminate (J). The correct answer is (H).

9. **B**

The question asks what else the experimenters could determine based on the amount of  $\text{Fe}_2\text{O}_3$  measured. The answer choices contain parts of the reaction equation, so look at the equation, and use POE. Based on the equation Fe and  $\text{H}_2\text{O}$  are converted into  $\text{Fe}_2\text{O}_3$  and  $\text{H}_2$ . So, when  $\text{Fe}_2\text{O}_3$  is produced,  $\text{H}_2$  is also produced. Eliminate (A) because it reverses the conversion of  $\text{H}_2\text{O}$  and  $\text{H}_2$ . Keep (B) because it correctly shows the conversion of  $\text{H}_2\text{O}$  into  $\text{H}_2$ . Eliminate (C) because Fe converts into  $\text{Fe}_2\text{O}_3$ , not  $\text{H}_2\text{O}$ . Eliminate (D) because  $\text{H}_2\text{O}$  converts into  $\text{H}_2$ . The correct answer is (B).

10. **G**

The question asks on which day Solution C with Additive X produced the same amount of  $\text{Fe}_2\text{O}_3$  as on Day 1 without an additive. The mass of  $\text{Fe}_2\text{O}_3$  in each solution without additives is shown in Table 1. Use Table 1 to find the amount of  $\text{Fe}_2\text{O}_3$  produced by Solution C on Day 1 without any additives. On Day 1, Solution C produced 0.76 g of  $\text{Fe}_2\text{O}_3$ . In Figure 1,  $\text{Fe}_2\text{O}_3$  is on the  $y$ -axis. Find the value 0.76 g on the  $y$ -axis and draw a horizontal line to the curve for Solution C with Additive X, which is the line with dots and dashes. Draw a vertical line down to the  $x$ -axis to determine that the mass of  $\text{Fe}_2\text{O}_3$  is approximately 0.76 on Day 3. The correct answer is (G).

11. **B**

The question asks how much  $\text{Fe}_2\text{O}_3$  Solution A produced between Day 2 and Day 3. The mass of  $\text{Fe}_2\text{O}_3$  in each solution is shown in Table 1. According to Table 1, by Day 2, Solution A had produced 0.23 g and by Day 3, Solution A had produced 0.51 g. To find the amount of  $\text{Fe}_2\text{O}_3$  produced between Day 2 and Day 3, subtract 0.23 g from 0.51 g to get 0.28 g. The correct answer is (B).

12. **F**

The question asks for a graph showing the relationship between time and the mass of  $\text{Fe}_2\text{O}_3$  produced by Solution C without any additives. The mass of  $\text{Fe}_2\text{O}_3$  in the solutions without additives is shown in Table 1. Look at Table 1 to find the trend between time and amount of  $\text{Fe}_2\text{O}_3$ . For all solutions, the amount of  $\text{Fe}_2\text{O}_3$  and time have a direct relationship; as one increases, so does the other. Eliminate (H) and (J) because these show an inverse relationship. Both (F) and (G) show a direct relationship and start at the same value, but they have different values for Days 2 and 3. Look back at Table 1 to find that the amount

of  $\text{Fe}_2\text{O}_3$  produced by Solution C on Day 2 is 2.03 g. Eliminate (G) because it incorrectly shows the amount of  $\text{Fe}_2\text{O}_3$  as less than 1 g on Day 2. The correct answer is (F).

### Passage III

13. D

The question asks for a drawing that represents a 10.0 N weight on Spring A only. Based on Figure 1, the length of Spring A with no weight is 0.30 m. Eliminate (A) and (B) because the length of the spring will be greater than 0.30 m with the weight attached. Based on Trial 1 in Experiment 1, the length of Spring A is 0.40 m when a 10.0 N weight is shared with Spring B. If Spring A only has the 10.0 N weight, the spring length will be longer than 0.40 m; eliminate (C). The correct answer is (D).

14. G

The question asks how the force exerted on Spring B changes as the distance between the weight and the attachment to Spring B increases, according to Experiment 2. Trials 4, 5, and 6 show the results of Experiment 2. Use these trials in Experiment 2 to determine the relationship between the force exerted in Spring B and the distance between the weight and the attachment to Spring B. The distance between the weight and the attachment to Spring B increases from Trial 4 to Trial 6. The length of Spring B decreases in each trial from Trial 4 to Trial 6. Additionally, the passage states that *the length of the springs increased as the force of the weights stretched the springs downwards*. Therefore, as distance between the weight and the attachment increased, the length of Spring B decreased, because the force exerted on Spring B decreased. The correct answer is (G).

15. A

The question asks for the most likely reason the students used identical springs in Trials 1–3. Use POE and eliminate answers that don't make sense. Keep (A) because the passage states that *the springs had identical spring constants*. Eliminate (B) because the passage states that the students used *identical springs*; it wouldn't make sense that identical springs would not share the weight evenly. Eliminate (C) because the passage states that the students measured the length *when the springs stopped oscillating*, so the students didn't need to compensate for oscillation. Eliminate (D) because the board was used in Trials 4–6, not Trials 1–3. The correct answer is (A).

16. **H**

The question asks for the weight of the board used in Experiment 2. Experiment 1 varies the weight of the masses attached to the spring, whereas Experiment 2 varies the position of the board and mass. Find the trial in Experiment 1 that is most similar to a trial in Experiment 2. Use Trial 5 for Experiment 2 since the weight is attached in the middle of the board, just as in Experiment 1. In Trial 5, Spring A and Spring B both have a length of 0.40 m. Find the Trial in Experiment 1 where Spring A and Spring B also both have a length of 0.40 m. In Trial 1, Spring A and Spring B both have a length of 0.40 m for a 10.0 N weight. Therefore, the combined weight of the board and the 5.0 N weight should be 10.0 N in Trial 5. Since the weight weighs 5.0 N, the board weighs the remaining 5.0 N. The correct answer is (H).

17. **B**

The question asks if the weight was distributed evenly between Spring B and Spring C in any of the trials in Experiment 2. Look at Trials 4–6 to find the different weight distributions between Springs B and C. For the weight distribution to be even, the springs need to be the same length. In Trial 5, the lengths of Springs B and C are both 0.40 m; therefore, the weight is distributed evenly. The correct answer is (B).

18. H

The question asks whether the elastic potential energy of Spring C was higher in Trial 5 or Trial 6. The question states that the elastic potential energy is determined by the spring constant and the amount of deformation of the spring. Since the spring constant is constant in all trials, the only remaining factor to affect the elastic potential energy of Spring C is the deformation of the spring. Figure 1 shows the length of the spring *when there were no weights attached*. Without a weight, the length of Spring C is 0.30 m. Spring C stretched beyond 0.30 m will show spring deformation. In Trial 5, Spring C is 0.40 m, and in Trial 6, Spring C is 0.50 m. Since Spring C is more stretched in Trial 6, Spring C has more spring deformation and thus a higher elastic potential energy in Trial 6 than in Trial 5. Eliminate (F) and (G). The passage states that *the length of the springs increased as the force of the weights stretched the springs downwards*. Since Spring C is longer in Trial 6, it has a greater force exerted on it. Eliminate (J) because it incorrectly states that Spring C has less force exerted on it. The correct answer is (H).

19. B

The question asks what the stretched length of Spring B would be if the weight was placed 0.150 m away from Spring B's attachment in Experiment 2. Use Trials 4–6 in Experiment 2 to find the relationship between stretched length and weight placement. In Trial 4, the distance is 0.075 m and Spring B is stretched to 0.45 m. In Trial 5, the distance is 0.125 m and Spring B is stretched to 0.40 m. As the distance increases, Spring B is stretched less. Since a distance of 0.150 m is between the distances in Trials 5 and 6, Spring B will be stretched between 0.32 m and 0.40 m. The correct answer is (B).

## Passage IV

20. G

The question asks how many *milliliters* of magnesium chloride is needed for a solution with a 106 proficiency rating. Figure 1 shows how the addition of magnesium chloride changes the proficiency rating of a solution. At a proficiency rating of 106, 2 mL of magnesium chloride was added. Read the description of Experiment 2 to find the amount of sodium chloride used. In Experiment 2, the amount of sodium chloride is 50 mL. In the question, the mechanic has 5 L of sodium chloride. Since  $1 \text{ L} = 1,000 \text{ mL}$ , 5 L is 5,000 mL. To find the correct amount of magnesium chloride, divide 5,000 mL by 50 mL to find that the volume of the mechanic's solution is 100 times greater than the volume used in Experiment 2. Multiply 2 mL of magnesium chloride by 100 to get 200 mL of magnesium chloride. The correct answer is (G).

21. C

The question asks what the proficiency ratings of De-icers A and B are at  $-30^{\circ}\text{C}$ . Table 2 shows the proficiency ratings at different temperatures. De-icer A has a proficiency rating of 78.9 at  $-25^{\circ}\text{C}$  and 68.8 at  $-50^{\circ}\text{C}$ , so the proficiency rating at  $-30^{\circ}\text{C}$  will be between 78.9 and 68.8. Eliminate (A) and (D) because those are the proficiency ratings for De-icer A at  $-50^{\circ}\text{C}$  and  $-25^{\circ}\text{C}$ . De-icer B has a proficiency rating of 64.9 at  $-25^{\circ}\text{C}$  and 59.7 at  $-50^{\circ}\text{C}$ , so the proficiency rating at  $-30^{\circ}\text{C}$  will be between 64.9 and 59.7. Eliminate (B). The correct answer is (C).

22. J

The question asks for the proficiency rating of a mixture of 3 mL distilled water and 7 mL sodium chloride. Table 1 shows the proficiency ratings for different mixtures of distilled water and sodium chloride. Since there is more sodium chloride than water, look for the proficiency ratings for mixtures with more sodium chloride. The proficiency ratings of 0, 20, and 40 are all for mixtures that have more

water than sodium chloride. Therefore, the proficiency rating of a mixture with more sodium chloride than water will be above 40. Eliminate (F), (G), and (H) because they are all below 40. The correct answer is (J).

23. A

The question asks how the minimum proficiency rating for a de-icer to be effective changes as temperature decreases. Table 2 shows temperature, TDM, and the proficiency ratings for two de-icers. The description of Experiment 3 says that TDM, or the temperature de-icing minimum, is the *minimum de-icer proficiency rating necessary for a de-icing solution to have any effect on ice*. As the temperature decreases (becomes more negative), the TDM always increases. The correct answer is (A).

24. H

The question asks which expression is equal to the proficiency rating for each de-icer mixture in Table 1. To find the correct expression, plug in numbers from Table 1. A proficiency rating of 100 has 0 mL of distilled water and 50 mL of sodium chloride. Start with (F). Plugging in the values makes the expression  $50/0 \times 100$ . Dividing by 0 is not possible, so eliminate (F). For (G),  $0/50 \times 100$  equals 0, rather than the actual proficiency rating of 100. Eliminate (G). For (H),  $50/(0 + 50) \times 100$  equals 100. Keep (H). For (J),  $0/(0 + 50) \times 100$  equals 0. Eliminate (J). The correct answer is (H).

25. C

The question asks how adding 6 mL of magnesium chloride would change the proficiency rating of a mixture of 10 mL water and 40 mL sodium chloride. Figure 1 shows how magnesium chloride changes the proficiency rating of a mixture of 50 mL sodium chloride and 0

mL water. Each of the mixtures in Figure 1 has a proficiency rating above 100. Based on Table 1, 50 mL of sodium chloride has a proficiency rating of 100, so adding magnesium chloride must increase the proficiency rating. Based on Table 1, a mixture 10 mL water and 40 mL sodium chloride has a proficiency rating of 80. Adding magnesium chloride will increase the rating above 80. Eliminate (A) and (B). According to Figure 1, adding 6 mL of magnesium chloride to a pure sodium chloride solution with a proficiency rating of 100 results in a proficiency rating below 112. Since a 40 mL sodium chloride and 10 mL water mixture has a lower proficiency than pure sodium chloride, it would also have a proficiency below 112 after the addition of 6 mL of magnesium chloride. Eliminate (D). The correct answer is (C).

26. G

The question asks which de-icer would be better to use to melt ice between  $-10^{\circ}\text{C}$  and  $-75^{\circ}\text{C}$ . Use POE by checking each answer choice against Table 2. De-icer A has a higher proficiency rating than the TDM at each temperature. Eliminate (F) as it contradicts this. De-icer B has a higher proficiency rating than the TDM at most temperatures except at  $-75^{\circ}\text{C}$ , when De-icer B's proficiency rating is lower than the TDM. Eliminate (H) and (J), as De-icer B's proficiency rating is higher than the TDM at some temperatures, but lower than the TDM at one temperature. The correct answer is (G).

## Passage V

27. B

The question asks which planet is closest to the region of space where comets originate according to Scientist 2. Look for the phrase *region of space* in Scientist 2's paragraph. Scientist 2 says, *comets originate from regions of space beyond the orbit of the farthest planet*. Outside

knowledge is needed to know that the farthest planet in the solar system is Neptune. The correct answer is (B).

28. J

The question asks for the diameter of a comet that burns up in the thermosphere according to Scientist 1. Look for mentions of the size of comets in Scientist 1's explanation. According to Scientist 1, *small comets are about 20 to 30 feet in diameter and burn up in the magnetosphere, and comets with larger diameters will burn up in portions of the atmosphere much closer to Earth.* Figure 1 shows the portions of the atmosphere. Based on Figure 1, the thermosphere is closer to Earth than the magnetosphere, so a comet that burns up in the thermosphere will have a diameter bigger than 30 feet. Eliminate (F), (G), and (H). The correct answer is (J).

29. A

The question asks which statement about small comets is most consistent with Scientist 1's viewpoint. Every answer choice mentions *meteor* so look for *meteor* in Scientist 1's paragraph. Scientist 1 says, *small comets are about 20 to 30 feet in diameter and burn up in the magnetosphere because they are much smaller than the comets that become meteors.* This is consistent with the claim that no small comets become meteors, which matches (A). Eliminate (B), (C), and (D), which all mention small comets becoming meteors. The correct answer is (A).

30. J

The question asks how Scientist 2 would classify the *Perseids* meteor shower. According to the information provided in the question, during the *Perseids* meteor shower, *more than 1 object visibly burns up in the atmosphere per minute.* Scientist 2 says that the bright flashes of

meteors burning up in the atmosphere occur *far less than two times every five minutes*, so more than 1 object per minute during the *Perseids* is an unusual frequency. Eliminate (F) and (H) because the frequency is not typical. According to Scientist 2, *as objects enter the Earth's mesosphere, they burn up*. Eliminate (F), which claims that the meteor activity would occur in the magnetosphere and uses the incorrect term *comet*. The correct answer is (J).

31. **D**

The question asks at what altitude a meteor would NOT be visibly glowing. The first paragraph of the passage states that *meteors become visible about 50 to 85 km above the surface of Earth as air friction causes them to glow*. Therefore, a meteor would not be visibly glowing above 85 km. Eliminate (A), (B), and (C) because those numbers are all at or below 85 km and thus in the range where meteors are visibly glowing. The correct answer is (D).

32. **F**

The question asks how a large meteor visible in the stratosphere would affect the scientists' viewpoints, if at all. The discussion of when meteors are visible is in the introduction, which says, *Meteors become visible about 50 to 85 km above the surface of Earth as air friction causes them to glow. Most meteors vaporize completely before they come within 50 km of the surface of Earth*. The use of the term *most* means that a few do not. Therefore, the observation of a large meteor that does not burn up before the stratosphere does not contradict any information in the introduction. Both scientists discuss small comets rather than large meteors, so the observation of the large meteor would not affect their viewpoints. Eliminate (G), (H), and (J). The correct answer is (F).

33. **D**

The question asks which region astronomers should focus on to take pictures of small comets with enhanced imaging technology, according to Scientist 1. Scientist 1 claims that *about 30,000 small comets enter the Earth's magnetosphere every day*. Based on Figure 1, the magnetosphere is more than 600 km above sea level. Eliminate (A), (B), and (C), which all discuss altitudes below 600 km above sea level. The correct answer is (D).

## Passage VI

34. G

The question asks how the amount of hydrogen peroxide changed during the elongation period of S2. Tables 1–3 show Day 1 of the elongation period, the midpoint of the elongation period, and the end of the elongation period, respectively. Look at each table to find the amount of hydrogen peroxide for S2. Table 1 shows that S2 had 6.0  $\mu\text{mol}/\text{mg}$  of hydrogen peroxide on Day 1. Table 2 shows that S2 had 5.3  $\mu\text{mol}/\text{mg}$  of hydrogen peroxide at the midpoint of the elongation period. Table 3 shows that S2 had 0.2  $\mu\text{mol}/\text{mg}$  of hydrogen peroxide at the end of the elongation period. Therefore, the hydrogen peroxide only decreased over the elongation period of S2. The correct answer is (G).

35. A

The question asks for the dependent variable of the experiment. This question requires outside knowledge of dependent variables. An independent variable is a variable the scientists manipulate and a dependent variable is a variable whose value depends on the independent variable. A dependent variable is measured, but not directly manipulated or controlled by the scientists. Use POE. Eliminate (B) and (D) since scientists selected the type of plant and directly manipulated which type of superoxide dismutase each strain could produce. Eliminate (C) as the point in time during elongation

did not depend on anything. The introduction of the passage states that *scientists wanted to study whether the level of hydrogen peroxide affected the length of the cotton fiber*. Therefore, the length of the cotton fiber is a dependent variable that was measured but not directly manipulated. The correct answer is (A).

36. **F**

The question asks which type of cell does not have a cell wall. This is an outside knowledge question. The Animal kingdom is the only kingdom in which cell walls do not exist. The correct answer is (F).

37. **C**

The question asks for the most likely description of a plant with a fiber length of 0.6 cm and an average amount of hydrogen peroxide of 5.9  $\mu\text{mol/mg}$ . Use POE. For (A), use Table 2 to find that S1 at the midpoint of the elongation period had a fiber length of 2.7 cm and 4.1  $\mu\text{mol/mg}$  of hydrogen peroxide. These numbers are not close to the ones given in the question, so eliminate (A). For (B), use Table 3 to find that S1 at the end of the elongation period had a fiber length of 3.6 cm and 2.1  $\mu\text{mol/mg}$  of hydrogen peroxide. Eliminate (B). For (C), use Table 1 to find that S2 at the beginning of the elongation period had a length of 0.5 cm and 6.0  $\mu\text{mol/mg}$  of hydrogen peroxide. These numbers are close to the ones in the question, so keep (C). Check (D). Use Table 3 to find that S2 had a length of 1.4 cm and 0.2  $\mu\text{mol/mg}$  of hydrogen peroxide. These numbers are not close to the ones in the question, so eliminate (D). The correct answer is (C).

38. **J**

The question asks which strain was used as a control. Outside knowledge is needed here: control is the strain that was not changed and serves as a basis of comparison. The introduction says, *The gene*

*for SOD1 was active in S1, the gene for SOD2 was active in S2, and the gene for SOD3 was active in S3.* The fourth strain, S4, is not mentioned as having an active gene. Therefore, S4 is the control. The correct answer is (J).

39. A

The question asks how to characterize the slope of the line in a graph with the time of the elongation period on the  $x$ -axis and the length of the cotton fiber on the  $y$ -axis. Compare Table 1, which shows Day 1 of the elongation period, with Table 3, which shows the end of the elongation period. For each strain, the length of the cotton fiber is longer in Table 3 than Table 1. Therefore, as the time of the elongation period increases, the length of the cotton fiber increases. Since the relationship is direct, the slope is positive. The correct answer is (A).

40. F

The question asks how the amount of hydrogen peroxide and the length of the cotton fiber compare between S1 and S2 after 4 days. Day 4 for S1 is shown in Table 2. On Day 4, S1 had 4.1  $\mu\text{mol/mg}$  of hydrogen peroxide and a length of 2.7 cm. Day 4 for S2 is shown in Table 3. On Day 4, S2 had 0.2  $\mu\text{mol/mg}$  of hydrogen peroxide and a length of 1.4 cm. Therefore, S1 had more hydrogen peroxide and a longer length. The correct answer is (F).