Part 2 ACT Science Test

The ACT Science Test asks you to answer 40 multiple-choice questions in 35 minutes. The questions measure the interpretation, analysis, evaluation, and problem-solving skills associated with science. The Science Test is made up of seven test units, each consisting of a passage with scientific information followed by several multiple-choice questions.

Content of the ACT Science Test

The content areas of the ACT Science Test parallel the content of courses commonly taught in grades 7 through 12 and at the entry level at colleges and universities. Each test unit consists of one of the following content areas (examples of subjects included in each content area are given in parentheses):

- **Biology** (cell biology, botany, zoology, microbiology, ecology, genetics, evolution)
- **Chemistry** (properties of matter, acids and bases, kinetics and equilibria, thermochemistry, organic chemistry, biochemistry, nuclear chemistry)
- **Earth/Space Sciences** (geology, meteorology, oceanography, astronomy, environmental science)
- **Physics** (mechanics, thermodynamics, electromagnetism, fluids, solids, optics)

You do not need advanced knowledge in these subjects, but you will need some knowledge—scientific terms or concepts—to answer some of the questions. The test assumes that students are in the process of taking the core science course of study (three years or more) that will prepare them for college-level work, and have completed two years of science coursework.

You do not need advanced mathematical skills for the Science Test, but you may need to make minimal arithmetic computations in order to answer some questions. The use of calculators is not permitted on the Science Test. The passages of the Science Test are concise and clear; you should have no trouble understanding them. The test emphasizes application of scientific reasoning skills rather than recall of scientific content, skill in mathematics, or reading ability.

Format of the ACT Science Test

The scientific information presented in each passage of the ACT Science Test is conveyed in one of three different formats. The **Data Representation** format requires you to understand, evaluate, and interpret information presented in graphic or tabular form. The **Research Summaries** format requires you to understand, evaluate, analyze, and interpret the design, execution, and results of one or more experiments. The **Conflicting Viewpoints** format requires you to evaluate several alternative theories, hypotheses, or viewpoints on a specific observable phenomenon. The approximate proportion of the ACT Science Test devoted to each of the three formats is given in the chart on page 24 at the beginning of this chapter.

You'll find examples of the kinds of passages that you're likely to find in each of the formats in the pages that follow.

The sample ACT Science Test passages and questions in this section are representative of those you'll encounter in the actual ACT. The following chart illustrates the content area, format, and topic covered by each sample passage given in the remainder of this section:

Passage	Content Area	Format	Topic of Passage
I	Chemistry	Data Representation	Calorimetry
II	Physics	Research Summaries	Illuminance
III	Biology	Conflicting Viewpoints	Conjugation

Data Representation Format

This type of format presents scientific information in charts, tables, graphs, and diagrams similar to those found in science journals and texts. Examples of tables used in an actual Data Representation passage administered to students are found in Sample Passage I on page 100.

The questions you'll find in the Data Representation format ask you to interpret charts and tables, read graphs, evaluate scatterplots, and analyze information presented in diagrams. There are five sample Data Representation questions presented with the sample Data Representation passage.

Sample Passage I

A *bomb calorimeter* is used to determine the amount of heat released when a substance is burned in oxygen (Figure 1). The heat, measured in kilojoules (kJ), is calculated from the change in temperature of the water in the bomb calorimeter. Table 1 shows the amounts of heat released when different foods were burned in a bomb calorimeter. Table 2 shows the amounts of heat released when different amounts of sucrose (table sugar) were burned. Table 3 shows the amounts of heat released when various chemical compounds were burned.

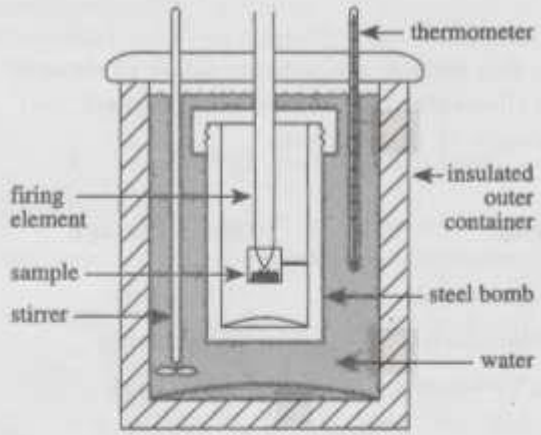


Figure 1

Figure 1 adapted from Antony C. Wilbraham, Dennis D. Staley, and Michael S. Matta, *Chemistry*. ©1995 by Addison-Wesley Publishing Company, Inc.

Table 1

Food	Mass (g)	Change in water temperature (°C)	Heat released (kJ)
Bread	1.0	8.3	10.0
Cheese	1.0	14.1	17.0
Egg	1.0	5.6	6.7
Potato	1.0	2.7	3.2

Table 1 adapted from American Chemical Society, *ChemCom: Chemistry in the Community*. ©1993 by American Chemical Society.

Table 2

Amount of sucrose (g)	Heat released (kJ)
0.1	1.6
0.5	8.0
1.0	16.0
2.0	32.1
4.0	64.0

Table 3

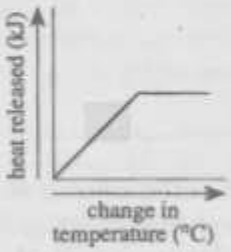
Chemical compound	Molecular formula	Mass (g)	Heat released (kJ)
Methanol	CH_3OH	0.5	11.4
Ethanol	C_2H_5OH	0.5	14.9
Benzene	C_6H_6	0.5	21.0
Octane	C_8H_{18}	0.5	23.9

1. According to Tables 1 and 2, as the mass of successive sucrose samples increased, the change in the water temperature produced when the sample was burned most likely:

   A. increased only.
   B. decreased only.
   C. increased, then decreased.
   D. remained the same.

2. Which of the following graphs best illustrates the relationship between the heat released by the foods listed in Table 1 and the change in water temperature?

F.



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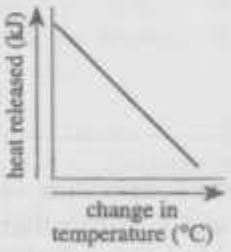

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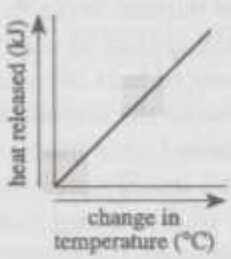

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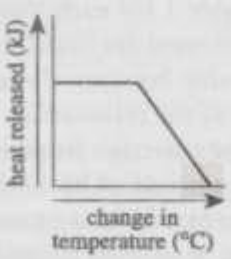


3. Based on the data in Table 2, one can conclude that when the mass of sucrose is decreased by one-half, the amount of heat released when it is burned in a bomb calorimeter will:

A. increase by one-half.
B. decrease by one-half.
C. increase by one-fourth.
D. decrease by one-fourth.

4. Which of the following lists the foods from Tables 1 and 2 in increasing order of the amount of heat released per gram of food?

F. Potato, egg, bread, sucrose, cheese
G. Sucrose, cheese, bread, egg, potato
H. Bread, cheese, egg, potato, sucrose
J. Sucrose, potato, egg, bread, cheese

5. Based on the information in Tables 1 and 2, the heat released from the burning of 5.0 g of potato in a bomb calorimeter would be closest to which of the following?

A. 5 kJ
B. 10 kJ
C. 15 kJ
D. 20 kJ

Discussion of Sample Passage I (Data Representation)

According to this Data Representation passage, the amount of heat generated when a material is burned in oxygen can be determined using a *bomb calorimeter*. The bomb calorimeter has an outer shell made of an insulating material. Inside this shell is a bomb (steel casing) immersed in a fixed amount of water. When a material is burned inside the bomb, the water absorbs heat generated by the combustion, causing the temperature of the water to increase. The amount of the increase in water temperature depends upon the amount of heat absorbed by the water. So, if we measure the increase in water temperature, we can calculate the amount of heat released when a material is burned inside the bomb.

Note that the passage contains 3 tables. Table 1 lists the temperature change of the water and the amount of heat generated when 1 g of each of 4 foods is burned in the calorimeter. Table 2 lists the amounts of heat released when various quantities of the sugar sucrose are burned. Table 3 lists several chemical compounds and their chemical formulas, as well as the amount of heat released for each compound when 0.5 g of the compound is burned in the calorimeter.

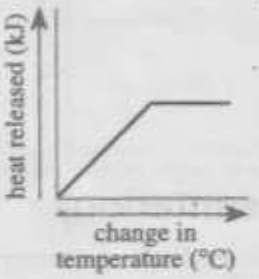
1. According to Tables 1 and 2, as the mass of successive sucrose samples increased, the change in the water temperature produced when the sample was burned most likely:

   A. increased only.
   B. decreased only.
   C. increased, then decreased.
   D. remained the same.

Question 1 asks you to determine how the change in water temperature varied as the amount of sucrose burned increased, based on the data in Tables 1 and 2. Notice that the change in water temperature and the amount of heat released are listed in Table 1 for each material burned. In Table 2, the amount of sucrose burned and the amount of heat released are listed, but the change in water temperature is not listed. Let us assume that the relationship between the amount of heat released and the change in water temperature for sucrose is the same as the relationship between the amount of heat released and the change in water temperature for the materials listed in Table 1. According to Table 2, as the amount of sucrose burned increased, the amount of heat released steadily increased. According to Table 1, as the amount of heat released increased, the magnitude of the change in water temperature steadily increased. Therefore, as the amount of sucrose burned increased, the magnitude of the change in the water temperature steadily increased. The best answer is **A.**

2. Which of the following graphs best illustrates the relationship between the heat released by the foods listed in Table 1 and the change in water temperature?

F.



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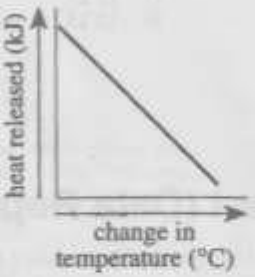

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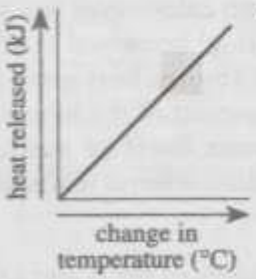

J.