

Energy and Chemical Change

Section 15.1 Energy

pages 516–522

Practice Problems

pages 519–521

1. A fruit and oatmeal bar contains 142 nutritional Calories. Convert this energy to calories.

$$142 \text{ Calories} = 142 \text{ kcal}$$

$$142 \text{ kcal} \times \frac{1000 \text{ cal}}{1 \text{ kcal}} = 142,000 \text{ cal}$$

2. An exothermic reaction releases 86.5 kJ. How many kilocalories of energy are released?

$$86.5 \text{ kJ} \times \frac{1 \text{ kcal}}{4.184 \text{ kJ}} = 20.7 \text{ kcal}$$

3. **Challenge** Define a new energy unit, named after yourself, with a magnitude of one-tenth of a calorie. What conversion factors relate this new unit to joules? To Calories?

$$\text{Unit X} = 0.1 \text{ cal}$$

$$1 \text{ cal} = 4.184 \text{ J}$$

$$\text{X} = (0.1 \text{ cal})(4.184 \text{ J/cal}) = 0.4184 \text{ J}$$

$$1 \text{ cal} = 0.001 \text{ Calorie}$$

$$\text{X} = (0.1 \text{ cal})(1 \text{ Cal}/1000 \text{ cal}) = 0.0001 \text{ Calorie}$$

4. If the temperature of 34.4 g of ethanol increases from 25.0°C to 78.8°C, how much heat has been absorbed by the ethanol? Refer to Table 15.2.

$$q = c \times m \times \Delta T$$

$$q = 2.44 \text{ J/(g} \cdot ^\circ\text{C)} \times 34.4 \text{ g} \times 53.8^\circ\text{C} = 4.52 \times 10^3 \text{ J}$$

5. A 155-g sample of an unknown substance was heated from 25.0°C to 40.0°C. In the process, the substance absorbed 5696 J of energy. What is the specific heat of the substance? Identify the substance among those listed in Table 15.2 on page 520.

$$q = c \times m \times \Delta T$$

$$c = \frac{q}{m\Delta T} = \frac{(5696 \text{ J})}{(155 \text{ g})(40.0 - 25.0^\circ\text{C})} = 2.45 \text{ J/(g} \cdot ^\circ\text{C)}$$

The specific heat is very close to the value for ethanol.

6. **Challenge** A 4.50-g nugget of pure gold absorbed 276 J of heat. The initial temperature was 25.0°C. What was the final temperature?

$$q = c \times m \times \Delta T$$

$$\Delta T = \frac{q}{cm} = \frac{(276 \text{ J})}{(0.129 \text{ J/g} \cdot ^\circ\text{C})(4.50 \text{ g})} = 475^\circ\text{C}$$

$$\Delta T = T_f - T_i = T_f - 25.0^\circ\text{C} = 475^\circ\text{C}$$

$$T_f = 5.00 \times 10^2^\circ\text{C}$$

Section 15.1 Assessment

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7. **Explain** how energy changes from one form to another in an exothermic reaction. In an endothermic reaction.

Chemical potential energy changes to heat in exothermic reactions and the heat is released. In endothermic reactions, heat is absorbed and changed to chemical potential energy.

8. **Distinguish** between kinetic and potential energy in the following examples: two separated magnets; an avalanche of snow; books on library shelves; a mountain stream; a stock-car race; separation of charge in a battery.

Two separated magnets illustrate potential energy. In a snow avalanche, positional potential energy is changing to kinetic energy. Books on a shelf illustrate positional potential energy. As water races down a mountain stream, positional potential energy is changing to kinetic energy. In a stock-car race, chemical potential energy is being changed to kinetic energy. The separation of charge in a battery illustrates electrical potential energy.

9. **Explain** how the light and heat of a burning candle are related to chemical potential energy.

Chemical potential energy, contained in the candle, is changed to energy in the form of light and heat and released as the chemical combustion reaction takes place.

Solutions Manual Energy And Chemical Change

**John Krenos, Joseph Potenza, Carl
Hoeger**



Solutions Manual Energy And Chemical Change:

Basic Concepts of Chemistry, 9e Study Guide and Solutions Manual Leo J. Malone, Theodore O. Dolter, 2012-01-03 The 9th edition of Malone's Basic Concepts of Chemistry provides many new and advanced features that continue to address general chemistry topics with an emphasis on outcomes assessment. New and advanced features include an objectives grid at the end of each chapter which ties the objectives to examples within the sections, assessment exercises at the end of each section, and relevant chapter problems at the end of each chapter. A new Math Check allows quick access to the needed basic skill. The first chapter now includes brief introductions to several fundamental chemical concepts, and Chapter Synthesis Problems have been added to the end of each chapter to bring key concepts into one encompassing problem. Every concept in the text is clearly illustrated with one or more step-by-step examples. Making it Real essays have been updated to present timely and engaging real-world applications, emphasizing the relevance of the material they are learning. This edition continues the end-of-chapter Student Workshop activities to cater to the many different learning styles and to engage users in the practical aspect of the material discussed in the chapter.

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