

11

THERMOCHEMISTRY—HEAT AND CHEMICAL CHANGE

PRACTICE PROBLEMS

In your notebook, solve the following problems.

SECTION 11.1 THE FLOW OF ENERGY

Use the 3-step problem-solving approach you learned in Chapter 4.

1. How many kilojoules of energy are in a dietary Calorie that contains 320.0 Calories?
2. What is the specific heat of a substance that has a mass of 25.0 g and requires 525.0 calories to raise its temperature by 15.0 °C?
3. Suppose 180.0 g of $\text{H}_2\text{O}(l)$ absorbs 1255.0 J of heat. What is the corresponding temperature change? The specific heat capacity of $\text{H}_2\text{O}(l)$ is $2.1 \text{ J/(g} \cdot \text{°C)}$.
4. How many joules of heat energy are required to raise the temperature of 180.0 g of aluminum by 120.0 °C? The specific heat capacity of aluminum is $0.90 \text{ J/(g} \cdot \text{°C)}$.

SECTION 11.2 MEASURING AND EXPRESSING HEAT CHANGES

1. A student mixed 75.0 mL of water containing 0.75 mol HCl at 25 °C with 75.0 mL of water containing 0.75 mol of NaOH at 25 °C in a foam cup calorimeter. The temperature of the resulting solution increased to 35 °C. How much heat in kilojoules was released by this reaction?

$$C_{\text{soln}} = 4.18 \text{ J/(g} \cdot \text{°C)}$$

2. Calculate the amount of heat involved when 15.0 g of Ca(OH)_2 forms from the reaction of $\text{CaO}(s) + \text{H}_2\text{O}(l)$.

$$\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca(OH)}_2(s) \quad \Delta H = -65.2 \text{ kJ}$$
3. Calculate the amount of heat produced when 22.4 g of methane, CH_4 , burns in an excess of air, according to the following equation.

$$\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(l) \quad \Delta H = -890.3 \text{ kJ}$$
4. Balance the following equation then calculate the enthalpy change for the reaction given that the standard heat of combustion of $\text{NH}_3(g)$ is -226 kJ/mol .

$$\text{NH}_3(g) + \text{O}_2(g) \rightarrow \text{NO}(g) + \text{H}_2\text{O}(g)$$

SECTION 11.3 HEAT IN CHANGES OF STATE

1. Calculate the amount of heat needed to melt 25.0 g of ice at 0 °C. Express your answer in kilojoules.
2. Calculate the amount of heat needed to convert 180.0 g of liquid water at 18 °C to steam at 100.0 °C.
3. How much heat is released when 2.543 mol $\text{NaOH}(s)$ is dissolved in water?

$$\text{NaOH}(s) \xrightarrow{\text{H}_2\text{O}(l)} \text{Na}^+(aq) + \text{OH}^-(aq) \quad \Delta H_{\text{soln}} = -445.1 \text{ kJ/mol}$$
4. Calculate the amount of heat needed to convert 98 g of ice at -24 °C to water at 18 °C. The specific heat capacity of $\text{H}_2\text{O}(s)$ is $2.1 \text{ J/(g} \cdot \text{°C)}$.

11 Thermochemistry Heat And Chemical Change Answers

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