

REVIEW QUESTIONS

## Chapter 3

1. Classify the following properties of sodium metal as *physical* or *chemical*:

- a) silver metallic color physical
- b) turns grey in air chemical
- c) melts at 98°C physical
- d) reacts explosively with chlorine chemical
- e) dissolves in water to produce a gas chemical
- f) malleable (can be shaped) physical

2. Classify the following changes as *physical* or *chemical* :

- a) steam condenses to a liquid on a cool surface physical
- b) baking soda dissolves in vinegar, producing bubbles chemical
- c) moth balls gradually disappear at room temperature physical
- d) when a can of soda is opened bubbles form physical

3. Complete each statement below by choosing a suitable word or phrase:

- a) At the beach, sand is hotter than water in the day because it has a lower specific heat.
- b) Changes that do not involve a change in composition are called physical changes
- c) When water freezes to ice, energy is released
- d) For all substances, heat of fusion is lower than heat of vaporization.

4. How many calories of heat are required to heat 45 g of water from 12°C to 76°C? (Specific heat of water = 1.0 cal/g°C)

$$Q = m \times s \times \Delta T$$

$$Q = (45 \text{ g})(1.0 \text{ cal/g}^\circ\text{C})(64 \text{ }^\circ\text{C}) = 2900 \text{ cal} \quad (2 \text{ sig figs})$$

5. A sample of oxygen weighing 18 g was heated in presence of nitrogen and a chemical change occurred. The product was found to have a mass of 56 g. How much nitrogen reacted in this reaction?

$$\text{Total mass} = \text{mass of oxygen} + \text{mass of nitrogen}$$

$$\text{Mass of nitrogen} = \text{Total mass} - \text{mass of oxygen}$$

$$= 56 \text{ g} - 18 \text{ g} = 38 \text{ g}$$

6. A sample of gold weighing 15 g requires 84 calories of heat to increase its temperature from 35°C to 215°C. Calculate the specific heat of gold.

$$s = \frac{Q}{m \times \Delta T} = \frac{84 \text{ cal}}{(15 \text{ g})(180 \text{ }^\circ\text{C})} = 0.031 \text{ cal/g}^\circ\text{C} \quad (2 \text{ sig figs})$$

7. How much heat (in kcal) is required to melt a 20.0 lb bag of ice at 0°C? (Heat of fusion of ice = 80.0 cal.g)

$$Q = m \times H_f = 20.0 \text{ lb} \times \frac{454 \text{ g}}{1 \text{ lb}} \times \frac{80.0 \text{ cal}}{1 \text{ g}} \times \frac{1 \text{ kcal}}{10^3 \text{ cal}} = 726 \text{ kcal} \quad (3 \text{ sig figs})$$

8. When 2.0 kg of dry ice sublimates at its normal sublimation point, it absorbs 94 kcal of heat. Calculate the heat of sublimation for dry ice in cal/g.

$$\text{Heat of sublimation} = \frac{Q}{m} = \frac{94 \text{ kcal} \times \frac{10^3 \text{ cal}}{1 \text{ kcal}}}{2.0 \text{ kg} \times \frac{10^3 \text{ g}}{1 \text{ kg}}} = 47 \text{ cal/g} \quad (2 \text{ sig figs})$$

9. How many calories of heat are required to heat 85.0 g of water at 30.0°C to steam at 100.0°C? (Specific heat of water = 1.00 cal/g°C; heat of vaporization of water = 540 cal/g)

**Total heat = Heat of warming + Heat of vaporization**

**Heat of warming =  $m \times s \times \Delta T$**

$$= (85.0 \text{ g})(1.00 \text{ cal/g}^\circ\text{C})(70.0 \text{ }^\circ\text{C}) = 5950 \text{ cal}$$

**Heat of vaporization =  $m \times H_v = (85.0 \text{ g})(540 \text{ cal/g}) = 45900 \text{ cal}$**

**Total heat = 5950 cal + 45900 cal = 57350 cal or  $5.74 \times 10^5 \text{ cal}$**