REVIEW QUESTIONS
Chapter 3

1. Convert the following temperatures:

   a) 10 °C to °F

   °F = [(10 + 40) x 1.8] –40 = 50 °F

   b) 200 K to °C

   °C = K – 273 = 200 – 273 = –73 °C

   c) 425 °F to °C

   °C = [(425 + 40) ÷ 1.8] –40 = 218 °C

2. 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**

3. 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**

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

$$\mathbf{Q = m \times C \times \Delta T}$$

$$\mathbf{Q = (45\ g) \times (1.0\ cal/g^{\circ}C) \times (76\ ^{\circ}C - 12\ ^{\circ}C)}$$

$$\mathbf{Q = 2880\ cal \xrightarrow{\text{round to 2 sig figs}} 2900\ cal}$$

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

$$\mathbf{C = \frac{Q}{m \times \Delta T} = \frac{84\ cal}{(15\ g) \times (215\ ^{\circ}C - 35\ ^{\circ}C)} = 0.031\ cal/g^{\circ}C}$$

6. If 372 J of heat are added to 5.00 g of water originally at 23.0°C, what would be the final temperature of the water? (specific heat of water=4.184 J/g°C)

$$\mathbf{\Delta T = \frac{Q}{m \times C} = \frac{372\ J}{(5.00\ g) \times (4.184\ J/g^{\circ}C)} = 17.9\ ^{\circ}C}$$

$$\mathbf{T_f = T_i + \Delta T = 23.0\ ^{\circ}C + 17.9\ ^{\circ}C = 40.9\ ^{\circ}C}$$

7. How many kWh of energy are needed to heat 60.0 gal of water from 22.0°C to 110.0°C? (1 gal of water=3.77 kg; specific heat of water= 4.184 J/g°C)

$$60.0 \text{ gal} \times \frac{3.77 \text{ kg}}{1 \text{ gal}} \times \frac{10^3 \text{ g}}{1 \text{ kg}} = 2.26\times10^5 \text{ g}$$

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

$$Q = (2.26\times10^5 \text{ g}) \times (4.184 \text{ J/g}^\circ\text{C}) \times (88.0\ ^\circ\text{C}) = 8.32\times10^7 \text{ J}$$

$$8.32\times10^7 \text{ J} \times \frac{1 \text{ kWh}}{3.60\times10^6 \text{ J}} = 23.1 \text{ kWh}$$

8. When ice melts, it absorbs 0.33 kJ of heat per gram. How many grams of ice are required to cool a 12-oz drink from 75°C to 35°C, if the specific heat capacity of the drink is 4.18 J/g°C? (1 oz = 28.3 g)

$$12 \text{ oz} \times \frac{28.3 \text{ g}}{1 \text{ oz}} = 3\underline{3}9.6 \text{ g}$$

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

$$Q = (3\underline{3}9.6 \text{ g}) \times (4.184 \text{ J/g}^\circ\text{C}) \times (40\ ^\circ\text{C}) = 5\underline{6}.835 \text{ J}$$

$$5\underline{6}.835 \text{ kJ} \times \frac{1 \text{ kJ}}{10^3 \text{ J}} \times \frac{1 \text{ g}}{0.33 \text{ kJ}} = 170 \text{ g of ice} \qquad \text{(2 sig figs)}$$

9. Three blocks of metal (silver, copper and aluminum) with equal masses are heated in an oven for the same time.

a) Which metal will attain the highest temperature? Explain.

Silver, since it has the lowest specific heat capacity

b) Which metal will attain the lowest temperature? Explain.

Aluminum, since it has the highest heat capacity

TABLE 3.4 Specific Heat Capacities of Some Common Substances

Substance	Specific Heat Capacity (J/g °C)
Lead	0.128
Gold	0.128
Silver	0.235
Copper	0.385
Iron	0.449
Aluminum	0.903
Ethanol	2.42
Water	4.184