

# PQ 12 Heat

Q and A

# Q1

- How much heat must be absorbed by 375 grams of water to raise its temperature by 25° C?

$$m_w = 375 \text{ g}$$

$$c_w = 4.18 \text{ J/g}\cdot\text{K}$$

$$\Delta T = 25^\circ \text{ C} = 25 \text{ K}$$

$$q_g = m_w c_w \Delta T_w$$

$$q_g = 375 \text{ g} \times 4.18 \text{ J/g}\cdot\text{K} \times 25 \text{ K} = 3.9 \times 10^4 \text{ J}$$

## Q2

- What mass of water can be heated from 25.0° C to 50.0° C by the addition of 2825 J?

$$m_w = ?$$

$$c_w = 4.18 \text{ J/g}\cdot\text{K}$$

$$\Delta T = 50.0^\circ \text{ C} - 25.0^\circ \text{ C} = 25.0 \text{ K}$$

$$q_g = m_w c_w \Delta T_w$$

$$m = q_g / c \Delta T$$

$$m = 2825 \text{ J} / (4.18 \text{ J/g}\cdot\text{K} \times 25.0 \text{ K}) = \mathbf{27.0 \text{ g H}_2\text{O}}$$

# Q3

- What is the final temperature when 625 grams of water at 75.0° C loses  $7.96 \times 10^4 \text{ J}$ ?

$$m_w = 625 \text{ g}$$

$$c_w = 4.18 \text{ J/g}\cdot\text{K}$$

$$T_i = 75.0^\circ \text{ C}$$

$$q_1 = 7.96 \times 10^4 \text{ J}$$

$$q_1 = m_w c_w \Delta T_w$$

$$\Delta T_w = q_1 / (m \times c)$$

$$\Delta T_w = 7.96 \times 10^4 \text{ J} / (625 \text{ g} \times 4.18 \text{ J/g}\cdot\text{K}) = 30.5 \text{ K} = 30.5^\circ \text{ C}$$

$$\Delta T = T_i - T_f$$

$$T_f = T_i - \Delta T = 75.0^\circ \text{ C} - 30.5^\circ \text{ C} = 44^\circ \text{ C}$$

# Q4

- A 65.0 g piece of iron at 525° C is put into 635 grams of water at 15.0° C. What is the final temperature of the water and the iron?

$$m_{\text{iron}} = 65.0 \text{ g}$$

$$m_{\text{w}} = 635 \text{ g}$$

$$c_{\text{iron}} = 0.451 \text{ J/g}\cdot\text{K}$$

$$c_{\text{w}} = 4.18 \text{ J/g}\cdot\text{K}$$

$$T_{\text{i}} = 525^{\circ} \text{ C}$$

$$T_{\text{i}} = 15^{\circ} \text{ C}$$

$$\Delta q = 0$$

$$q_{\text{i}} = q_{\text{f}}$$

$$m_{\text{i}}c_{\text{i}}\Delta T_{\text{i}} = m_{\text{w}}c_{\text{w}}\Delta T_{\text{w}}$$

$$65.0 \text{ g} \times 0.451 \text{ J/g}\cdot\text{K} \times (525^{\circ} \text{ C} - T_{\text{f}}) = 635 \text{ g} \times 4.18 \text{ J/g}\cdot\text{K} \times (T_{\text{f}} - 15^{\circ} \text{ C})$$

$$T_{\text{f}} = 20.6^{\circ} \text{ C}$$

# Q5

- It takes 487.5 J to heat 25 grams of copper from 25 °C to 75 °C. What is the specific heat in Joules/g·°C?

$$q = mc\Delta T$$

$$487.5 \text{ J} = (25 \text{ g})c(75 \text{ °C} - 25 \text{ °C})$$

$$487.5 \text{ J} = (25 \text{ g})c(50 \text{ °C})$$

Solve for c:

$$c = 487.5 \text{ J}/(25\text{g})(50 \text{ °C})$$

$$c = 0.39 \text{ J/g}\cdot\text{°C}$$

## Q6

- The temperature of a piece of Metal X with a mass of 95.4g increases from 25.0°C to 48.0°C as the metal absorbs 849 J of heat. What is the specific heat of Metal X?
- $849 \text{ J} / (95.4\text{g} \times 23.0^\circ\text{C})$  ***0.387 J/g°C***
-

# Q7

- When 435 J of heat is added to 3.4 g of olive oil at 21°C, the temperature increases to 85°C. What is the specific heat of the olive oil?
- $435 \text{ J} / (3.4\text{g} \times 64^\circ\text{C})$  ***2.0 J/g°C***

## Q8

- A piece of stainless steel with a mass of 1.55 g absorbs 141 J of heat when its temperature increases by 178°C. What is the specific heat of the stainless steel?
- $141 \text{ J} / (1.55 \text{ g} \times 178^\circ\text{C})$  ***0.511 J/g°C***

## Q9

- How many kilojoules of heat are absorbed when 1.00 L of water is heated from 18°C to 85°C?
- $1.00\text{kg} \times 4.18 \text{ J/g}^\circ\text{C} \times 67^\circ\text{C}$  ***280 kJ***

# Q10

- A piece of aluminum with a mass of 100.0 g has a temperature of 20.0°C. It absorbs 1100 J of heat energy. What is the final temperature of the metal?
- $1100 \text{ J} / (100.0 \text{ g} \times 0.902 \text{ J/g}^\circ\text{C}) = 120.^\circ\text{C} + 20^\circ\text{C} =$   
***140.0°C***