Solutions

Each answer shows the steps, then the **result**.

2.1

- q heat, m mass, c specific heat, ΔT temperature change

2.2

- heat absorbed by the water:

$$q = mc\Delta T = (100\text{ g})(4.18\text{ J g}^{-1}\,^\circ\text{C}^{-1})(5.0^\circ\text{C}) \quad \text{M1}$$

- $q = \mathbf{2090}$ J

2.3

- Exothermic (it released heat to the water)

2.4

- **copper**: its lower specific heat capacity means less energy is needed per degree, so the same heat gives a larger ΔT

3.1 B

- $T_{\text{final}} - T_{\text{initial}}$

3.2

(a)

- heat absorbed by the water:

$$q = mc\Delta T = (200\text{ g})(4.18\text{ J g}^{-1}\,^\circ\text{C}^{-1})(6.0^\circ\text{C}) \quad \text{M1}$$

- $q = 5016\text{ J} \approx \mathbf{5.0}$ kJ

(b)

- $q_{\text{reaction}} = -5.0$ kJ (exothermic)

3.3

- heat gained by the water:

$$q_{\text{water}} = mc\Delta T = (100\text{ g})(4.18\text{ J g}^{-1}\,^\circ\text{C}^{-1})(10.0^\circ\text{C}) = 4180\text{ J}$$

- all of it came from burning 0.50 g of fuel:

$$\frac{q}{m_{\text{fuel}}} = \frac{4180\text{ J}}{0.50\text{ g}}$$

- **8360** J g^{-1} (about 8.4 kJ g^{-1})

3.4

(a)

- $q_{\text{water}} = (100.0)(4.18)(25.6 - 22.0) = \mathbf{1.50 \times 10^3}$ J

(b)

- energy is conserved: $q_{\text{metal}} = -q_{\text{water}} = -1.50 \times 10^3$ J, and $\Delta T_{\text{metal}} = 25.6 - 95.0 = -69.4^\circ$C
- $c = \dfrac{-1505}{(50.0)(-69.4)} = \mathbf{0.434}$ J g$^{-1}\,^\circ$C^{-1}

(c)

- heat flows from the hotter body to the cooler one until they reach thermal equilibrium, when there is no net transfer

3.5

(a)

- **endothermic**: the solution cools, because the dissolving process absorbs energy from the water

(b)

- $q_{\text{solution}} = (55.0)(4.18)(-7.0) = -1609$ J, so $q_{\text{dissolving}} = +1609$ J
- $n = \dfrac{5.0}{80.04} = 0.0625$ mol
- $\Delta H = \dfrac{+1.609\text{ kJ}}{0.0625\text{ mol}} = +\mathbf{25.8}$ kJ mol^{-1}