

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

2.1 100 kPa, usually 298 K. Temperature must be specified; standard does not mean room conditions chosen without a value.

2.2 $q = mc\Delta T = 100.0 \times 4.18 \times 4.0 = 1672 \text{ J}$, or 1.67 kJ.

2.3 $\Delta H = -q/n = -1.672 \text{ kJ}/0.0300 \text{ mol} = -55.7 \text{ kJ mol}^{-1}$.

3.1 $q = mc\Delta T = 200 \times 4.18 \times 12.0 = 10032 \text{ J} = 10.032 \text{ kJ}$. $n = m/M = 0.460/46.0 = 0.0100 \text{ mol}$. $\Delta H = -q/n = -1003 \text{ kJ mol}^{-1}$. Heat loss, incomplete burning or fuel evaporation makes energy received per measured mole too small.

3.2 Two readings give $\pm 0.2 \text{ }^{\circ}\text{C}$; $100(0.2/2.0) = 10\%$. A safely larger rise reduces relative reading uncertainty, or use a more precise thermometer.

3.3 Formation: one mole of compound; combustion: one mole of substance completely burned; neutralisation: one mole of water formed; atomisation: one mole of gaseous atoms formed. $\frac{1}{2}\text{Cl}_2(\text{g}) \rightarrow \text{Cl}(\text{g})$. Each process is under specified standard conditions.