

3.1 Energetics

Name: _____ Class: _____ Date: _____

Total: 20 marks

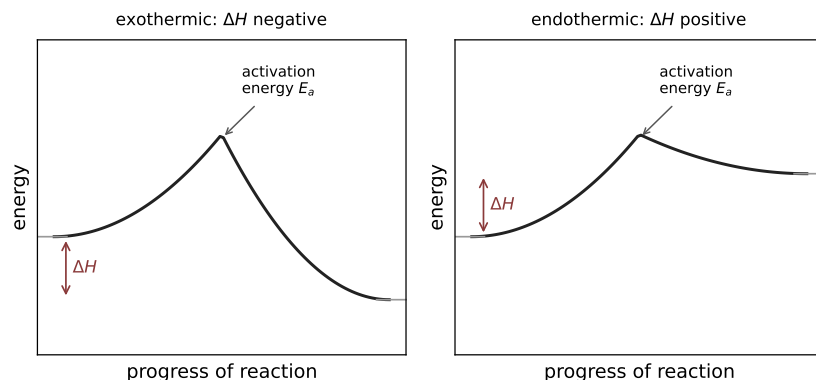
Objective

Cover energetics (3.1–3.8): exo- and endothermic changes, calorimetry with $Q = mc\Delta T$, molar enthalpy, (C) energy profiles and bond-energy calculations. Original IGCSE-level practice.

1 Key knowledge and worked examples

■ $Q = mc\Delta T$, then per mole

Worked check. 25.0 g of solution warms 14.6 °C in a displacement reaction: $Q = 25.0 \times 4.2 \times 14.6 = 1533 \text{ J}$. If 0.0050 mol reacted: $\Delta H = -1533/0.0050 = -307\,000 \text{ J mol}^{-1} \approx -307 \text{ kJ mol}^{-1}$ – negative, because the mixture warmed.



■ (C) Bonds

ΔH = energy to break bonds – energy released making bonds. Breaking is always endothermic, making always exothermic.

2 Practice

2.1 Classify as exothermic or endothermic: burning methane; decomposing limestone; acid + alkali. [3]

2.2 200 g of water warms 12 °C. Calculate Q in kJ. [2]

2.3 0.020 mol of fuel releases 8.4 kJ. Calculate ΔH in kJ/mol with its sign. [2]

2.4 (C) On an energy profile, what do the height of the hump and the gap between the levels represent? [2]

2.5 (C) Which process is exothermic: breaking bonds or making bonds? [1]

3 Exam-style questions

3.1 In a spirit-burner experiment 0.012 mol of ethanol heated 100 g of water from 21.0 °C to 49.0 °C. Calculate Q and the molar enthalpy of combustion, and give one reason the true value is more negative. [4]

3.2 (C) Use bond energies to calculate ΔH for $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$ (H–H 436, Cl–Cl 242, H–Cl 431 kJ/mol), stating the reaction type. [4]

3.3 A student's temperature-rise results are lower than the data book's every time. Give two improvements to the apparatus. [2]
