

Enthalpy Changes and Calorimetry: Formative Check

Time: 25 min. 6 questions.

Instructions

Answer all six questions using your knowledge of enthalpy, molar enthalpy, and calorimetry from Unit A. Show all steps for the numeric question, including units at each stage. Where a question asks for an explanation, write in complete sentences and use correct chemistry terminology.

Questions

1. Which statement best defines the enthalpy of a chemical reaction?

- A) The kinetic energy of reactant particles at the start of the reaction
- B) The total heat content of a system at constant pressure
- C) The rate at which a reaction proceeds to completion
- D) The mass of reactants converted into products

([Outcome](#))

2. A student adds 150 g of water to a calorimeter. During the reaction, the water temperature rises from 21.0°C to 35.5°C. Using $Q = mc\Delta T$, calculate the heat released by the water in kilojoules, to three significant figures. ([Outcome](#))

3. A student burns a sample of fuel beneath a calorimeter containing a known mass of water and records the resulting temperature change. Describe the steps the student would follow to use this calorimetry data to determine the molar enthalpy of combustion of the fuel. ([Outcome](#))

4. True or false: A negative ΔH value indicates that a reaction is endothermic and absorbs energy from the surroundings. ([Outcome](#))

5. When constructing and testing a polystyrene-cup calorimeter, which experimental design choice would most reduce heat loss to the surroundings and improve the precision of enthalpy calculations?

- A) Using a large excess of water in the calorimeter
- B) Stirring the mixture only after the reaction is complete
- C) Covering the cup with a lid and minimizing air gaps
- D) Recording only the initial temperature of the reactants

([Outcome](#))

6. In a calorimetry investigation where a nut is burned beneath a container of water, the energy released by the burning nut, as calculated from the water's temperature change, is typically lower than the accepted energy content listed for that type of nut. Explain why this discrepancy occurs. ([Resource](#))

Curriculum coverage

Question	Outcome alias
1	Outcome
2	Outcome
3	Outcome

4	Outcome
5	Outcome
6	Resource

Answer key

1. B) The total heat content of a system at constant pressure. This matches the definition of enthalpy required by [Outcome](#).
2. 9.11 kJ. $Q = mc\Delta T$, where $m = 0.050 \text{ kg}$, $c = 4.18 \text{ J K}^{-1} \text{ g}^{-1}$, and $\Delta T = 44.2^\circ \text{C}$, which rounds to 9.11 kJ, consistent with the application of $Q = mc\Delta T$ in [Outcome](#).
3. The student calculates the heat absorbed by the water using $Q = mc\Delta T$, converts the mass of fuel burned into moles using its molar mass, and divides the heat released by the number of moles burned to obtain the molar enthalpy of combustion, as required by [Outcome](#).
4. False. A negative ΔH , $-\Delta H$ is exothermic reaction, one that releases energy to the surroundings, not an endothermic one, per the notation conventions in [Outcome](#).
5. C) Covering the cup with a lid and minimizing air gaps. This reduces energy loss to the surroundings, improving the accuracy of experimental data as expected in the skills outcome [Outcome](#).
6. Some of the heat released by the burning nut escapes into the surrounding air rather than transferring into the water, and combustion may be incomplete, so the calorimeter captures only part of the total energy released, explaining the lower experimental value described in [Resource](#).