

Enthalpy Changes and Calorimetry: Formative Check

Time: 25 min. 6 questions.

Instructions

Answer all six questions in the space provided or on separate paper. Show your work for the numeric question, including units at each step. You may use a calculator and a specific heat capacity table if needed.

Questions

1. Which of the following best defines molar enthalpy for a chemical reaction?

- A) The heat released when 1 g of reactant is consumed
- B) The energy change, in kJ, associated with a reaction as written, expressed per mole of a specified substance
- C) The temperature change per mole of product formed
- D) The specific heat capacity of one mole of reactant

([Outcome](#))

2. Explain what each variable in the equation $Q = mc\Delta T$, and state the SI unit normally used for each one. ([Outcome](#))

3. True or false: A negative value of ΔH for a reaction indicates that the reaction is exothermic. ([Outcome](#))

4. In a calorimetry trial, 75.0 g of water increases in temperature from 21.0°C to 38.5°C after absorbing heat released by a combustion reaction. Using $c = 4.19 \text{ J/(g}\cdot\text{°C)}$ for water, calculate the heat absorbed by the water, in joules. ([Outcome](#), [Outcome](#))

5. In a calorimetry experiment, which assumption is typically made to simplify the calculation of enthalpy change from measured temperature data?

- A) The calorimeter absorbs all of the heat released by the reaction
- B) Heat lost to the calorimeter and to the surroundings is negligible
- C) The specific heat capacity of the solution differs from that of pure water
- D) The reaction proceeds at constant volume rather than constant pressure

([Outcome](#))

6. Outline the steps a student would take to convert calorimetry data (mass of solution, specific heat capacity, and temperature change) into a molar enthalpy value for the reaction studied. ([Outcome](#), [Outcome](#))

Curriculum coverage

Question	Outcome(s) assessed
1	Outcome
2	Outcome
3	Outcome

4	Outcome, Outcome
5	Outcome
6	Outcome, Outcome

Answer key

1. B. Molar enthalpy is defined as the energy change, in kJ, for a reaction as written, expressed per mole of a specified substance ([Outcome](#)).
2. Q is the heat absorbed or released (in joules), m is the mass of the substance being heated or cooled (in grams), c is the specific heat capacity (in J/(g·°C)), and ΔT is the change in temperature (in °C). This equation is applied to analyze heat transfer in calorimetry ([Outcome](#)).
3. True. By convention, ΔH is negative for exothermic reactions, since the system loses energy to the surroundings ([Outcome](#)).
4. $Q = 5.50 \times 10^3 \text{ J}$ (5499 J). Using $Q = mc\Delta T$, $5499 \text{ J} = m \times 4.19 \text{ J/(g}\cdot^\circ\text{C)} \times 17.5^\circ\text{C}$, so $Q = 75.0 \text{ g} \times 4.19 \text{ J/(g}\cdot^\circ\text{C)} \times 17.5^\circ\text{C} = 5499 \text{ J}$, or about $5.50 \times 10^3 \text{ J}$ ([Outcome](#), [Outcome](#)).
5. B. Calorimetry calculations generally assume that heat lost to the calorimeter itself and to the surroundings is negligible, so all the heat released by the reaction is absorbed by the water or solution being measured ([Outcome](#)).
6. First calculate Q using $Q = mc\Delta T$, specific heat capacity, and temperature change of the solution. Then convert Q to kilojoules and assign the correct sign based on whether the reaction released or absorbed heat. Finally, divide this value by the number of moles of the limiting reactant to obtain the molar enthalpy of reaction ([Outcome](#), [Outcome](#)).