

Enthalpy Changes and Calorimetry: Formative Quiz

Time: 30 min. 6 questions.

Instructions

Answer all six questions in the space provided or on separate paper. Show all steps for numeric questions, including the formula used, substituted values and correct units. For the short-answer question, write in complete sentences. You may use a periodic table and a calculator.

Questions

1. Which of the following statements best defines enthalpy?

- A) The total kinetic energy of the particles in a substance
- B) The heat content of a system measured at constant pressure
- C) The energy required to raise the temperature of 1 g of water by 1°C
- D) The minimum energy needed to initiate a reaction

(Outcome)

2. A calorimeter contains 50.0 g of water at an initial temperature of 20.0°C. The water absorbs 2095 J of heat energy released by a reaction. Using $Q = mc\Delta T$, $c(\text{water}) = 4.19 \text{ J/(g}\cdot\text{°C)}$, calculate the final temperature of the water, in °C.

(Outcome)

3. True or false: The combustion of hydrocarbons is classified as an endothermic process.

(Outcome)

4. Explain how Hess's law allows a chemist to determine the enthalpy change of a reaction that cannot be measured directly, using a series of reactions whose enthalpy changes are already known.

(Outcome)

5. Which equation correctly relates the standard enthalpy change of a reaction, $\Delta H^\circ_{\text{rxn}}$, to the standard enthalpies of formation, ΔH°_f , of the products and reactants?

- A) $\Delta H^\circ_{\text{rxn}} = \sum \Delta H^\circ_f(\text{reactants}) - \sum \Delta H^\circ_f(\text{products})$
- B) $\Delta H^\circ_{\text{rxn}} = \sum \Delta H^\circ_f(\text{products}) - \sum \Delta H^\circ_f(\text{reactants})$
- C) $\Delta H^\circ_{\text{rxn}} = \sum \Delta H^\circ_f(\text{products}) + \sum \Delta H^\circ_f(\text{reactants})$
- D) $\Delta H^\circ_{\text{rxn}} = \sum \Delta H^\circ_f(\text{products}) \times \sum \Delta H^\circ_f(\text{reactants})$

(Outcome)

6. In a coffee-cup calorimeter, a salt dissolves in 100.0 g of water. The water temperature drops from 22.0°C to 18.0°C. Using $Q = mc\Delta T$, $c(\text{water}) = 4.19 \text{ J/(g}\cdot\text{°C)}$, calculate the quantity of heat, in joules, transferred to the dissolving process from the water.

(Outcome)

Curriculum coverage

Question	Outcome alias
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1	Outcome
2	Outcome
3	Outcome
4	Outcome
5	Outcome
6	Outcome

Answer key

1. **B.** Enthalpy is defined as the heat content of a system at constant pressure, which distinguishes it from kinetic energy of particles or activation energy ([Outcome](#)).
2. **30.0°C.** 9GB Ò r †Ö2' Ò # "R ¢ r fS ã r r Bã ' ¢ò†{{ 2" Ò ã 0, and the final temperature is $20.0^{\circ}\text{C} + 10.0^{\circ}\text{C} = 30.0^{\circ}\text{C}$ ([Outcome](#)).
3. **False.** Combustion of hydrocarbons releases energy to the surroundings and is classified as an exothermic process ([Outcome](#)).
4. Hess's law states that the enthalpy change for a net reaction equals the sum of the enthalpy changes of the individual steps that combine, when properly reversed and scaled, to give that net reaction, so a chemist can add or subtract reactions with known ΔH values to calculate the enthalpy change of a reaction that is difficult or unsafe to measure directly ([Outcome](#)).
5. **B.** $\Delta H_{\text{rxn}} = \sum \Delta H_{\text{f}}^{\circ}(\text{products}) - \sum \Delta H_{\text{f}}^{\circ}(\text{reactants})$ formation of the products minus the sum of the standard enthalpies of formation of the reactants ([Outcome](#)).
6. **1676 J** (or $1.68 \times 10^3 \text{ J}$). 9GB Ò # "ã 2 !" ,ã 2 Ò Bã 0, and $Q = mc\Delta T = 4.0^{\circ}\text{C} = 1676 \text{ J}$, which is the heat lost by the water and absorbed by the dissolving process ([Outcome](#)).