

Enthalpy Changes and Calorimetry

Time: 40 min. 6 questions.

Instructions

Answer all six questions in the space provided or on separate paper as directed by your teacher. Show all steps for the numeric question, including units, and use correct 9D, æ÷F F–öâ v†W&R &W V—&VBà Calculators are permitted.

Questions

1. Which statement correctly defines enthalpy as used in thermochemistry?

- A) The total kinetic energy of all particles in a substance
- B) The heat content of a system at constant pressure
- C) The activation energy required to start a reaction
- D) The rate at which a reaction releases energy

[\(Outcome\)](#)

2. In your own words, explain why chemical reactions absorb or release energy. Refer to the breaking and forming of bonds and to changes in potential and kinetic energy in your answer.

[\(Outcome\)](#)

3. True or false: The combustion of a hydrocarbon fuel is classified as an endothermic process.

[\(Outcome\)](#)

4. A calorimetry trial adds 50.0 g of water to a calorimeter. The water temperature rises from 20.0°C to 35.0°C. Using $Q = mc\Delta T$, calculate the heat, in joules, absorbed by the water.

[\(Outcome\)](#)

5. In the equation $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$, the sign of ΔH is _____.

- A) The reaction absorbs heat from the surroundings
- B) The reaction releases heat to the surroundings
- C) The reaction requires a catalyst to proceed
- D) The products have more potential energy than the reactants

[\(Outcome\)](#)

6. Describe how a student would use calorimetry data, such as mass, specific heat capacity and temperature change of the calorimeter contents, to determine the enthalpy change of a chemical reaction.

[\(Outcome\)](#)

Curriculum coverage

Question	Outcome alias
1	Outcome
2	Outcome
3	Outcome

4	Outcome
5	Outcome
6	Outcome

Answer key

1. B) The heat content of a system at constant pressure. Enthalpy is defined as the heat content of a system measured under constant pressure conditions ([Outcome](#)).
2. A complete answer notes that breaking bonds in reactants requires energy input while forming bonds in products releases energy, and that the net energy change reflects the difference between the potential energy of reactants and products, converted to or from kinetic energy of the surroundings ([Outcome](#)).
3. False. Hydrocarbon combustion releases energy to the surroundings and is classified as exothermic, not endothermic ([Outcome](#)).
4. 3135 J (or 3.14 kJ). Using $Q = mc\Delta T$ $Q = 50.0 \text{ g} \times 4.18 \text{ J/g}^\circ\text{C} \times 15.0^\circ\text{C} = 3135 \text{ J}$ ([Outcome](#)).
5. B) The reaction releases heat to the surroundings. A negative ΔH , $-\Delta H$ for the reaction indicates a lower enthalpy than the reactants, so energy is released, consistent with ΔH for the reaction being negative. Exothermic changes ([Outcome](#)).
6. A complete answer describes measuring the mass and initial and final temperature of the water or solution in the calorimeter, applying $Q = mc\Delta T$ for the water and $Q = n\Delta H$ for the reaction along with the moles of reactant to calculate the molar enthalpy change of the reaction ([Outcome](#)).