

Enthalpy Changes and Calorimetry

Chemistry 30, Unit A: Energy, Change and Systems

Why Study Energy in Chemical Reactions?

- Chemists quantify how much energy a reaction produces or absorbs.
- This unit builds on Science 10 energy concepts and Grade 7 heat and temperature.
- Students will determine and interpret energy changes in chemical reactions.
- Students will explain and communicate energy changes in chemical reactions.
- Society relies on chemical reactions for energy, from combustion to metabolism.

From Heat Transfer to Enthalpy Notation

1

$$Q = mc\Delta T$$

Recall this equation to analyze heat transfer between substances.

2

Define Enthalpy

Enthalpy and molar enthalpy describe energy content of chemical reactions.

3

Balanced Equations

Write balanced equations that include energy changes as terms.

4

ΔH , ΔH°

Use ΔH , ΔH° to communicate and calculate energy changes.

5

Classify Reactions

Classify reactions as endothermic or exothermic, including photosynthesis and combustion.

Calculating ΔH°_f Two Approaches

Standard Enthalpies of Formation

Predict the enthalpy change for a chemical equation using standard enthalpies of formation of reactants and products.

This method uses tabulated ΔH°_f values and the relationship $\Delta H^\circ_{\text{reaction}}$ equals the sum of ΔH°_f products minus the sum of ΔH°_f reactants.

Hess' Law

Explain and apply Hess' law to calculate the energy change for a net reaction by combining a series of known reactions. This method allows chemists to determine ΔH° for reactions that are difficult to measure directly.

Calorimetry in the Lab

Measuring enthalpy change with a coffee-cup calorimeter

Calorimetry data allows students to determine the enthalpy change occurring in a chemical reaction. In a typical lab, a known mass of solution reacts inside an insulated calorimeter while a thermometer records temperature change. Students apply $Q = mc\Delta T$ by the water, then relate this value to moles of reactant to calculate molar enthalpy.

Bringing It Together

This unit connects heat transfer calculations, enthalpy notation, energy diagrams and calorimetry to explain how chemists quantify energy changes in reactions. Students learn to analyze energy diagrams labelling reactants, products, enthalpy change and activation energy, and to explain energy changes in terms of bond breaking, bond forming and changes in potential and kinetic energy.

If a calorimetry experiment loses heat to the surroundings during the reaction, will the calculated enthalpy change be too large or too small in magnitude, and why?