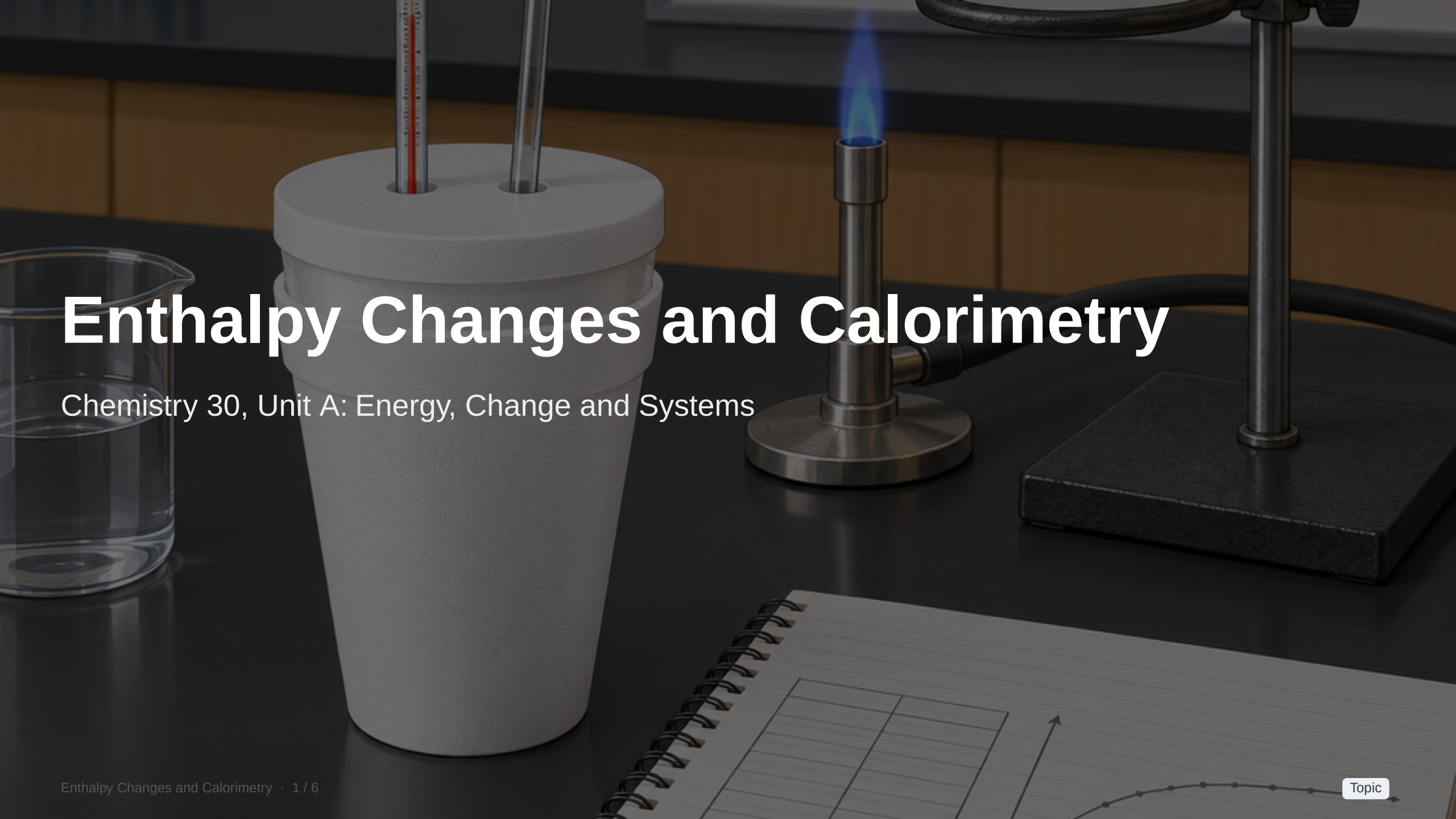


A laboratory setup for calorimetry. In the center is a white styrofoam calorimeter cup with a lid. Two glass tubes pass through the lid: one contains a thermometer with a red liquid column, and the other is empty. To the left of the cup is a clear glass beaker partially filled with water. To the right of the cup is a Bunsen burner with a blue flame. Further right is a black laboratory stand with a vertical rod. In the foreground, a spiral-bound notebook is open, showing a table with several rows and columns, and a graph with a curve plotted on it. The background is a dark laboratory bench with wooden cabinets.

Enthalpy Changes and Calorimetry

Chemistry 30, Unit A: Energy, Change and Systems

Unit Outcomes at a Glance

- Determine and interpret energy changes in chemical reactions.
- Explain and communicate energy changes in chemical reactions.
- Key concepts include enthalpy of formation, enthalpy of reaction, ΔH , ΔG , ΔS , molar enthalpy, energy diagrams, activation energy, catalysts, and calorimetry.
- This unit builds on Grade 7 Heat and Temperature and Science 10 Energy and Matter concepts.

Enthalpy: Definitions and Notation

Enthalpy and Molar Enthalpy

Enthalpy is the heat content of a system at constant pressure, and molar enthalpy expresses this quantity per mole of substance reacted. Reactions are classified as endothermic or exothermic based on whether they absorb or release energy, including photosynthesis, cellular respiration and hydrocarbon combustion.

Enthalpy Change and Standard Enthalpy Change

Enthalpy change (ΔH) indicates and quantifies the enthalpy change of a reaction. Energy changes during reactions arise from bonds breaking and forming, and from shifts between potential and kinetic energy of particles.

From Data to Enthalpy: The Calorimetry Process

1

Measure temperature change

Record initial and final temperature of the calorimeter contents using a thermometer.

2

Apply $Q = mc\Delta T$

Recall and use this equation to analyze heat transfer between the reaction and its surroundings.

3

Use calorimetry data

Use the calculated heat value to determine the enthalpy change of the chemical reaction.

4

Express as ΔH

Report the result using ΔH , $^\circ\text{C}$ for the reaction.

Calculating Enthalpy Without a Calorimeter

Standard enthalpies of formation

Predict the enthalpy change for a reaction using tabulated standard enthalpies of formation of reactants and products.

Hess' law

Explain and use Hess' law to calculate the energy change for a net reaction by combining a series of known reactions.

Energy diagrams

Analyze and label energy diagrams showing reactants, products, enthalpy change and activation energy.

Activation energy and catalysts

Recognize activation energy as the energy barrier a reaction must overcome, and catalysts as a way to lower that barrier.

Bringing It Together

Across this unit, students learn to quantify heat transfer with $Q = mc\Delta T$ and molar enthalpy changes, ΔH , and standard enthalpies of formation, interpret energy diagrams, and use calorimetry data to determine enthalpy changes for real chemical reactions.

If you ran a calorimetry experiment and your calculated ΔH was significantly more negative than the accepted value, what sources of heat loss might explain the discrepancy?