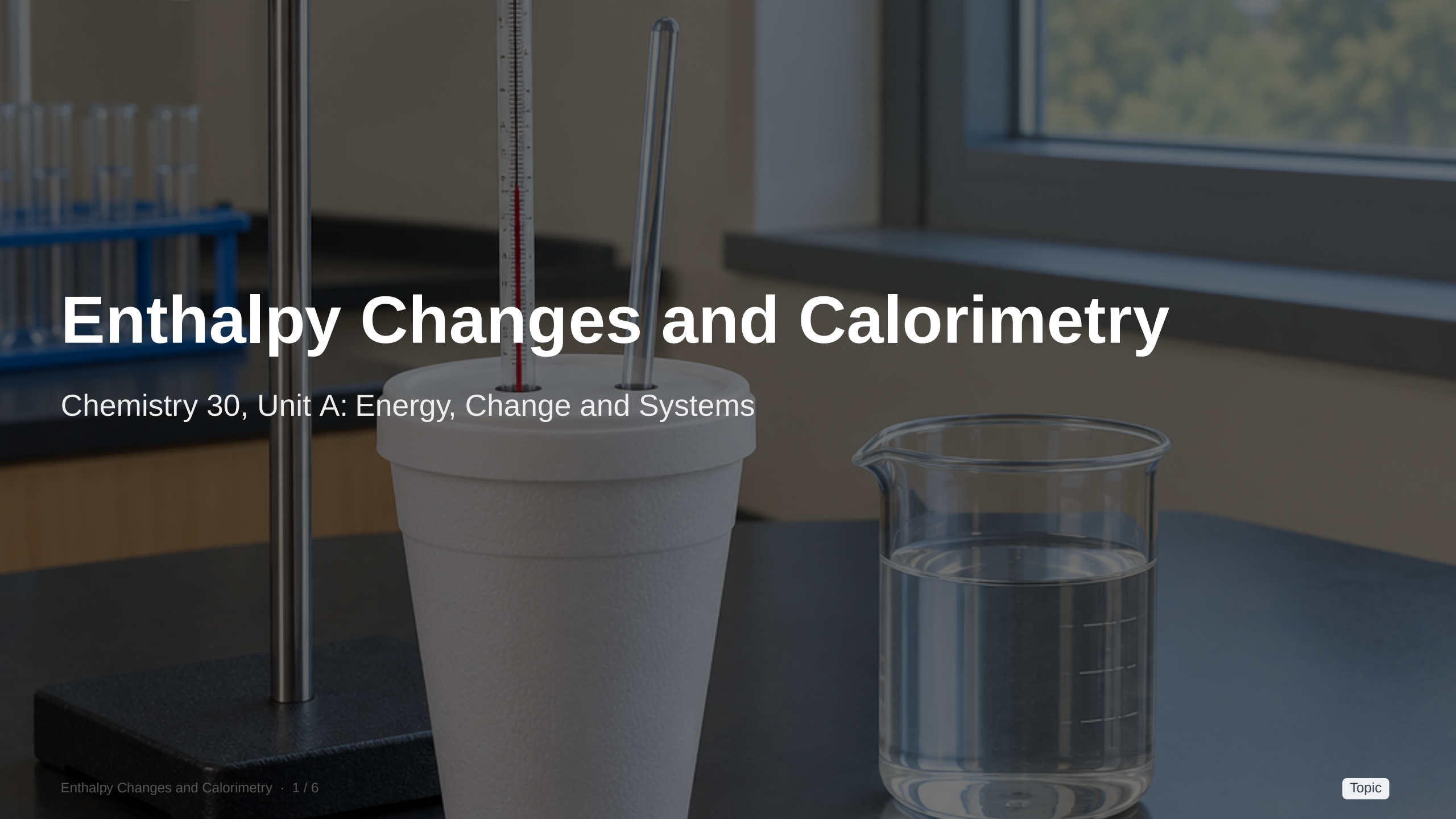


A laboratory setup for calorimetry is shown. In the foreground, a white styrofoam cup is used as a calorimeter. A thermometer is inserted into the cup, and a glass rod is also visible. To the right of the cup is a glass beaker containing a clear liquid. The background shows a laboratory bench with a rack of test tubes and a window with a view of greenery outside.

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.
- Society relies on chemical reactions for usable energy, so understanding energy changes has practical impact.
- Students will determine and interpret energy changes in chemical reactions.
- Students will also explain and communicate those energy changes.
- This unit builds on heat and temperature concepts from Science 10 and Grade 7 Science.

From Heat Transfer to Enthalpy

1

Measure heat transfer

Apply $Q = mc\Delta T$ to determine the heat absorbed or released by a substance.

2

Define enthalpy

Enthalpy and molar enthalpy describe the heat content change for a chemical reaction.

3

Use ΔH to calculate

ΔH indicates and calculates energy changes in reactions.

4

Classify the reaction

Reactions are classified as endothermic or exothermic, including photosynthesis, respiration and combustion.

Two Ways to Find ΔH° for a Reaction

Standard Enthalpies of Formation

Students predict the enthalpy change for a chemical equation using standard enthalpies of formation of reactants and products. This method uses tabulated reference values rather than direct measurement.

Hess' Law

Hess' law allows the enthalpy change for a net reaction to be calculated by combining a series of known reactions. This works because enthalpy is a state function, independent of the pathway taken.

Calorimetry in Practice

Determining ΔH , Experimentally

In a calorimetry experiment, students measure the temperature change of a known mass of water or solution surrounding a reaction to calculate heat transfer, then use that data to determine the enthalpy change of the chemical reaction itself. This experimental approach links the mathematical relationship $Q = mc\Delta T$ to real reaction data, and the resulting energy diagram shows reactants, products, enthalpy change and activation energy.

Bringing It Together

This unit connects heat transfer calculations, enthalpy definitions, $q = mc\Delta T$, $q = n\Delta H$, standard enthalpies of formation and calorimetry into one framework for quantifying energy changes in chemical reactions. Students also explain these changes at the particle level, referring to bonds breaking and forming and shifts between potential and kinetic energy.

If a calorimetry experiment measures a smaller temperature change than the true value due to heat loss to the surroundings, how would that affect the calculated molar enthalpy for an exothermic reaction?