

Enthalpy Changes and Calorimetry

30 minutes, 3 stages

Calorimetry lets you measure heat transfer experimentally and use that data to calculate the enthalpy change of a reaction ([Outcome](#)). This homework asks you to apply $Q = mc\Delta T$ ([Outcome](#)), work with ΔH notation ([Outcome](#)), and connect molar enthalpy ([Outcome](#)) to real calorimeter data, the same skills tested on the diploma exam.

Stage 1: Warm-up (8 min)

Answer the following in your notebook.

1. Define enthalpy and molar enthalpy in your own words ([Outcome](#)).
2. Write the equation $Q = mc\Delta T$. What variable represents, including units ([Outcome](#)).
3. A reaction releases heat to its surroundings. State whether ΔH is positive or negative, and name this type of reaction ([Outcome](#)).
4. A different reaction absorbs heat from its surroundings. State whether ΔH is positive or negative, and name this type of reaction ([Outcome](#)).

Stage 2: Calculations (16 min)

Solve each problem. Show all substitutions and units. Use $c(\text{water}) = 4.19 \text{ J/(g}\cdot^\circ\text{C)}$.

Problem 1:

In a calorimeter, 150.0 g of water increases in temperature from 21.4°C to 35.8°C after a combustion reaction. Calculate the heat absorbed by the water, in joules and in kilojoules ([Outcome](#), [Outcome](#)).

Problem 2:

A student burns 0.68 g of a hydrocarbon fuel (molar mass 114.2 g/mol) beneath a calorimeter containing 200.0 g of water. The water temperature rises from 19.6°C to 47.3°C.

- a) Calculate the heat released by the combustion, in kJ.
- b) Calculate the number of moles of fuel burned.
- c) Calculate the molar enthalpy of combustion for this fuel, in kJ/mol. Include the correct sign ([Outcome](#), [Outcome](#), [Outcome](#)).

Problem 3:

Write a thermochemical equation for the reaction in Problem 2, using ΔH and the molar enthalpy value you calculated ([Outcome](#)).

If you have completed a calorimetry lab this unit, for example burning a nut sample or testing a polystyrene-cup calorimeter, compare your calculated molar enthalpy to a published value and suggest one source of experimental error ([Resource](#), [Resource](#)).

Stage 3: Consolidation (6 min)

Write a short paragraph, four to six sentences, explaining how calorimetry data connects to the concept of molar enthalpy. Your paragraph should reference:

- what a calorimeter measures directly
- how $Q = mc\Delta T$ converts that measurement into a heat value ([Outcome](#))
- how heat value and moles of substance combine to give molar enthalpy ([Outcome](#), [Outcome](#))

Self-check

1. In Problem 2, why is the sign of q_D negative even though your Q calculation gave a positive number for heat gained by the water?
2. If you doubled the mass of water in the calorimeter but the temperature change stayed the same, what would happen to your calculated value of Q ? What would this suggest about your experimental setup?
3. State the difference between enthalpy (q_D , for a given amount of reactant) and molar enthalpy (q_D , per mole of reactant) ([Outcome](#)).