# Edexcel Chemistry A-level

## Practical 8

Determination of enthalpy change using Hess's Law.

Enthalpy change for a decomposition of potassium hydrogencarbonate **cannot be measured directly**. The reaction needs heating, so the recorded ΔT is not exclusively due to the decomposition of the starting material.

**Two reactions** (with measurable enthalpy changes) can be **combined** to form a desired reaction with unmeasurable enthalpy change (and therefore calculate its enthalpy change).

**Hess's law:** The enthalpy change for a reaction is independent of the path taken.

## Method

1. Place one of the reactants into a polystyrene cup and place a thermometer with it.
1. Start a stopwatch and record the temperature of the liquid every minute.
2. At 4 minutes, add the second reactant and dont record a temperature change for this minute.
3. At 5 minutes continue taking temperature readings each minute for a further ten minutes.
4. Plot temperatures of a graph and extrapolate to find ΔT.
5. Repeat for the second reaction.

## Key Points

- **Q = mcΔT**,
  where m = mass of the solution, c = specific heat capacity, ΔT = change in temperature.
- **ΔH = Q/moles**,
  where Q is in kJ. Include +/− sign to specify whether the reaction is exothermic or endothermic. If temperature increases it is exothermic. If temperature decreases it is endothermic.
- This practical combines two **neutralisation reactions**:

$$(1)\ K_2CO_3 + 2\ HCl \rightarrow 2\ KCl + H_2O + CO_2$$
$$(2)\ 2\ KHCO_3 + 2\ HCl \rightarrow 2\ KCl + 2H_2O + 2CO_2$$

- The desired reaction is: $2\ KHCO_3 \rightarrow K_2CO_3 + CO_2 + H_2O$. Therefore to find the enthalpy of the desired reaction, measure enthalpy change for (1) and (2) then calculate **(ΔH2) - (ΔH1)**.

## Errors

- We assume the **specific heat capacity** of the solution to be **that of water**.
- Polystyrene is more **insulating** than glass, so less heat is lost.