Edexcel Chemistry A-level

Practical 14

Activation energy for Bromide and Bromate(V).

The **Arrhenius** equation shows the relationship between the rate constant and the temperature.

Measuring the value of rate constant (k) at different temperatures (T) allows us to find the value for activation energy (E_a) of a reaction.

Solutions containing bromates, phenol, and an indicator, are prepared at different temperatures. The reaction will be initiated by the addition of sulfuric acid.

Method

1. Mix bromates, bromides and some sulfuric acid to produce bromide.
   $[BrO_3^- + 5\ Br^- + 6\ H^+ \rightarrow 3\ Br_2 + 3\ H_2O]$
2. Add phenol:
   $[C_6H_5OH + 3\ Br_2 \rightarrow C_6H_3Br_3OH + 3\ HBr]$
3. As soon as the produced bromine reacts with phenol, it reacts with the indicator. The decolourisation of the indicator is the end of the reaction.
4. Record time values for this point at different temperatures.

Data Manipulation

$1/t$ is proportional to rate constant. The rate constant can be thought of as being a **ratio** of c, concentration of phenol, to t, time taken for the reaction to finish.

Substituting this ($k = c/t$) to the Arrhenius equation gives:

$$\ln(t) = \ln c - \ln A + E_a/RT.$$

Therefore, plotting **$\ln(t)$ against $1/T$** should produce a straight graph, with gradient E_a/R. This allows the **activation energy** to be found.