

Order of Reaction and Effect of Temperature on Reaction Rate

Student Handout

Purpose

To study the order of a reaction and the effect of temperature change on the rate of a reaction.

Introduction

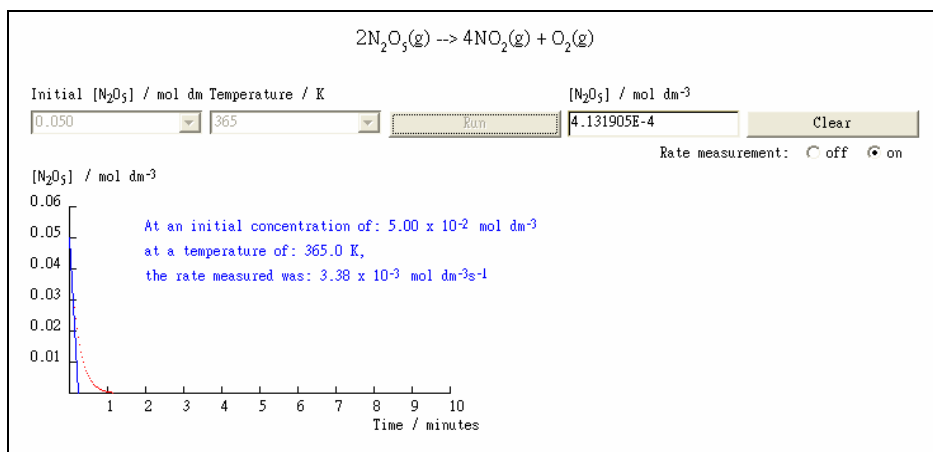
If the instantaneous rate is measured at time zero, i.e. just as the reaction starts, the rate is known as the initial rate of reaction. Multiple runs of the computer simulation enable us to collect data from which the order of reaction and the effect of temperature on the reaction may be determined. The Arrhenius equation

$$\ln k = \text{constant} - \frac{E_a}{RT}$$

can be applied to obtain the activation energy of the reaction. You will use a spreadsheet software e.g. MS Excel to analyse and present the data collected.

Tasks

1. Start the computer simulation by entering the following URL in a web browser.
http://www.chemit.co.uk/java/rsc_temperature_effect/applet.htm



2. While keeping the temperature constant, measure the initial rates of the reaction at different initial concentrations of $\text{N}_2\text{O}_5(\text{g})$. Record your results and determine the order of reaction with respect to $\text{N}_2\text{O}_5(\text{g})$.

Temperature: _____ K

Initial $[\text{N}_2\text{O}_5(\text{g})]$ / mol dm^{-3}	Rate / $\text{mol dm}^{-3} \text{ s}^{-1}$

3. While keeping the initial concentration of $\text{N}_2\text{O}_5(\text{g})$ constant, measure the initial rates at different temperatures. Using a spreadsheet software, construct a worksheet according to the following table. Create a graph with $\ln(\text{rate})$ against $1/T$.

Determine the activation energy of the reaction from the slope of the curve $(-E_a/R)$, taking R as $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$.

T / K	Rate/ $\text{mol dm}^{-3} \text{ s}^{-1}$	$\frac{1}{T} / \text{K}^{-1}$	$\ln(\text{rate})$

Discussion Question

Explain why temperature can affect reaction rate.
