

Practical 2 – Chapter 6

Investigating the effect of concentration on reaction rate

In this experiment you will study how changing concentration affects the rate of a reaction.

The reaction you will study is that between sodium thiosulfate solution and hydrochloric acid:



The reaction produces a precipitate of sulfur. You will time how long it takes to obscure a cross drawn on a piece of paper placed under the reaction flask. In other words, you will measure the time it takes to produce a fixed amount of sulfur.

Safety

- 2 mol dm⁻³ HCl is an irritant.
- The reaction produces SO₂, which is toxic and is an irritant to the eyes and respiratory system.
- Wear eye protection.

What to do

- Mark a cross in black pen on a piece of paper.
- Place the conical flask on the cross.
- Put 50 cm³ of 0.15 mol dm⁻³ sodium thiosulfate into the flask.
- Measure out 5 cm³ of 2.0 mol dm⁻³ hydrochloric acid using a measuring cylinder (**Care!**).
- Add the hydrochloric acid to the conical flask, start the stopwatch and swirl to mix the chemicals.
- Time how long it takes for the sulfur produced to obscure the cross.
- Wash the contents of the flask down the sink with lots of water.

Vary the concentrations by making up the mixtures detailed in the table. You can also use this table to record your results.

Expt No.	Volume of Na ₂ S ₂ O ₃ / cm ³	Volume of H ₂ O / cm ³	Volume of HCl / cm ³	Concentration of Na ₂ S ₂ O ₃ / mol dm ⁻³	Time, 1 / s ± 1 s	Time, 2 / s ± 1 s
1	50	0	5	0.15		
2	40	10	5			
3	30	20	5			
4	20	30	5			
5	10	40	5			

Processing the results

Because the procedure involves timing how long it takes to produce a fixed amount of product, the rate of reaction is inversely proportional to the reaction time:

$$\text{rate} \propto \frac{1}{\text{time}}$$

Plot a graph of rate of reaction (on the y-axis) against concentration of sodium thiosulfate (on the x-axis).

Draw a line of best fit, as either a straight line or a curve. Do NOT just join the points.

Explain, as far as you can, what your results indicate about the relationship between reaction rate and concentration.

Explain your conclusion in term of collision theory.

Answer the following questions

- 1 Were your repeat readings within 10% of each other?
- 2 Did all your points lie on the line of best fit?
- 3 List three reasons why the results of your experiment may have been inaccurate.
- 4 List a reason, different from those in question 3, why your results may be different from those of another group.
- 5 Suggest as many ways as you can in which the experiment could be improved to give more accurate results.