# GCSE Chemistry required practical activity 5: Rates of reaction

## Student sheet

| Required practical activity | Apparatus and techniques |
|---|---|
| Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. This should be an investigation involving developing a hypothesis. | AT 1, AT 3, AT 5, AT 6 |

**Investigation into how the concentration of a solution affects the rate of a chemical reaction.**

In this investigation you will use the reaction between sodium thiosulfate and hydrochloric acid to find out how the rate of reaction changes as the thiosulfate solution becomes more dilute.

| Learning outcomes |
|---|
| **1**<br><br>**2**<br><br>**Teachers to add these with particular reference to working scientifically** |

## Method

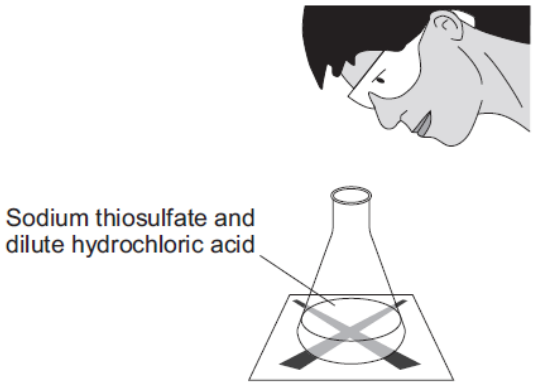
**You are provided with the following:**

- 40g/dm$^3$ sodium thiosulfate solution.
- 2.0M dilute hydrochloric acid
- 10cm$^3$ and 100cm$^3$ measuring cylinders
- 100cm$^3$ conical flask
- printed black paper cross
- stopclock

## Risk assessment

Safety goggles must be worn throughout.
**You should read these instructions carefully before you start work.**

1. Use a measuring cylinder to place 10cm$^3$ sodium thiosulfate solution into the conical flask. Again using a measuring cylinder, dilute this by adding 40cm$^3$ water. This will make a solution of thiosulfate with a concentration of 8g/dm$^3$. Put the conical flask on the black cross.
2. Put 10cm$^3$ of dilute hydrochloric acid into the small measuring cylinder.
3. As you tip this acid into the flask, swirl it gently and at the same time start the stopclock.
4. Looking down through the top of the flask, stop the clock when you can no longer see the cross.




5. Write the time taken **in seconds** in the first blank column of the table on the back of this sheet. You will need to multiply any minutes by 60 and then add the extra seconds.
6. Repeat **steps 1 - 4** four times, but **in step 1** use:

   - 20cm$^3$ sodium thiosulfate + 30cm$^3$ water (concentration 16g/dm$^3$)
   - 30cm$^3$ sodium thiosulfate + 20cm$^3$ water (concentration 24g/dm$^3$)
   - 40cm$^3$ sodium thiosulfate + 10cm$^3$ water (concentration 32g/dm$^3$)
   - 50cm$^3$ sodium thiosulfate + no water (concentration 40g/dm$^3$)

7. Repeat the **whole investigation** (steps 1 – 5) twice more and record the results in the second and third blank columns of the table.
8. Calculate the **mean** time for each of the thiosulfate concentrations and record it in the fourth blank column, leaving out of your calculations any anomalous values.
9. Plot a line graph of thiosulfate concentration in g/dm$^3$ (x axis) against mean time taken to obscure the cross in seconds (y axis). Draw a smooth curved line of best fit. What can you say about the effect of the independent variable (concentration) on the dependent variable (time taken for the cross to disappear)? What were your control variables?
10. Compare your results with those of others in the class. Is there evidence that this investigation is reproducible?

| Concentration of sodium thiosulfate ($g/dm^3$) | Time taken for cross to disappear (seconds) | | | |
|---|---|---|---|---|
| | First trial | Second trial | Third trial | Mean |
| 8 | | | | |
| 16 | | | | |
| 24 | | | | |
| 32 | | | | |
| 40 | | | | |