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Martin's Practical Guide on

Investigating the Effect of Concentration on Reaction Rate

Objective:

To investigate how the change in concentration affect the rate of reaction using the reaction between sodium thiosulfate and hydrochloric acid.

Materials	Product Code	
40g/dm³ sodium thiosulfate solution	CHE3570SE	See solution preparation (Pg 3)
2.0M dilute hydrochloric acid	CHE2138SE	See solution preparation (Pg 3)
10cm³ and 100cm³ measuring cylinders	CYL2080 and CYL2086	
100cm³ conical flask	SLS5084	
250cm³ Volumetric flask	FLA70140	
Printed paper cross.	-	See X Print template (Pg 4)
Stopwatch	TIM1030	
Safety glasses	SLS6000	



Safety considerations:

- Ensure safety glasses are worn throughout the experiment.
- Ensure there is a full risk assessment completed for the experiment.

Procedure:

1. Measure 10cm³ of sodium thiosulfate solution with a measuring cylinder.
2. Dilute the solution by adding 40cm³ of water. This creates a solution with a concentration of 8g/dm³.
3. Place the conical flask on the black cross.

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Reaction Setup:

1. Measure 10cm³ of dilute hydrochloric acid with a second clean measuring cylinder.
2. Slowly pour the acid into the conical flask while gently swirling it.
3. Start the stopwatch simultaneously with pouring the acid.

Observation:

Observe the reaction taking place. Stop the stopwatch when the black cross is no longer visible from the top of the flask.

Recording Data:

Record the time taken for the cross to disappear in seconds.
Repeat the experiment three times using different concentrations of sodium thiosulfate:

- 20cm³ sodium thiosulfate + 30cm³ water (concentration 16g/dm³)
- 30cm³ sodium thiosulfate + 20cm³ water (concentration 24g/dm³)
- 40cm³ sodium thiosulfate + 10cm³ water (concentration 32g/dm³)
- 50cm³ sodium thiosulfate + no water (concentration 40g/dm³)

Repeat the entire investigation twice more, if time allows.

Data Analysis:

1. Calculate the mean time for each concentration, excluding any anomalous values.
2. Plot a line graph with concentration (g/dm³) on the x-axis and mean time (seconds) on the y-axis.
3. Draw a smooth curved line of best fit.

Interpretation:

1. Analyse the graph to observe the effect of concentration on the reaction rate.
2. Discuss the relationship between the independent variable (concentration) and the dependent variable (time taken for the cross to disappear).
3. Identify control variables that were maintained throughout the experiment.



Comparison:

Compare your results with those of others in the class to evaluate reproducibility.

Conclusion:

Summarise the findings of the investigation, including any trends observed in the data, possible improvements and relate to the objective.

Technician notes:

Solution preparation:

- 40g/dm^3 Sodium Thiosulphate solution – 40g in 1L of Distilled water, we recommend using a stirrer plate (SLS4780).
- 2M hydrochloric acid – Measure out 43.4 mL of 35% HCl into a beaker. Add this to a 250-mL volumetric flask containing 150ml of distilled/deionised water. Top up with distilled/deionised water to the mark of the volumetric flask using a wash bottle. Stopper the volumetric flask and invert several times keeping your thumb on the stopper to mix the solution well. Always add acids to water.

Please ensure you use a fume cupboard and all protective equipment including eye protection and gloves when dealing with concentrated acid and keep a spill kit to hand.

Crosses to Print and Laminate:











