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School of Maths & Science
Science Practical

**The Kinetics Of The Reaction Between Iodine
And Propanone In Acid Solution**

◆ **Aim**

At the end of the experiment, you should be able to

- (i) Understand the term initial rate
- (ii) Calculate initial rates from initial concentrations and times
- (iii) Use initial rate data to deduce how the rate and reactant concentration are related for a reaction.
- (iv) Comment on possible sources of error

◆ **Introduction**

The reaction between iodine and propanone follows the overall equation



The reaction is catalysed by hydrogen ions.

This reaction is a clock reaction i.e. one where there is a sudden change in colour of the reaction mixture. In this reaction the solution changes from a brown colour (due to iodine in solution) to colourless (once there is too little iodine to colour the solution. For this reaction;

$$\text{Rate} \propto \frac{\text{volume of iodine solution used}}{\text{Time for iodine colour to disappear}}$$

Therefore in order to investigate how the concentration of each reactant affects rate we can measure the time for the iodine colour to disappear when different concentrations of each reactant are used. In this experiment concentrations of iodine, propanone and the acid catalyst will be varied.

Although we can make up reaction mixtures with known concentrations of reactants once the reaction starts these concentrations will change. We can avoid this problem by using what is called the initial rates method i.e. we measure the rate of the reaction for a short time at the beginning so that the concentrations of the reactants do not change significantly.

◆ Safety



Control Measures

- The wearing of safety glasses, gloves and a laboratory coat at all times will be sufficient to take account of most hazards and significant risks.
- Keep stoppers on bottles as much as is possible
- Keep flammable liquids away from flames
- All waste is to be placed in the labelled container immediately after use.
- You are reminded of the need of good laboratory practise in order to maintain a safe working environment.

Hazards

(Highly) Flammable
Corrosive
Harmful/Irritant

Propanone
Hydrochloric Acid
Iodine

◆ Procedure

Make up mixtures of hydrochloric acid, propanone solution and water according to the table, using burettes. Start the reaction by adding the appropriate volume of iodine solution, measured into test-tubes from a burette and measure the time in seconds for the colour of the iodine to disappear.

Run	Volume of solution to be added to test tube / cm ³				Time for colour to disappear / s	Rate / cm ³ s ⁻¹
	2 mol dm ⁻³ HCl	2 mol dm ⁻³ propanone	0.01 mol dm ⁻³ Iodine	water		
1	20	8	4	0		
2	10	8	4	10		
3	20	4	4	4		
4	20	8	2	2		

◆ **Question**

1. If you compare the mixtures for runs 1 and 2 you will see that the concentrations of propanone and of iodine are the same in both but the concentration of acid in run 2 is half of what it is in run 1.

What is the effect on the rate of change on concentration of iodine of halving the concentration of acid?

2. How do the concentrations of reactants differ in runs 1 and 3? What effect has this had on the rate?
3. How do the concentrations of reactants differ in runs 1 and 4? What effect has this had on the rate?
4. Why is the total volume of the reactant mixtures kept the same for each run?
5. What are the main sources of error in this experiment?
6. How could the experiment be improved?