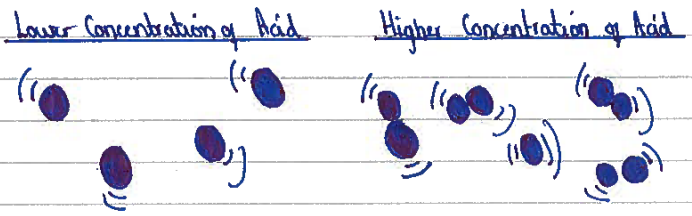
Candidate 3 evidence

How Acid Concentration Affects Reaction Rate.

Aim: To find out how increasing the acid concentration alters the rate of reaction.

Underlying Chemistry:

Reaction rate measures how fast a product takes to appear or for a reactant to be used up. It can measure how fast a reaction occurs. One of the factors affecting reaction rate is concentration. When the concentration of a solution gets increased, there will be particles moving nearer to each other. This will mean more collisions are likely to happen, resulting in an increase of reaction rate. When the reactants being used increase in concentration then the quicker the rate of reaction will occur.



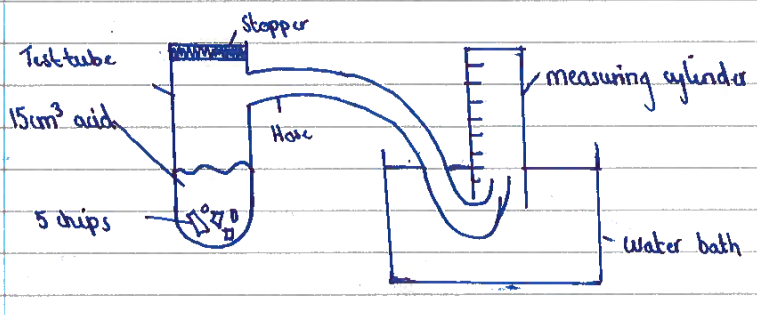
When the acid being used is diluted then the hydrogen ions' concentration will decrease resulting in the pH moving towards 7. Acidic solutions contain less hydroxide ions than hydrogen, whereas alkalis have less hydrogen ions and more hydroxide. Neutralisation can also take place when using acids. This is when acid reacts with a base to form salt and water. This also results in the pH moving closer to 7. Acids can be neutralised by metal carbonates. When they react together 3 products are formed, The formula used in this reaction is:-

Metal Carbonate + Acid → Salt + Water + Carbon Dioxide

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

When testing the reaction rate given off when changing the concentration of an acid the following method can be used:

(2)



Description of experiment:

Five chips of calcium carbonate where placed into a test tube with 15 cm^3 of acid and a lid. A delivery hose attached the test tube to a trough of water containing a measuring cylinder placed upside down.

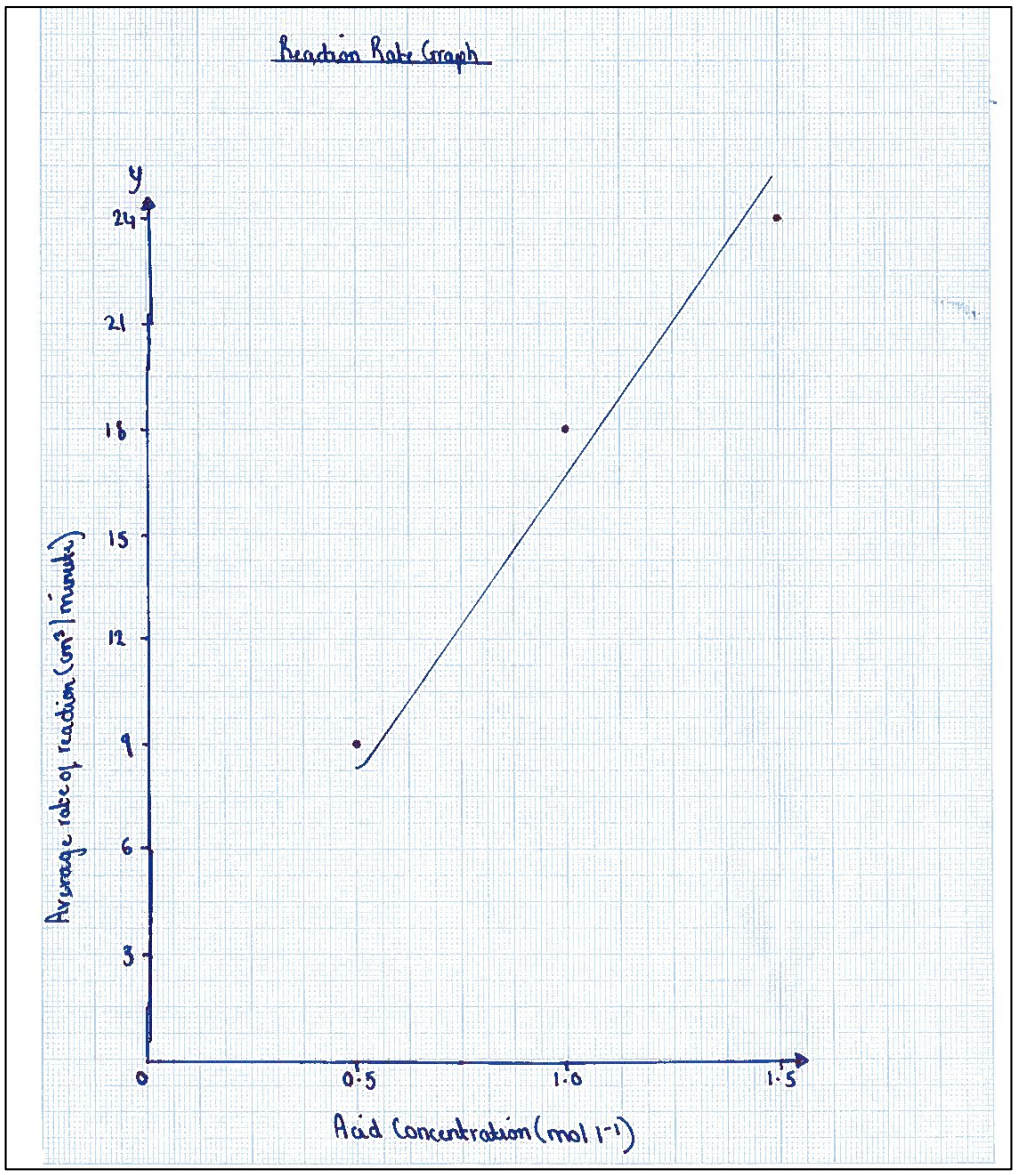
Experimental Data:

Acid Concentration ($mol\ l^{-1}$)	Volume of Gas Given Off (cm^3) Test 1	Test 2	Average Volume of Gas (cm^3)
0·5	27	26	26·5
1·0	53	56	54·5
1·5	75	70	72·5

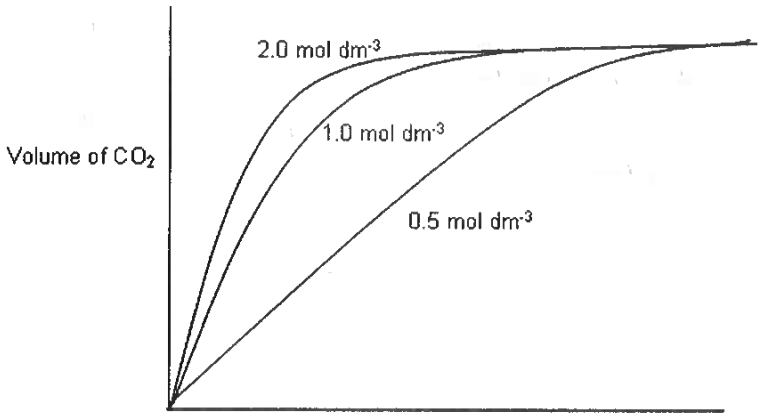
Rate of 0·5 = $\frac{\Delta \text{ quantity}}{\Delta \text{ time}} = \frac{26·5}{3} = 9 cm^3$ / minute

Rate of 1·0 = $\frac{\Delta \text{ quantity}}{\Delta \text{ time}} = \frac{54·5}{3.} = 18 cm^3$ / minute

Rate of 1·5 = $\frac{\Delta \text{ quantity}}{\Delta \text{ time}} = \frac{72·5}{3} = 24 cm^3$ / minute


Reaction Rate Graph
y
24
21
18
15
12
9
6
3
0
0·5
1·0
1·5
Average rate of reaction (cm³ / minute)
Acid Concentration (mol l⁻¹)

Internet Source



https://www.4college.co.uk/a/cp/rates.php

Source	Reference
Website	www.4college.co.uk/a/ep/rates.php

Analysis

Both the experimental data and the internet source were calculating how long it took for a reaction to occur whilst altering the concentration of a product. The internet changed the concentration by 0·5, 1·0 and 2·0 mol l^{-1} and my experiments changed the concentration of the product by 0·5, 1·0 and 1·5 mol l^{-1}.

Conclusion

As we can see by this experiment, increasing the acid concentration of a product also increases the speed at which a reaction takes place. The higher the concentration became, a higher volume of gas was given off.

Evaluation

For the majority of the experiment, all results were reliable. We can see this because as the concentration were increased, the volume of gas always went up by $1cm^3$. To make the experiment reliable we ensured the exact number of acid went into the test tube and that there were no air bubbles in the measuring cylinder when calculating the volume of gas given off. Next time we can ensure the volume of gas is written down at the exact second, instead of reading the number up to ten seconds after the three minutes are over. This will make our results slightly more precise, and more accurate.