Factors affecting the rate of a reaction

The aim of this experiment is to investigate whether changing the concentration of a solution will have any effect on the rate of the reaction. We are trying to prove that increasing the concentration will speed up the rate of the reaction.

The rate of a chemical reaction is the rate at which reactants are used up or products are produced. In order to measure the rate of reaction we measure the amount of reactants used or products produced over a certain period of time. In our experiment we have chosen to use sodium thiosulphate and hydrochloric acid. This is because this reaction would be the easiest for us to note the rate of the reaction.

According to Le Chatelier's Principle; " if a system that is in equilibrium is disturbed, the equilibrium position will change in order to oppose the disturbing influence and re-establish equilibrium" (1). Therefore if the concentration of a substance is increased then the reaction that removes that substance will be favoured in order to re-establish equilibrium in the system. So if we are increasing the concentration of the reactants then the forward reaction will speed up. Based on this information we can predict that the rate of the reaction of sodium thiosulphate and hydrochloric acid will speed up with increased concentration.

Since increasing the concentration will increase the amount of molecules we can predict that there will be more effective collisions taking place. The more effective collisions taking place, the quicker the rate of the reaction will be.

Increasing the concentration of a substance will increase the rate of the reaction.

- 5 Equal Volume conical flasks
- One 500cm³ measuring cylinder
- Two 100cm³ measuring cylinder
- One 10cm³ measuring cylinder
- 8g of sodium thiosulphate
- 35cm³ concentrate hydrochloric acid
- 1 electronic scale
- 1 filter paper
- 1 stopwatch
- 1 piece of white paper with black cross

1. First we had to use the electronic scale to measure out 8g of sodium thiosulphate and then dissolve the 8g of thiosulphate in 200cm³ of water. This was done in the 500cm³ measuring cylinder.

0. The next step was to use the 100cm³ measuring cylinder to measure and pour 50cm³, 40cm³, 30cm³, 20cm³ and 10cm³ respectively into the five identical conical flasks.

0. In order to make sure that each conical flask had a total volume of 50cm³ of solution we added 10cm³, 20cm³, 30cm³ and 40cm³ of water into the last four flasks.

0. The next step in the process was to use the other 100cm³ measuring cylinder to prepare a dilute solution of hydrochloric acid. This was done by adding 35cm³ of hydrochloric acid to 65cm³ of water.

0. Once all the solutions were prepared it was time to conduct the experiment. We placed the conical flask on the piece of paper over the

black cross. We used the 10cm³ measuring cylinder to measure 5cm³ of hydrochloric acid solution and added this to the conical flask. As soon as it was added we started the stopwatch. We observed the solution and as soon as it turned a creamy-yellow and the cross could not be seen the stopwatch was stopped and the time was written down.

0. This was then repeated on the other four conical flasks.

0. Once we had completed all the tests we cleaned out all the apparatus and repeated the whole experiment again with the remaining hydrochloric acid solution so that we could compare the results.

Flask	Sodium Thiosulphate concentration (cm³)	Time (s) (experiment 1)	Time (s) (experiment 2)
1	50	32. 72	24. 16
2	40	33. 80	27. 90
3	30	54. 60	43. 01
4	20	84. 92	71. 01
5	10	197. 40	158. 19

From the above tables and graphs we can see that our hypothesis is correct. Increasing the concentration of a solution will increase the rate of the reaction. We can also see from the table and the graphs that the rate of the reaction differed in experiment 2. The reason for this could be that when we prepared the dilute solution of hydrochloric acid we did not mix it properly with the water. This lead to there being a stronger dilute in the bottom of the measuring cylinder compared to that at the top of the measuring cylinder. This would have affected the results as it means that in experiment 1 there was a weaker solution of hydrochloric acid used, when it came to experiment 2 we were using the solution at the bottom of the cylinder and that part of the solution is stronger and more concentrated.

This actually helped prove our hypothesis as we can see that in experiment 2 the rate of the reaction was shorter. This is because there was a higher concentration of hydrochloric acid being added to the solution.

In the graph concentration vs. 1/time we can see that a straight line is formed. This means that there is an inverse relationship between concentration and the rate of a reaction. As the concentration of a substance is increased then the time for the reaction to take place is decreased.

From all of the above results from the experiment conducted we can conclude that the rate of a reaction is affected by the concentration of a substance. As there is a higher concentration of molecules in the substance then there will be more effective collisions taking place which means that the reaction will take place much faster.

Chemistry Practical Investigation Preparation

In this practical investigation we are going to investigate the effect that concentration has on the rate of a reaction. In order to do this we are going to conduct an experiment which involves adding different concentrations of a substance to another substance and then take note of the different rates of reaction, if any difference is to be seen. If a difference is seen then we can come to the conclusion that concentration does have an effect on the rate of a reaction.

According to Le Chatelier's Principle; " if a system that is in equilibrium is disturbed, the equilibrium position will change in order to oppose the disturbing influence and re-establish equilibrium" (1). Therefore if the concentration of a substance is increased then the reaction that removes that substance will be favoured in order to re-establish equilibrium in the system. So if we are increasing the concentration of the reactants then the forward reaction will speed up. Based on this information we can predict that the rate of the reaction of sodium thiosulphate and hydrochloric acid will speed up with increased concentration.

Since increasing the concentration will increase the amount of molecules we can predict that there will be more effective collisions taking place. The more effective collisions taking place, the quicker the rate of the reaction will be. Thus we can conclude in our hypothesis that increasing the concentration of a substance will increase the rate of the reaction.

The rate of a chemical reaction is the rate at which reactants are used up or products are produced. In order to measure the rate of reaction we measure the amount of reactants used or products produced over a certain period of

time. In our experiment we have chosen to use sodium thiosulphate and hydrochloric acid. This is because this reaction would be the easiest for us to note the rate of the reaction. Other reactions that we could've used include the reaction that is represented in the following equation; 2 NO + O2 = 2 NO2. The reason that we did not chose this reaction is because it would be to complicated for us to monitor the rate of the reaction. It is for this reason that we chose to use the reaction between hydrochloric acid and sodium thiosulphate.

In this experiment we are going to prepare five measuring cylinders each with different concentrations of sodium thiosulphate in. This is to test what effect the different concentrations have on the rate of the reaction. In order to make sure that each flask has an equal total volume we will add water to the each measuring cylinder. The next step of the process is to draw a cross on a piece of paper and place it under the measuring cylinder. Once that has been done we will add a dilute solution of hydrochloric acid to each of the measuring cylinders. Since we know that this reaction produces a creamy yellow precipitate it will not be hard to measure the rate of the reaction. Once the hydrochloric acid has been added we will time how long it takes until we cannot see the cross on the paper, this means until the creamy yellow precipitate is formed and the solution becomes turbid.

If our hypothesis is correct then we will find that the measuring cylinders with a higher concentration of sodium thiosulphate will take quicker to form a creamy-yellow precipitate, thus proving that increasing concentration increases the rate of the reaction.

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