Sodium thiosulphate and hydrochloric acid

ASSIGN BUSTER

Aim: To investigate how the rate of reaction between Sodium Thiosulphate and Hydrochloric acid is affected by changing the concentration.

Background:

THE REACTION: when Sodium Thiosulphate reacts with hydrochloric acid sulphur is produced. The sulphur forms in very small particles and causes the solution to cloud over and turn a yellow colour. This causes the cross to fade and eventually disappear.

Sodium Thiosulphate + Hydrochloric acid »» Sulphur + Sodium Chloride + Sulphur Dioxide + Water

$NA2S2O3 + 2HCL \rightarrow S + 2NaCl + SO2 + H2O$

(aq) + (aq) »» (s) + (aq) + (g) + (l)

PREDICTION: As the concentration of Sodium Thiosulphate increases the length of time for cross to disappear decreases (inverse). This is because the increase of concentration of Sodium Thiosulphate will increase the rate of reaction between Hydrochloric acid and sodium Thiosulphate particles.

SCIENTIFIC REASONS FOR PREDICTION: the results from preliminary experiments support the prediction made.

From the results you can see that there is a directly proportional relationship between the concentration and the rate of reaction. If you increase the concentration then the rate of reaction will also increase.

METHOD:

1. Set up apparatus as in preliminary experiment.

2. Record the temperature of the room.

3. Add the first of the concentrations of sodium Thiosulphate to the flask. As you add 10cm3 of HCL and start the stopwatch

4. Watch the solution as it clouds over. Once the cross has disappeared stop the clock.

5. Record the time in a results table

6. Repeat the above steps for the other concentration of sodium Thiosulphate. Repeat the experiment 3 times for each of the concentrations.

7. Record all results in a table and work out the rate by dividing 1 by the average time for each.

This extract was taken from the link below:

This experiment is testing how the rate of reaction is affected when concentration is changed. The theory is said that increasing the concentration can increase the rate of reaction by increasing the rate of molecular collisions. The phenomenon behind all of this is the collision theory and how it plays a big role in this investigation. The higher the concentration the less time/faster it will take for the system to turn into equilibrium, and if concentration id decreased, time taken for the solution to go cloudy increases.

Hypothesis: The higher the concentration the faster the rate of reaction will be and the time taken to reach equilibrium will decrease. A more diluted concentration will have a longer rate of reaction and a longer time to reach equilibrium.

Apparatus:

Method:

Gathered all the apparatus needed for the experiment.

Using a weight balance we measure out 8g of Sodium thiosulphate, that we added too 200cm^3 of water. We mixed the solution until all the crystals were dissolved.

Then you pour 50 cm^3, 40 cm^3, 30 cm^3, 20 cm^3, and 10 cm^3 of the solution into five identical conical flasks. Then you add water to the other conical

flasks so that the total volume in each flask in 50 cm^3. Make sure to label the flasks so you know which one has so much concentration.

Once that's done, you must now take a beaker and add 35 cm^3 of concentrated Hydrochloric acid to 65 cm^3 of water to make a diluted solution.

Now take a piece of paper and draw a black cross on it, and then place one of the flasks on the paper (do one flask at a time). Using a measuring cylinder measure out 5 cm^3 of the hydrochloric solution, and add this to the flask. Immediately stir the flask and start the stop watch. One person should do this part.

As soon as you can't see the cross any more stop the stopwatch, and record the results in a table. Repeat this with all the flasks.

Results:

Concentration (cm^3)	Time (s)	Rate of reaction (s)
50	24.9	0. 04
40 + water	32	0. 0313

30 + water	42.2	0.0237
20 + water	74.07	0.0135
10 + water	202. 8	0.0049

The rate of reaction is measured by dividing 1 by the time taken for the reaction to take place.

Number of moles of sulphur used: n= m/M

n= 8/32 = 0. 25 mols

Discussion:

You can see from the graph that as concentration increases, the time taken for the solution to go cloudy decreases. So the stronger the concentration the faster the rate of reaction is. As the concentration of sodium Thiosulphate decrease the time taken

for the cross to disappear increases, this is an inverse relationship. When equilibrium was reached the solutions turned a yellow color, the stronger the concentration was the higher the turbidity was. When equilibrium was reached SO2 gas and water were released. The more concentrated solution has more molecules, which more collision will occur. So therefore the rate of reaction should depend on how frequently the molecules collide, so more

molecules have greater collisions and the reaction happens faster as more products are made in a shorter time. All related to the collision theory.

What we saw what happened was exactly what we expected from the experiment. Our predictions were accurate.

Evaluation:

The method we used was fairly accurate, our results weren't perfect but they were good enough for us to see what happens during the experiment. So overall the results proved the hypothesis and I was able to draw graphs with a line of best fit. In our experiment we keep the HCL a constant, and also keeping the volume of the solution was important to get more accurate results. The results were fairly reliable under our conditions. They could be a bit off from bad measuring, unclean equipment and the timing.

Conclusion:

When the concentration of Sodium thiosulphate was increased the rate of reaction increased and the time taken to reach equilibrium decreased, so therefore the rate of reaction is directly proportional to the concentration.

Bibliography:

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