

Invest 6.1A: Rate Dependant Factors

INTRODUCTION:

Thiosulfate ions react in acid solution to produce a precipitate of sulfur according to the equation:



The rate of the reaction can be followed by measuring the time taken for a fixed amount of sulfur to be produced. This practical first examines the effect on the rate of the reaction when the concentration of thiosulfate ions is altered at a fixed temperature. Then it examines how the rate varies with temperature for a fixed concentration of thiosulfate ions.

ENVIRONMENTAL CARE: Sodium thiosulfate is known as photographers 'hypo' for fixing developed films and prints. To minimize pollution the concentrations of thiosulfate ions have been kept low and only very small amounts of sulfur dioxide are evolved. The residues can be disposed of down the sink.

SAFETY: There are no particular hazards associated with this practical except that you should avoid breathing in any sulfur dioxide that is evolved while you are waiting for the cross to disappear.

PROCEDURE:

1. Concentration.

- Measure 50 cm³ of 0.20 mol dm⁻³ sodium thiosulfate solution into a conical flask.
- Place the flask onto a white piece of paper or note card marked with a black "X".
- Measure out 5 cm³ of 2.0 mol dm⁻³ hydrochloric acid into a measuring cylinder and then add the acid to the thiosulfate starting a stop-clock at the same time.
- Swirl the contents of the flask initially to mix and then allow the flask to remain still on the tile.
- Look down vertically through the solution and time how long it takes for the cross to "just" disappear.
- Rinse the flask out immediately but take care not to get the X on the paper wet.
- Then put 40 cm³ of the 0.20 mol dm⁻³ sodium thiosulfate solution into the flask and add 10 cm³ of water.
- Add 5 cm³ of the hydrochloric acid and time as before.
- Repeat the experiment four more times using 30, 20, 15 and 10 cm³ of the thiosulfate solution making the total volume up to 50 cm³ with water each time.

2. Temperature.

- Measure 10 cm³ of 0.20 mol dm⁻³ thiosulfate solution. Add distilled water to a total volume of 50 cm³ into the conical flask and warm until the temperature is one or two degrees above 30-35 °C on a hot plate.
- Place the flask on the tile marked with a cross and add 5 cm³ of 2.0 mol dm⁻³ hydrochloric acid, timing as before.
- Record the temperature of the mixture after the acid has been added.
- Repeat the experiment using fresh portions of the 0.20 mol dm⁻³ thiosulfate solution each time at temperatures of approximately 40, 50 and 60 °C.

Lab Investigation 33a

Yi-Tong Ma

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