

EXPERIMENT 30: RATE OF A CHEMICAL REACTION

Equipment: 5 test tubes, test tube rack, and one of each of the following: 50 mL and 25 mL graduated cylinders, rubber stopper, 250 mL beaker
Materials: 75 mL 0.01M KIO₃, 75mL sat'd H₂SO₃ + starch, H₂O at room temp.

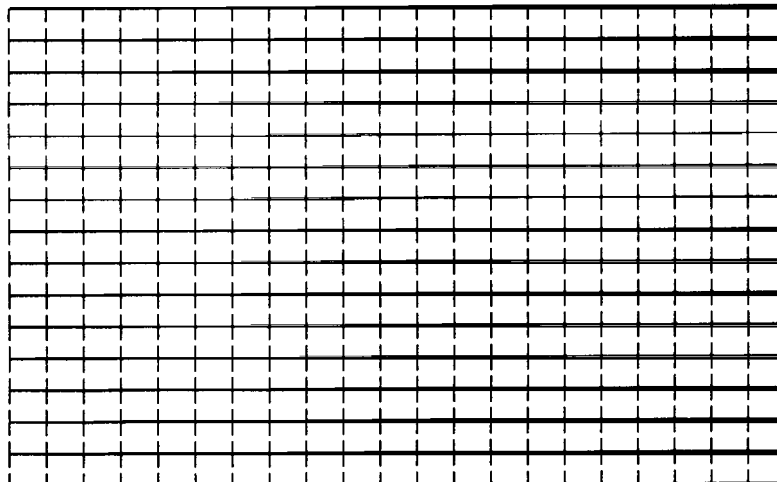
In this experiment, you will determine to what extent the speed of a chemical reaction can be affected by varying the concentrations of the reactants. Other factors which can affect the speed of chemical reactions are discussed in Exp. 29.

PART I- PROCEDURE

- A. Prepare a set of test tubes of varying amounts of 0.01M KIO₃ (one of the reactants) as outlined in the table below.
- B. To test tube 1, add 15 mL of saturated H₂SO₃ and stir several times, recording the exact time of addition of H₂SO₃. Use a watch with a second hand or other timing device. (All solutions and water should be at room temperature).
 - 1. Record the number of seconds needed for the solution to become blue.
 - 2. Calculate the rate, for each trial, which would be proportional to the time, 1000/t (t=time in seconds). Record in the table below.
- C. Repeat the same procedure with the remaining test tubes. Using 15 mL of H₂SO₃ in all cases. It is advisable to complete the work with one test before going on the next. (If time is short, however, one partner of each pair of students could do one test tube so that two would be done simultaneously).

Test tube	0.01 M KIO ₃	H ₂ O	Saturated H ₂ SO ₃	Time (sec.)	Rate = 1000/t	Molarity of KIO ₃ After Mixing
1	25 mL	10 mL	15 mL			
2	20 mL	15 mL	15 mL			
3	15 mL	20 mL	15 mL			
4	10 mL	25 mL	15 mL			
5	5 mL	30 mL	15 mL			

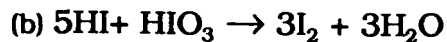
- D. Prepare a graph by plotting the concentration (molarity) of KIO₃ (0 to 0.005 with 0.001 intervals) as the abscissa (horizontal axis) and rate (speed) 1000/t as the ordinate (vertical axis).



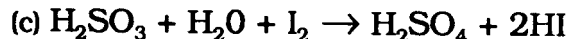
PART II- DISCUSSION

Equations involved in the above reaction are: (a) $3\text{H}_2\text{SO}_3 + \text{HIO}_3 \rightarrow 3\text{H}_2\text{SO}_4 + \text{HI}$

This equation (a) is a slow reaction and will be completed when the H_2SO_3 is depleted. The concentrations of the reactants being such that the KIO_3 is in excess in all the tubes.



This reaction (b) occurs the moment that the H_2SO_3 has been removed and is an instantaneous reaction. Starch is present in the H_2SO_3 solution and immediately detects the presence of iodine. Although this reaction is instantaneous, I_2 cannot exist if any H_2SO_3 is still present because of the following reaction:



SUMMARY QUESTIONS

1. From the shape of the curve, what is the relationship between the concentration of KIO_3 and the rate of the chemical reaction. _____

2. Define "rate of reaction". _____

3. Explain why results of above experiment may have been distorted if all parts of the experiment were not performed at the same temperature. _____

4. In any chemical reaction, as time continues, what should happen to the speed of the forward reaction? Explain. _____

5. What is the Law of Mass Action. (Consult text) _____
