

## Factors Affecting Rate of Reactions

**Objective :** Determine the factors affecting the rates of reactions.

**Materials and Methods:** Read the procedure for this information. Don't forget to include items you will need that are not mentioned, such as a test tube rack.

### Procedure:

#### Part 1

- (1) Obtain 5 test tubes and number them #1 to #5. For each, place 1-cm strip of Mg.
- (2) Add 1mL of 2M sulfuric acid to #1, 1mL of 2M hydrochloric acid to #2, 1mL of 2M nitric acid to #3, 1mL of 2M phosphoric acid to #4, 1mL of 2M acetic acid to #5.
- (3) Note the rates.
  - \* Write a balanced equation between Mg and acetic acid including states.

#### Part 2

- (4) Obtain 3 test tubes and place 1mL of 6.0M HCl in each.
- (5) Add 1cm polished strips of Mg to the first, Zn to the second and Cu to the third.
- (6) Note the rates.
  - \* Write a balanced equation between HCl and Mg. Make sure to include states.

#### Part 3

- (7) Obtain 5 test tubes and number them #1 to #3. For each, place on 1-cm strip of Mg.
- (8) Add 1mL of 1M sulfuric acid to #1, 1mL of 3M sulfuric acid to #2 and 1mL of 6M sulfuric acid to #3.
- (9) Note the rates.
  - \* Write a balanced equation between Mg and sulfuric acid including states.

#### Part 4

- (10) Obtain 2 test tubes. Place one marble chip ( $\text{CaCO}_3$ ) into one test tube and about same amount of crushed marble chips into the other test tube.
- (11) Add 1mL of 6.0M HCl to each test tubes.
- (12) Note the rates
  - \* Write a balanced equation between  $\text{CaCO}_3$  and HCl including states.

#### Part 5

- (13) Obtain 3 test tubes and add 1mL of 6.0M HCl to all three.
- (14) Place one test tube in an ice bath, the second in a warm water bath, and the third in a tap water. Wait 5 minutes.
- (15) To each test tube, add a piece of Zn.
- (16) Note the rates.
  - \* Write a balanced equation between Zn and HCl including states.

#### Part 6

(17) Obtain 2 test tubes and add 1mL of 3%  $\text{H}_2\text{O}_2$  to both.

(18) Add few grains of  $\text{MnO}_2$  to one of the test tubes.

(19) Note the rates.

\* Write a balanced equation for decomposition of  $\text{H}_2\text{O}_2$  including states.

**Data/Analysis:** During the experiment, the parts may be done in any order, but it is helpful to have all the notebooks following the same order. So, before your lab period, prepare a separate data table for your observations of each part. Leave sufficient room after the table to write the balanced equation indicated for each part, to indicate the factor being tested in each part, and to indicate the order of increasing rate due to that factor.

**Conclusion :** Summarize the results of your investigation of the factors influencing reaction rates

#### Postlab Questions:

(Q1) How did you determine rate differences for each part? i.e. Color changing to red? Test tube getting hot?

(Q2) In part 1, the acids used all have the same concentration, but they differ in other ways. Some are polyprotic, producing more than one  $\text{H}^+$  per molecule. They have varying strengths (degree of dissociation). The nitrate ion itself is an oxidizing agent. Do your results make sense when you consider all of this information? Explain.

(Q3) What would happen to the rate in part 3, if you use cubic chunks of Mg instead of Mg ribbon of same mass? Why?