

## Chemistry 150

This one does not require a lot of preparation. The photocopied pages of the write-up is due in class on **Wednesday, March 7**.

The rate of a chemical reaction is the speed at which reactants are converted to products. Some reactions are very fast and some are very slow. In order for a chemical reaction to occur, particles of the reactants involved must collide with one another at the correct angle and with the correct amount of energy. The factors which affect the rate of a reaction are the surface area, nature of the reactants, concentration, temperature, and catalysts.

In this experiment you will study four of the five factors that affect rate by running a series of chemical reactions. It is up to you to decide how to document the rate of each reaction as well as document in detail all your observations (hint: a watch may be handy, and a benchmark might be waiting for the solid reactant to disappear) (further hint: you may not wish to wait more than a couple minutes for a reactant to disappear). Your documented evidence for rate as well as your observations should be clearly written into your notebook.

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### Lab 6: What factors affect the rate of a reaction?

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#### Part 1. Purpose

Determine four factors that affect the rate of a chemical reaction

#### Part 2. Materials and methods

Chemicals list: develop list from the procedure section.

No sketch of the equipment is necessary, since no new glassware or techniques are being used.

#### Part 3. Procedure

##### Part 1a:

1. Obtain 5 test tubes and number them 1-5. Place a 1-cm polished strip of Mg into each tube.
2. Add the following:  
Tube 1: 1mL of 2 M sulfuric acid  
Tube 2: 1mL of 2 M HCl  
Tube 3: 1mL of 2 M nitric acid  
Tube 4: 1mL of 2 M phosphoric acid

Tube 5: 1mL of 2 M acetic acid

3. Note the rates.

**Part 1b:**

4. Obtain 3 test tubes and number them 1-3. Place 1mL of 6.0M HCl in each.

5. Add the following:

Tube 1: 1cm polished strip of Mg

Tube 2: 1 cm polished strip of Zn

Tube 3: 1 cm polished strip Cu

6. Note the rates.

**Part 2:**

7. Obtain 2 test tubes. Place one marble chip into one test tube and about the same amount of crushed marble chips into the other test tube.

8. Add 1 mL of 6.0M HCl to each test tube.

9. Note the rates

**Part 3:**

10. Obtain 3 test tubes and add 5mL of 6.0M HCl to all three.

11. 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.

12. Add a strip of Zn to each tube.

13. Note the rates.

**Part 4:**

14. Obtain 2 test tubes and add 1 mL of 3% H<sub>2</sub>O<sub>2</sub> to both.

15. Add few grains of MnO<sub>2</sub> to one of the test tubes.

16. Note the rates.

**Safety issues:** Some strong acids (hydrochloric, nitric, sulfuric and phosphoric) are being used; behave accordingly.

**Waste disposal:** All materials in this lab are to be treated as metals and acid waste; nothing should go down the sink. Please use the appropriately labeled beakers in the hoods to get rid of waste.

**Part 4. Original data**

For each part in the procedure, set up tables listing the reaction and associated recorded times. You may also wish to make some observations about gases evolved, heat given off, etc.

**Part 5. Analysis**

Please write the **balanced** chemical equation for each of the reactions in all of the different procedure parts. Write “fast” or “slow” or similar kinds of words after each reaction to denote its speed.

### Part 6. Group results

None.

### Part 7. Questions

1. a. Given the relative rates of reaction you saw with the different acids in part 1a reacting with magnesium, write a list of the acids from strongest acid to weakest acid. How did you decide what acid was “strong” and what acid was “weak”?

b. Compare your list to the list on page 124 of the text. Were there any differences between that list and your list? If so, where were the differences, and what might be the cause of that?

2. a. Given the relative rates of reaction you saw with the different metals in part 1b reacting with hydrochloric acid, write a list of the metals from most active metal to least active metal. How did you decide what metal was “most active” and what metal was “least active”?

b. Compare your list to the list on page 132 of the text. Were there any differences between that list and your list? If so, where were the differences, and what might be the cause of that?

### Part 8. Conclusion

State the four factors that affect chemical reaction rates that each of the parts of the procedure were supposed to demonstrate, and predict which of the reactions within each part was supposed to be the fastest (and why). Assess whether your observations of the reactions of that part were consistent or inconsistent with your prediction.

Note that parts 1a and 1b show the same factor.

### Abstract

None.