Name: _____ Class: _____ Date: _____

Factors the Affect Rates of Reaction Lab

"I Feel the Need - The Need for Speed"

Learner Outcomes:

- Observe and describe patterns of chemical change by:
  - Identifying conditions that affect rates of reactions (e.g., investigate and describe how factors such as heat, concentration, surface area and electrical energy can affect a chemical reaction).

Key Terms:

Reaction rate	Surface area	Enzymes
Concentration	Catalysts	Temperature

Background Information:

Some chemical reactions, such as the inflation of an automobile air bag, occur very quickly. Others, such as the discoloration of paper, are very slow. In order for many chemical reactions to be useful, we must be able to control their rate. To do so, we have to be able to control the number and / or speed of collisions between particles. In this activity, we will investigate a variety of conditions that affect the rates of reaction.

Research Question: What factors can be changed to increase the rate of reaction.

Prediction:

Predict and explain how each of the following conditions will affect the rate of reaction.

1. Increased surface area -
2. Increased temperature -
3. Increased concentration -
4. Addition of a catalyst -

Part A "Get Ready, Get Set, Dissolve!"

Chemical Equation we will observe:

$$C_6H_8O_{7(aq)} + 3NaHCO_{3(aq)} \rightarrow 3H_2O_{(l)} + 3CO_{2(g)} + Na_3C_6H_5O_{7(aq)}$$

citric acid + sodium bicarbonate → water + carbon dioxide + sodium citrate

Materials:

2 Alka-Seltzer tablets	2 250-mL beakers	hot plate
	stopwatch	mortar and pestle

Procedure:

1. You have been given two pieces of Alka-Seltzer. Place one of the tablets in a beaker of tap water and record the length of time it takes to completely react:

Time to dissolve Alka-Seltzer #1 _____

2. Your mission is to develop a method that will allow your second piece of Alka-Seltzer to react as quickly as possible. You may use only the materials at your lab station (no chemicals allowed). Write your procedure below.

3. ***Before you actually react the second piece of Alka-Seltzer***, you must ask your instructor to come and check over your procedure.

4. Conduct your second trial and record the length of time it takes to completely react:

Time to dissolve Alka-Seltzer #2: _____

Analysis:

1. What evidence of a chemical reaction did you observe?

2. Which of your products formed as bubbles?

3. What did you do to increase the rate of reaction? Was it effective?

4. Were there any other options that you could have used to increase the rate of reaction with the materials you were provided? What were they?

5. Using the particle model of matter, explain why you were able to speed up the reaction rate.

Part B "Who Wants to be a Catalyst?"

Materials:

test tube rack	Test tube brush	graduated cylinder
6 medium test tubes	3% hydrogen peroxide	Cleaning solution

substances to try for catalysts (in separate containers)

- sugar
- salt
- baking soda
- yeast
- manganese dioxide
- liquid soap

Write the Chemical Equation for the DECOMPOSITION of Hydrogen peroxide into water and oxygen gas.

Procedure:

1. Using only the materials at your lab station, design a lab to determine the best catalyst for decomposing hydrogen peroxide. Write your procedure below.
Do not use more than 30 mL of hydrogen peroxide.

2. ***Before you actually proceed with the lab***, you must ask your instructor to come and check over your procedure.

3. Record your observations in data table form

Catalyst	Qualitative Observation

Analysis:

1. How did you know if the chemical reaction occurred?

2. Rank your substances from least effective to most effective catalyst.

3. How did you determine the most effective catalyst?

4. Was a combination of catalysts better than just one on its own?

Conclusion: summarize the factors that increase the rate of reaction and the factors that decrease the rate of reaction

Extension:

1. Identify and describe two chemical reactions you might encounter every day that you would want to increase the rate of and two reactions you would want to decrease the rate of. Describe how each of these reactions is important to you and what people do to control their rates.