Factors that Affect Rates of Reaction
DEMONSTRATIONS

Learner Outcomes:
Identify 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:
Reactant
Product
Catalyst
Surface Area
Concentration

Materials:

2L pop bottle	Wire Gauze	Hot water
Ring stand and clamp	Match	Ice water
30% hydrogen peroxide	Straw	Test tube rack
Potassium iodide	Bunsen burner / propane torch	3 x med test tubes
Filter paper	Aluminum pie plate	Magnesium ribbon
Thread	2 x 250 mL beakers	Hydrochloric acid (0.5 M, 1.0 M, 3.0 M)
Coffee Mate creamer	2 x glow sticks	3 balloons

Demonstration Procedures:

"Genie in a Bottle"
Procedure:

1. Using a clamp, secure the neck of a 2-L bottle to a ring stand so that it will remain stable throughout the demo. Very carefully add 75 mL of 30% hydrogen peroxide to the bottle.
2. Place approximately 2 grams of potassium iodide into a small piece of filter paper and tie it together with thread.
3. Inform the students that you could sit all day waiting for the hydrogen peroxide to react - but it won't (at least not visibly). Then drop the filter paper containing potassium iodide into the bottle. Observe.

"Dragon's Breath"

Procedure:

1. Place about a tablespoon of CoffeeMate creamer onto a piece of wire gauze. Attempt to light it with a match. *(It will not burn.)*
2. Place a small amount of the corn starch into the end of a straw (about 2 cm works well, although you could use more). If you decide to use lycopodium powder, be advised that many people are allergic to it – so use good ventilation.
3. Light a Bunsen burner, being sure that a nice blue flame is produced. Holding the straw horizontally about 15 cm from the flame, blow the powder across the top of the flame. Observe.

"When You're Hot, You're Hot"

Procedure:

1. Obtain two beakers, one with very hot water and one with ice water.
2. Activate two light sticks and place one in each container of water.

"The More the Merrier"

Procedure:

1. Obtain three medium test tubes and place them in a test tube rack.
2. Place 5 mL of 0.5 M hydrochloric acid in one test tube, 5 mL of 1.0 M hydrochloric acid in the second test tube, and 5 mL of 3.0 M hydrochloric acid in the third.
3. Obtain 3 5-cm piece of magnesium ribbon. Cut each piece of magnesium into small piece and place them into three separate balloons.
4. Without spilling the magnesium, fit each balloon over the mouth of one of the test tubes you prepared earlier.
5. Simultaneously, drop the magnesium into the test tubes. Watch closely, paying particular attention to the size of the balloons for the first 2-3 minutes.

Observations:

Analysis:

1. Write a balanced chemical equation for each of the reactions performed. (Remember some substances used do not participate in the overall reactions.

2. Identify what factors influenced the rate of reaction in each.

3. Explain how each factor changes the rate of reaction (think collision theory here).

4. Would manipulating other factors change the rate of reaction in all of the situations shown? For example, would increasing the temperature change the rate of reaction for the dragon's breath?

Conclusion:

Extension: Identify 3 real-life situations where we intentionally manipulate the rate of chemical reactions and describe why and how this is done.

Adapted from *Factors that Affect Rates of Reaction* by Rogers, P. V. Williamson, T. Jose Eds.