Lab – Factors Affecting the Rate of a Chemical Reaction

Purpose:
To determine which factors affect the reaction rate and to describe the influence of each factor on reaction rate.

Demo 1 – Elephant Toothpaste

Reaction A
-Potassium Iodide
-Dishwashing Detergent

Reaction B
-Potassium Iodide
-Dishwashing Detergent
-Hydrogen Peroxide

Which reaction has the faster rate? _____

What is the only factor that differs between the two reactions? _____

Demo 2 – Burning Iron

Reaction A
-Compressed Steel Wool

Reaction B
-Pulled Apart Steel Wool

Which reaction has the faster rate? _____

What is the only factor that differs between the two reactions? _____

Demo 3 – Glowsticks

Reaction A
-Glowstick
-Ice water bath (~0°C)

Reaction B
-Glowstick
-Warm water bath (~30°C)

Which reaction has the faster rate? _____

What is the only factor that differs between the two reactions? _____

Useful Information:

- Powdered chalk, chalk, and marble chips are all made of calcium carbonate.
- The speed of a reaction is directly related to the frequency of collisions and the number of those collisions that are successful (have sufficient energy).

Station A

1. Take two Erlenmeyer flasks and add a piece of chalk to each.
2. Take two graduated cylinders and measure 10mL of 0.5M HCl in one and 10mL of 1M HCl in the other.
3. Add each acid to its own flask at the same time. Then wait 5 seconds before gently swirling contents. Observe throughout.
4. When complete, place the two flasks in the "dirty" bin.

What is the only factor that differs between the two reactions? _____

Which reaction has the faster rate? _____

State the relationship between this factor and reaction rate: _____

Using collision theory, explain how this factor increases the reaction rate.

Station B

1. Take two Erlenmeyer flasks and add a piece of chalk to each.
2. Take two graduated cylinders and measure 10mL of 1M CH_3COOH in one and 10mL of 1M HCl in the other.
3. Add each acid to its own flask at the same time. Then wait 5 seconds before gently swirling contents. Observe throughout.
4. When complete, place the two flasks in the "dirty" bin.

What is the only factor that differs between the two reactions? _____

Which reaction has the faster rate? _____

If we were to compare the rate of reaction for the combustion of wax ($C_{25}H_{52}$) with the rate of reaction for the combustion of alcohol (CH_3OH), which do you think would be faster and why?

Station C

1. Take one Erlenmeyer flask containing powdered chalk.
2. Take an empty Erlenmeyer flask and add 1 marble chip.
3. Take two graduated cylinders and measure 10mL of 0.5M HCl in each one.
4. Add each acid to its own flask at the same time. Then wait 5 seconds before gently swirling contents. Observe throughout.
5. When complete, place the two flasks in the "dirty" bin.

What is the only factor that differs between the two reactions? _____

Which reaction has the faster rate? _____

State the relationship between this factor and reaction rate: _____

Using collision theory, explain how this factor increases the reaction rate.

Station D

1. Take two Erlenmeyer flasks and add a piece of chalk to each.
2. Take two graduated cylinders and measure 10mL of 0.5M HCl in each one.
3. Add each acid to its own flask at the same time.
4. Then quickly hold one flask in the 60°C water bath and the other in the ice bath. Swirl gently. Observe throughout.
5. When complete, place the two flasks in the "dirty" bin.

What is the only factor that differs between the two reactions? _____

Which reaction has the faster rate? _____

State the relationship between this factor and reaction rate: _____

Using collision theory, explain how this factor increases the reaction rate.