Name: ______________________

**Answer Key: Simulation: Investigating Reaction Rates**

**Background**
In this investigation you will investigate the factors that can affect the rate of a chemical reaction. Access the simulation here: [teachchemistry.org/reaction-rates](http://teachchemistry.org/reaction-rates)

**Investigate**
1. Run the reaction. Record your observations as you examine the effect of each variable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>During the 5 second reaction, the reactants, shown as blue and red spheres, react with each other to form product, shown as purple. This implies a synthesis reaction. The graph shows product formed over time.</td>
</tr>
<tr>
<td>Temperature</td>
<td><strong>Decreased</strong> Particles have less kinetic energy, so are moving and reacting slower, fewer reactants combine to form products during the 5 second time frame. <strong>Increased</strong> Particles have more kinetic energy and are moving and reacting faster, more reactants combine to form products before the 5 second time frame is complete.</td>
</tr>
<tr>
<td>Concentration</td>
<td><strong>Decreased</strong> There are noticeably less particles present due to the decrease in concentration. During the 5 second time frame fewer products are formed than in the controlled reaction. <strong>Increased</strong> There are noticeably more particles present due to the increase in concentration. During the 5 second time frame more products are produced than in the controlled reaction.</td>
</tr>
<tr>
<td>Surface Area</td>
<td><strong>Decreased</strong> Due to the decrease in surface area there is less opportunity for reactants to interact and form products. During the 5 second time frame fewer products are formed than in the controlled reaction. <strong>Increased</strong> Due to the increase in surface area there is more opportunity for reactants to interact and form products. During the 5 second time frame more products are produced than in the controlled reaction.</td>
</tr>
<tr>
<td>Catalyst</td>
<td>The reaction appears to happen at a faster rate. During the 5 second time frame more products are produced than in the controlled reaction.</td>
</tr>
</tbody>
</table>

**Analysis**
2. Describe in one sentence the meaning of the graph produced by:
   a. The controlled reaction:
   The graph shows that product is formed over time.

*Teacher Note/Reminder: The simulation is showing a simplified particle view of the initial rate of reaction before equilibrium is reached (5 second time frame only). The reverse reaction is not being considered in this simulation.*
b. Increasing the concentration of reactants:
Product is formed at a faster rate than it was in the controlled reaction.

c. Decreasing the surface area of reactants:
Product is formed at a slower rate than it was in the controlled reaction.

3. Making specific reference to the behavior of particles explain why the rate of reaction is affected by:

a. Temperature Change:
Temperature change affects the kinetic energy of the particles. At higher temperatures particles collide more frequently and with greater intensity. At lower temperature the opposite affect can be observed.

b. Concentration:
Increasing the concentration of the reactants increases the number of collisions between the reactants, in turn increasing the reaction rate. Decreasing the concentration of the reactants decreases the number of collisions between reactant, in turn decreasing the reaction rate.

c. Surface Area:
Increasing the surface area of the reactants increases the number of collisions between the reactants, in turn increasing the reaction rate. Decreasing the surface area of the reactants decreases the number of collisions between reactant, in turn decreasing the reaction rate.

Extension

4. Based on what you have learned brainstorm (or complete internet research to help you) an everyday example of:

Answers will vary:

a. The effect of temperature change on reaction rate:
Cooking: Increase in temperature will cook the food faster.

b. The effect of surface area on reaction rate:
Grain Elevator fires.

c. The effect of adding a catalyst on reaction rate:
Catalytic converters use catalysts to help convert harmful gases through a reaction.

d. The effect of concentration on reaction rate:
Acid Rain: Higher concentrated acid rain will cause more harmful corrosion.