Colorado Regional Science Olympiad
March 3, 2001

Chemistry Lab – Participant Lab Sheet

Part A. Reactions **Group #_____**

Perform each chemical reaction below by placing a few drops of each solution indicated into a cell of the microcell plate. Record your observations, and write the balanced ionic equation (be sure to indicate the phase of each component). The chemical solution concentrations are all 0.1 M.

1. Barium nitrate and copper(II) sulfate

   Observations:

   Balanced ionic equation:

2. Sodium iodide and lead(II) acetate

   Observations:

   Balanced ionic equation:

3. Calcium chloride and potassium carbonate

   Observations

   Balanced ionic equation:

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Part B. Kinetics Procedure **Group #_____**

The purpose of this experiment is to make observations and then deductions about the kinetics of a reaction. The vial marked 'B' contains the reaction you'll be studying. The reaction mixture is a solution which contains 2 drops Methylene Blue, 10 g glucose, and 8 g strong base in 300 mL water.

1. Shake your reaction vial for 3 seconds and then gently set it down. The reaction should turn blue. Immediately start your timer. Record the amount of time it takes for the solution to turn colorless again (be careful not to disturb the reaction while you wait for the color change).

   Time_____

2. Repeat step 1, but shake the vial for 30 seconds this time.

   Time_____

3. Gently set your vial in a beaker containing ice water for about 2 or 3 minutes. Remove the vial from the ice water, shake it for 3 seconds and gently place it back into the ice water. Immediately start the timer. Record the amount of time it takes for the solution to turn colorless again.

   Time_____

4. Allow your reaction vial to return to room temperature. You can hasten this event by setting the vial in a beaker containing room temperature water. Let it stand in the water bath about 4 or 5 minutes. Add water up to the second line on the vial. Shake the vial for 3 seconds and then gently set it down. Immediately start the time. Record the amount of time it takes for the reaction to turn colorless again.

   Time_____

Colorado Regional Science Olympiad
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Part C. Kinetics Analysis **Group #_____**

I. Discuss, both in general and in reference to your reaction data, the four factors listed below that affect the rate of a reaction.

1. Concentration of the reactants

2. Physical state of the reactants

3. Temperature

4. Use of a catalyst

Colorado Regional Science Olympiad
March 3, 2001

Chemistry Lab – Participant Lab Sheet

Part C. Kinetics Analysis **Group #_____**

II. Did you observe a difference in the rate of reaction when you shook your vial for 30 seconds instead of 3 seconds. Can you explain your observation? (*Hint: colorless Methylene Blue will react with oxygen to give blue Methylene Blue)*

III. Propose a reaction mechanism to describe the kinetics of your reaction, be sure to label the rate limiting step. Use the following symbols: O_2 = oxygen, G = glucose, OH^- = base, MB_b = Methylene Blue (blue), MB_c = Methylene Blue (colorless).

IV. How do you know when your reaction has reached equilibrium?

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Part D. Tie Breaker Questions **Group #_____**

These questions will graded as necessary to break ties

1. A pile of flour on your kitchen counter does not ignite with a match, but the flour dust in a mill or silo can react explosively. Explain.

2. For the reaction $A_{(g)} \rightarrow B_{(g)}$, sketch two curves on the same set of axes that show a) the formation of product as a function of time, and b) the consumption of reactant as a function of time.

3. How would the increase in pressure affect the rate of a gas phase reaction? Explain.

4. a) Will a reaction with a catalyst yield more product?

   b) For the reaction AB $\xrightarrow{cat}$ A + B, on the same set of axes, sketch the reaction energy diagrams for the catalyzed and uncatalyzed reactions.