

Student Directions for *Reactions and Rates 3: Introduction to Equilibrium***Learning Goals: Students will be able to:**

- Use a physical experiment to model chemical equilibrium
- Sketch how the number of reactants and products will change as a reaction proceeds
- Predict how changing the initial conditions will affect the equilibrium amounts of reactants and products.
- Predict how the shape of the reaction coordinate will affect the equilibrium amounts of reactants and products.

PART I: Done in pairs in class

Materials: 4 beakers: 100 mL, and 50 mL, and two 1000 mL beakers.

Directions: Read a-e, make an appropriate data table, and then begin.

- a) Label the 1000 mL beakers A and B
- b) Put about 700 mL water in the large beaker "A". Leave the other beaker "B" empty.
- c) Record the volume of water in the beakers in your table.
- d) Transfer water between the large beakers using the following "rules"
 - Use the 100 mL beaker to transfer water from A to B;
 - Use the 50 mL beaker transfer water from B to A.
 - Fill the small beakers as full as possible **without tipping the large beakers** in any way.
 - One cycle consists of one A → B transfer and one B → A transfer.
 - **For each cycle**, record the volume of water in beakers A and B.
- e) Continue cycles and recording the volumes, until the level of water in beakers A and B are unchanging.

Analysis:

1. Graph the volumes of water in beakers A and B per cycle.
2. Describe in your own words how this experiment relates to chemical reaction equilibrium.
3. What is the ratio of the volume in Beaker B to Beaker A at equilibrium? ____ When we work with chemical experiments, what do we calculate that is similar?
4. What do you think would be different and same if the water transfers were repeated with the beaker A initially half full?
5. Repeat the directions to test your ideas. Use a table, graph, and ratio of B to A to show your results. Explain how your ideas were supported or need to be corrected.

6/29/2009 Loeblein derived from Amy Jordan activity

1

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