AP Chemistry 30 – Lab Activity 8: Equilibrium Straw Model

Learning Objective

1. Use graphs to compare and analyze an irreversible and reversible reaction model
2. Develop an understanding of equilibrium reactions

Background Information

A reversible reaction is one in which reactants are being converted to products at the same time as products are being converted back to reactants. There is a forward reaction and a reverse reaction. Irreversible reactions only proceed forward, so it continues until reactants are all used up.

$A + B \rightleftharpoons AB$ *general form for reversible reaction*

$A + B \rightarrow AB$ *general form for irreversible reaction*

Materials

- Two graduated cylinders of the same size
- Two straws (one "fat" and one "skinny")

Procedure

Note: if you spill water (which is likely to happen), fill the graduated cylinders back up to the last measurement that totals 20 mL, then continue.

Part A

1. Label one graduated cylinder with an "R" (reactants) and one with a "P" (products).
2. Add 20.0 mL of water to the "R" cylinder. Record the initial volumes: 20.0 mL and 0.0 mL.
3. Choose one straw. This straw can only take water out of the reactants.
4. Put the straw all the way to the bottom of the "R" cylinder. Cover the top with a thumb and transfer the water in the straw to the other cylinder.
5. Repeat Step 4 two more times, and then record the volume of water in each cylinder. Volumes should be measured to one decimal place.
6. Continue to transfer water as in Steps 4 and 5 (three transfers, then measure) until the volume of each cylinder becomes constant (change of less than 0.3 mL) for three measurements.

Part B

7. Add 20.0 mL of water to the "R" cylinder. Record the initial volumes: 20.0 mL and 0.0 mL.
8. Choose one straw to be the forward reaction. This straw can only take water out of the reactants. The other straw is the reverse reaction and can only take water out of the products.
9. Put each straw all the way to the bottom of the correct graduated cylinder. Cover the top with a thumb and transfer the water in both straws to the other cylinder. Do the transfer at the same time. For the first few transfers, there may not be enough water in the products cylinder for any to be moved.
10. Repeat Step 4 two more times, and then record the volume of water in each cylinder.
11. Continue to do transfers as in Steps 9 and 10 (three transfers, then measure) until the volume of each cylinder becomes constant (change of less than 0.3 mL) for three measurements.

Discussion:

1. Make a scatterplot that shows Trials ("time") on the x-axis and Volume (mL) on the y-axis. Graph your data for both Part A and Part B on the same graph. (This can be done electronically.)
2. Compare the graphs for both systems. Identify how the graphs are the same, and how they are different. Use the words "reversible" and "irreversible". Be specific and reference your data**.**
3. What would happen for Part B if you kept transferring water? What has happened to the system? Did the same thing happen to the system in Part A?