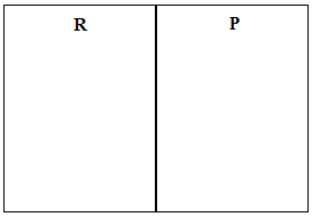
M&M Equilibrium Lab

Materials:

- 40 M&M candies
- 1 blank sheet of paper

Introduction:

For this lab, we will be using M&M candies to represent chemical compounds undergoing a reaction. In groups of two, draw a line down the middle of a sheet of paper. Label the left side of the paper "R" for reactants and the right side "P" for products.



You will be performing all of your reactions on this paper according to the following equation:

$$R \rightleftharpoons P$$

To represent molecules that are reactants, you will put M&M's on the reactant side of the paper; products will be M&M's on the product side of the paper. Reactions will be represented by moving an M&M from one side of the paper to the other.

This activity will help you to model the following three key concepts:
(Please keep these in mind as you work and fill in the blanks as you determine the answers)

Q1. At equilibrium, the rate of the forward reaction _____ the rate of the reverse reaction.

Q2. Under the same conditions, at equilibrium the concentrations of both reactants and products remain _____.

Q3. Equilibrium may be approached from different starting points, but at equilibrium the ratio of products to reactants will be _____.

Part I

For this part, one person should take care of moving M&M's from the reactant side and the other should take care of the product side of the paper.

1. Start with 40 M&M's on the reactant side of the paper.
2. Each round, you will be ***SIMULTANEOUSLY*** exchanging M&M's between R and P.
3. At the beginning of each round, count the M&M's on your side of the paper and then do the following:

   R should move half of his/her M&M's to the P side.
   P should move one fourth of theirs to the R side.

   If you end up with a decimal for the number to exchange, you should round up.)

   Note: These exchanges need to happen at the same time…do not have R give to P and then P give to R. Doing this does not reflect the way the real world works.

4. At the end of each round, count the M&M's on each side of the paper and keep track of the numbers in a table.

Round	R	P
0	40	0
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

5. Keep going for at least 10 rounds.
6. At the end of 10 rounds, calculate the ratio of products to reactants.

$$\text{ratio} = P/R$$

Part II

1. Part two is the exact same as part one except for the starting amounts of reactants and products. Choose a number of M&M's to put in the reactant side and put the rest in the products side.
2. Start exchanging the M&M's by following the same rules from step 3 in part one. Keep track of the number of candies on each side after each transaction in another table.
3. Keep going to at least 10 rounds.
4. At the end of 10 rounds, calculate the ratio of products to reactants.

Part III

1. Part three follows the same rules as parts one and two. Except you will need to join up with another group for this part because it requires more M&M's than parts one and two. Start again with 40 reactants and no products.
2. Exchange for five rounds and calculate the ratio of products to reactants.
3. After the fifth round, add another group's candies to the reactant side of the equation and continue to exchange for another 10 rounds.
4. At the end of the last round, calculate the ratio of products to reactants.

Q4. What happened after several rounds of reaction in each of the three parts?
Q5. Why do you think this phenomenon is often described as "dynamic" equilibrium?
Q6. Do you think that temperature would affect these systems in any way? If yes, how? If no, why not?