

Name: _____

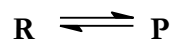
M & M's – Equilibrium & Le Chatelier's Principle Lab

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.

R	P

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



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.

Purpose: To understand the concept of equilibrium and apply Le Chatelier's principle to an equilibrium system of M & M's

Materials: 50 M & M's 2 cupcake liners Calculator Graph Paper

Procedure:

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 exchanging M&M's between R and P.
3. For each round, R should move 20% of his/her M&M's to the P side. P should move 10% of theirs to the R side. (If you end up with a decimal for the number to exchange, you should round up.)
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 the Part 1 table in the data section.
5. Keep going for 15 rounds.

Part II

1. Part two is the exact same as part one except for the starting amounts of reactants and products. Start with 20 reactants and 20 products.
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 for 15 rounds.

Part III

1. Part three follows the same rules as part one. Start again with 40 reactants and no products.
2. Start exchanging the M&M's by following the same rules from step 3 in part one, but exchanging 50% of the reactants and 25% of the products. Keep track of the number of candies on each side after each transaction in another table.
3. Keep going for 15 rounds.

Calculations/Graphing:

1. Calculate the ratio of the amount of products to the amount of reactants for all four parts after 5 rounds.
2. Calculate the ratio of the amount of products to the amount of reactants for all four parts after 10 rounds.
3. Calculate the ratio of the amount of products to the amount of reactants for all four parts after 15 rounds.
4. Graph your data for ALL four parts using appropriate titles for the graph and axes. Make sure that you use graph paper or Excel and use two separate colors per graph – one for reactants and one for products.

Analysis:

1. At equilibrium, the rate of the forward reaction _____ the rate of the reverse reaction.
2. Under the same conditions, at equilibrium the concentrations of both reactants and products remain _____.
3. Equilibrium may be approached from different starting points, but at equilibrium the ratio of products to reactants will be _____.
4. What happened after 4 or 5 rounds of reaction in each of the first three parts? (HINT: Refer back to your data tables.)
5. When your number of M&M's of reactants were equivalent to the number of products, was the reaction at equilibrium? Why or why not?
6. Why do you think that chemical equilibrium is often described as “dynamic?”
7. What was the “stress” that you applied to the reaction in part 4? (You may need to look back at your notes.)
8. How did the reaction respond to the “stress” in part 4?
9. Assuming that the amount of reactants and products are concentrations, what could the ratios from Calculations Question 3 represent? What does this value tell us about the equilibrium of the reaction?