“It’s a Toss-Up”

by

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Today we are going to ask you to help us out with a little experiment as we model what is happening in some types of chemical reactions.

- We need two lab groups today...please number off. [The presenter team will not number off. We will play a different role today.]
- The odd-number individuals will become members of the “Reactants Group”. This group will line up on the left side of the lab.
- The even-numbered individuals will become members of the “Products Group”. This group will line up on the right side of the lab.
- As each the “Reactants” assume their positions, please pick up a pair of paper wads from the supply area.

The paper wads represent reactants when they are on that side of the lab and products when on the other side of the lab. We are now going to begin our reaction; i.e., toss paper wads at one another. But first, there are a couple of ground rules.

- I will act as the official time-keeper, Jennifer will be the official counter for the “Reactants”, Noel will be the official counter for the “Products”, and Nancy will be our official recorder.
- Lab members may toss only one paper wad at a time.
- If/when a paper wad lands near you, pick it up and toss it back.
- When the time-keeper yells “Stop,” all activity ceases.

I am about to start the reaction...

- We will run the reaction for four five second bursts. At the end of each burst, I will yell “Stop!”
- Each official counter will facilitate counting how many paper wads are on each side of the reaction. These results will be given to the official recorder to tally.
- When the reaction is terminated, please dispose of all wastes in an appropriate container.

At the end of the experiment, I will guide a discussion of the results.
Teacher’s Guide

This activity is based upon the article, Jessica N. Orvis and Jeffrey A. Orvis (2005), *Journal of College Science Teaching*, Volume XXXV (3), pages 23-25, “Throwing Paper Wads in the Chemistry Classroom: Really Active Student Learning”.

Students frequently come into our chemistry classes with misconceptions that are difficult to expunge. Several misconceptions involve the chemical concept of equilibrium...

**MISCONCEPTION #1:**

The condition of equilibrium means equal concentrations of reactants and products.

**MISCONCEPTION #2:**

A reaction at equilibrium has stopped.

**MISCONCEPTION #3:**

Equilibrium may be attained by starting from either the reactants or the products side.

The activity today addresses misconception #2. Simple revisions of the initial make up of the “lab groups” allow for addressing the other two misconceptions.

**DISCUSSION:**

- Results are expected to show that after one or two bursts of reaction, the number of products and reactants remains constant over time.
- The system has reached a state of equilibrium
- The reaction has not stopped.
- The rates of the forward and reverse reactions are essentially the same.
- At the end of the experiment the system is in a state of dynamic equilibrium.
sample experiment