Water Volumes in Equilibrium Demonstration: Irene Walsh

Teacher's Guide

Goals

- To demonstrate the principles of chemical equilibrium
- To illustrate equilibrium reactions to the students

The Demonstration

In this demonstration, two plastic aquariums filled up with water are used to model the reactants and products of an equilibrium reaction. Students transfer water between the aquariums and see that at constant rates the system will no longer change, macroscopically, despite the constant exchange of water between them.

Materials

- Two 5 liter plastic aquariums
- Two 250 ml beakers
- Two signs: "reactants" and "products" that you can hang next to the aquariums

Instructions

1. Fill one aquarium with water and leave the other empty.
2. Call up two students, and instruct each to take water from his or her own aquarium, in the beakers, and pour it into the second aquarium.
3. Follow what happens with the class.

Lecture Notes

We are going to pretend that we have a reaction going on here. This is kind of a fake reaction that we are setting up.

One aquarium represents the reactants and the other represents the products. This is the beginning of the reaction.

The students will put the beaker down at the bottom [of the aquarium] and transfer whatever they have in the container to the other aquarium.

Ask the students to predict what the water level will be in the aquariums, when the experiment is finished.

The volumes in the aquariums will not be equal.

If they were to do this until 4 o'clock in the afternoon, would the water levels change?

Why wouldn't they change?

What kind of a condition have we achieved? Equilibrium.

Comment

At the end of the demonstration, it should be related to the chemical mechanism which it represents:

> A<->B, where only A is present at the beginning, and B is formed along the way. Emphasize that, in other cases, both reactants and products exist at the same time.

A system will reach a state of equilibrium when the reaction rates of both forward and reverse reactions are the same.

Despite the molecular changes, the system always keeps a constant composition, and looks as if nothing changes on the macro scale. In the solid state you also have a relationship between macro and micro: The solid appears to be static, despite the constant movement of the molecules within.

References: Links

http://www.chem.uncc.edu/faculty/murphy/1252/Chapter15/
A comprehensive slide show on equilibrium and LeChatelier's Principle that can be used with students.

References: Readings

Rudd, J.A. II, Greenbowe, T.J., Hand, B.M., and Legg, M.J. (2001) "Using the Science Writing Heuristic To Move Toward an Inquiry-Based Laboratory Curriculum: An Example From Physical Equilibrium," *Journal of Chemical Education,* Vol. 78, No. 12, p: 1680.