Experiment
21

Diffusion: How Fast?

Diffusion is a process that allows particles to move from where they are more concentrated to where they are less concentrated. This process allows particles to move through a cell membrane. Diffusion enables cells to get food and get rid of waste.

A Conductivity Probe can measure the concentration of ions in a solution. A salt solution contains ions. In this experiment, you will use a Conductivity Probe to measure the diffusion of salt through a membrane. You will also study the effect of salt concentration on diffusion rate.

OBJECTIVES

In this experiment, you will

- Use a computer to measure conductivity.
- Measure the diffusion of salt through a membrane.
- See the effect of salt concentration on diffusion rate.

MATERIALS

computer
Vernier computer interface
Logger*Pro*
Vernier Conductivity Probe
5% and 10% saltwater
ring stand
utility clamp
50 mL beaker
400 mL beaker
dialysis tubing
dropper
scissors
stirring rod
2 dialysis tube clamps or dental floss
distilled water

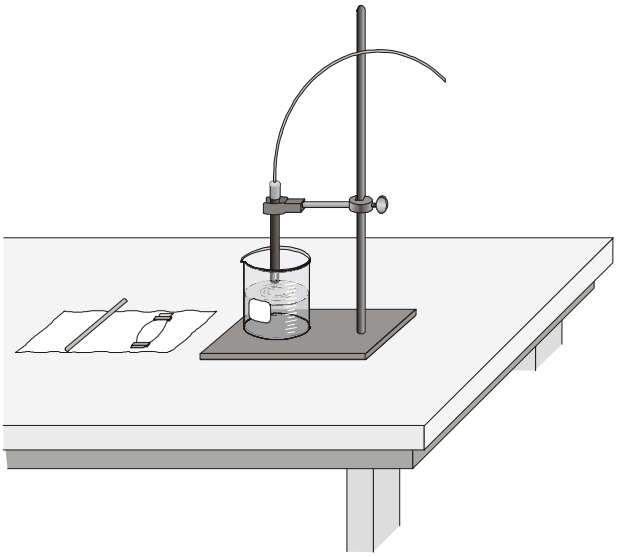

Figure 1

PROCEDURE

Part I Measuring Diffusion

1. Your experiment setup should look like Figure 1. Your teacher will have connected the Conductivity Probe and interface to the computer. The Conductivity Probe should be set on the 0-2000 µS/cm position.

2. Prepare the computer for data collection by opening the file "21 Diffusion How Fast" from the *Middle School Science with Computers* folder.

3. Get a wet dialysis tube and a dialysis tube clamp or a short length of dental floss. Using the clamp or floss, tie one end of the tube closed about 1 cm from the end, as in Figure 2.

4. Put 5% saltwater into the dialysis tubing.
   a. Get about 15 mL of 5% saltwater in the 50 mL beaker.
   b. Use a dropper to transfer about 10 mL of the 5% saltwater into the tube. Note: To open the tube, you may have to rub it between your fingers.
   c. Tie off the top of the tube. Try not to allow any air to stay in the tube.
   d. Wash the outside of the tubing with tap water to wash away any saltwater.

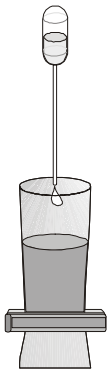

Figure 2

5. Put 250 mL of distilled water into the 400 mL beaker. Position the Conductivity Probe in the distilled water as shown in Figure 1.

6. Put the dialysis tube into the water. Make sure it is completely covered with water. **Important:** The Conductivity Probe and the tube must be the same distance apart in both parts of the experiment.

7. After stirring the water for 15 seconds, click Collect to begin data collection. Stir the water slowly and continuously for the next 120 seconds. Data collection will end automatically after 120 seconds.

Part II The Effect of Salt Concentration on Diffusion

8. Choose Store Latest Run from the Experiment menu to store your data.

9. Use a tissue to carefully blot the Conductivity Probe dry.

10. Prepare the dialysis tubing for reuse.
    a. Remove one of the clamps. If the tubing is tied off with floss, use scissors to carefully cut one of the dental floss strings. Discard the floss.
    b. If you cut the tubing, replace it.
    c. Empty all of the liquid out of the dialysis tube.
    d. With your fingers, squeeze out any remaining liquid.
    e. Wash the outside of the tubing with tap water to wash away any saltwater.

11. Repeat Steps 4-7 using 10% saltwater.

12. Determine the diffusion rates.
    a. Click the Regression button, .
    b. Click OK.
    c. Drag the top box down and away from the box it is covering.
    d. The diffusion rates are equal to the slope, *m*, values in units of µS/(cm·s). Record the rate for each run in your data table.
13. Print copies of the graph as directed by your teacher.

DATA

Salt concentration	Diffusion rate µS/(cm·s)
5%	
10%	

PROCESSING THE DATA

1. Describe what happened in this experiment.

2. What evidence is there that salt diffused through the membrane?

3. From which saltwater solution did salt diffuse faster? How could you tell?

EXTENSION

1. Design an experiment to find the effect of temperature on the diffusion of salt. Perform the experiment you designed.