Lab: What Are Diffusion + Osmosis?

Some chemicals can pass through a cell membrane, but others cannot. Furthermore, not all chemicals can pass through a cell membrane with equal ease. The cell membrane determines which chemicals can diffuse into or out of a cell.

As chemicals pass into and out of a cell, they move from areas of high concentration to areas of low concentration. Cells in *hypertonic* solutions have solute concentrations lower than the solution that bathes them. This concentration difference causes water to move out of the cell into the solution. Cells in *hypotonic* solutions have solute concentrations greater than the solution that bathes them. This concentration difference causes water to move from the solution into the cell. The movement of water into and out of a cell through the cell membrane is called *osmosis*.

In this lab, you will use a model of a living cell to predict the results of an experiment that involves the movement of water through a membrane.

OBJECTIVES

Explain changes that occur in a cell as a result of diffusion.

Distinguish between hypertonic and hypotonic solutions.

MATERIALS

- balance
- beakers, 250 mL (2)
- beakers, 600 mL (2)
- corn syrup
- distilled water
- eggs (2)
- lab apron
- paper towels (2)
- safety goggles
- tablespoon or tongs
- vinegar, 400 mL
- wax pencil

Procedure

DAY 1: SOAKING EGGS IN VINEGAR

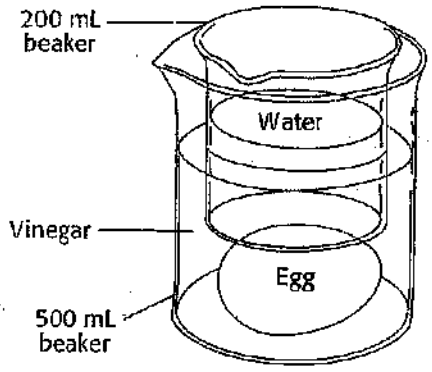
1. Label one 600 mL beaker "Egg 1: water" and the other 600 mL beaker "Egg 2: syrup." Also label the beakers with the initials of each member of your group.
2. Measure the mass of each of two eggs to the nearest 0.1 g, and record your measurements in the second column of **Table 1. CAUTION: Uncooked eggs may contain harmful bacteria. Do not touch your face after you have handled raw eggs. Clean up any material from broken eggs immediately. Wash your hands with soap and water after handling the eggs.**
3. Put on safety goggles and a lab apron. Pour 200 mL of vinegar into each labeled beaker. Using a tablespoon or tongs, place an egg into each beaker. Always return each egg to the same beaker.

TABLE 1 EGGS IN VINEGAR

Egg	Mass of fresh egg with shell	Observations after 24 h	Mass after 24 h in vinegar
1			
2			

4. Place a 250 mL beaker containing 100 mL of water on each egg to keep it submerged, as shown in **Figure 1.** Add more vinegar if the egg is not covered by the vinegar already in the beaker. If some vinegar spills over when the 250 mL beaker is placed on the egg, carry the beaker carefully to the sink and pour out some vinegar. Store the beakers for 24 hours in the area specified by your teacher.

FIGURE 1 EGG IN VINEGAR



5. Clean up your work area and wash your hands before leaving the lab.

DAY 2: SOAKING EGGS IN TWO LIQUIDS

6. After 24 hours, observe the eggs. Record your observations in **Table 1.**
7. Put on safety goggles and a lab apron. Label two separate sheets of paper towel "Egg 1" and "Egg 2." Pour the vinegar from the beakers into the sink. Using a tablespoon or tongs, remove the eggs and rinse them with water. Place each egg on the appropriately labeled paper towel. Measure the mass of each egg, and record the measurement in the last column of **Table 1.**
8. Return Egg 1 to its beaker, and add water until the egg is covered. Return Egg 2 to its beaker, and add corn syrup until the egg is covered. Store the beakers for 24 hours in the same place as before.
9. Clean up your work area and wash your hands before leaving the lab.

DAY 3: MEASURING CHANGES IN THE EGGS

10. Predict how the mass of each egg has changed after 24 hours in each liquid. (Hint: An egg is surrounded by a membrane. Inside the membrane, the egg white consists mainly of water and dissolved protein. The yolk consists mainly of fat and water. Corn syrup is sugar dissolved in water. The protein, fat, and sugar are solutes.) Record your predictions in **Table 2.**

- What will have occurred if your egg gains or loses mass?

11. Observe your eggs. Record your observations in **Table 2.** Measure and record the final masses of the two eggs.

TABLE 2 EGGS SOAKED IN TWO LIQUIDS

Egg	Liquid	Predicted change after 24 h	Observations after 24 h	Final Mass of egg
1				
2				

12. Dispose of your materials according to your teacher's instructions.

13. Clean up your work area, and wash your hands before leaving the lab.

Analysis

1. Describing Events What effect did the vinegar have on the eggs?

2. Explaining Events What caused the change in appearance in Egg 1 after it soaked in water?

3. Explaining Events What caused the mass of the egg to increase after soaking in the vinegar solution?

4. **Analyzing Results** What material seems to have moved through the membrane of Egg 2 after it soaked in the corn syrup? In what direction did the material move?

Conclusions

1. **Evaluating Results** How did your results in step 11 compare with your prediction?

2. **Drawing Conclusions** Which egg was in a hypertonic solution? Explain.

3. **Drawing Conclusions** Which egg was in a hypotonic solution? Explain.

4. **Applying Conclusions** What do you think would happen to a red blood cell placed in a test tube of distilled water? Explain.

Extensions

1. **Designing Experiments** Design an experiment to find out the effects of placing living yeast cells in hypertonic and hypotonic solutions.
2. **Research and Communications** Look up the chemical compositions of egg shell and of vinegar. Use this information to write a chemical equation that explains how egg shell dissolves in vinegar.