Hands on Lab: Diffusion and Osmosis

Submission instructions

If an assignment is submitted incorrectly, you will be contacted and the assignment will not be graded unless resubmitted properly. Late penalties may apply.

Type your answers and copy all pictures directly into this Word document. Submit it via the blackboard submission link in Word format (docx).

- Answers typed into a blank document or submitted in the incorrect format will not be accepted.
- Pictures will not be accepted as stand-alone files.
- Assignments may not be submitted via email without express permission from the instructor.

Introduction

One of the universal activities within the body is the movement of substances into and out of cells. Gases, nutrients, wastes, chemicals, and water must all be transported in a controlled manner for cells to maintain homeostasis. For example, if a cell contains too much or too little salt, then it will die.

The plasma membrane is the major regulator of cellular transport. This lab will demonstrate the two simplest transport mechanisms used by the plasma membrane, diffusion and osmosis.

Prelab Questions

Answer the following questions in **complete sentences**. (5pts. each)

1. **To facilitate transport, the plasma membrane of a cell is selectively permeable. Define this term.**

   A selectively permeable cell membrane allows certain molecules or ions to pass through it by means of active or passive transport.

2. **What is a solution? Describe and give examples of the two major components of solutions.**

   A Solution is a liquid mixture in which the solute is uniformly distributed within the major component. Two major components are salt and water. Salt is the solute.

3. **Explain concentration and concentration gradient.**

   The term concentration refers to the amount of a substance per defined space. A concentration gradient occurs where the concentration of something changes over a certain distance. For example, movement of molecules continue as long as there is a concentration gradient.

4. **Define diffusion and osmosis.**

Diffusion is the intermingling of substances by the natural movement of their particles. Osmosis is the process by which molecules of a solvent tend to pass through a semipermeable membrane from a less concentrated solution into a more concentrated one. The result equalizes the concentrations on each side of the membrane.

5. **Compare and contrast diffusion and osmosis. Give at least 2 differences and 2 similarities.**

   Diffusion can occur in any medium, such as liquid, solid, or gas. Osmosis can only occur in a liquid (water). Also, diffusion does not require a semipermeable membrane, but osmosis does.

   In relation, osmosis and diffusion equalize the concentration of two solutions. Also, they both are a passive transport process.

Part 1: Diffusion

In this activity, you will observe a substance diffusing through a selectively permeable membrane. As evidence of diffusion, we will use iodine, an indicator that turns blue-black the presence of starch.

Materials

- 2-cup clear glass container
  - Size does not have to be exact, but it should be taller than it is wide
  - Drinking glasses or measuring cups work fine.
- 1 sandwich size Ziploc bag
  - The cheaper the bag, the better this experiment will work
- ~10 drops liquid Iodine
  - Warning: Handle with care, toxic if ingested and can stain!
  - Can be obtained in any drugstore
    - Do NOT purchase colorless iodine! It will not work. Iodine should be brownish-yellow in color.
- ~2 tablespoons Cornstarch
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- Water
- Camera

https://www.cvs.com/shop/cvs-health-iodine-tincture-usp-1-oz-prodid-1011941

Procedure

1. Fill the glass container with 200 mL (~1 cup) of water and add 10 drops of iodine
2. Place 2-4 tablespoons of cornstarch in a plastic bag and add 100 mL of water.
3. Carefully close the bag and gently squeeze to mix the cornstarch and water.
4. Gently place the bag into the container so that the cornstarch solution is submerged in the iodine solution.

5. Gather data
    a. Take a picture at the start (0min) and end of your experiment (60min). Post these pictures in the results section.
    b. In the provided data table, record the starting color of the solution in the beaker and bag, then observe and record color changes every 15 minutes for 1 hour.

Results

0min Picture (4pts)

60min Picture (4pts)

Data Table (6pts)

Solution	**0 min**	**15min**	**30min**	**45min**	**60min**
Color in Container	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown
Color in Bag	White	Hint of Blue	Purple	Dark and Light Purple	Dark Purple

Part 1 Conclusion Questions

Answer the following questions in **complete sentences**. (5pts. each)

6. **Based on your observations, which substance moved, the iodine or the cornstarch? How can you tell?**

The cornstarch did not transfer but the iodine moved into the bag because the cornstarch inside the bag changed color. The iodine solution outside of the bag did not change color.

7. **What would happen if you did an experiment in which the iodine solution was in the plastic bag and the cornstarch solution was in the beaker?**

The iodine would diffuse out of the bag and into the cornstarch solution in the beaker. The iodine solution in the bag would continue to be light brown and the cornstarch solution in the beaker would become blackish.

Part 2: Osmosis
In this activity, you will observe osmosis through a selectively permeable membrane. Osmosis is easily observed in plants, as the osmotic pressure of the water is what provides support (this is why plants wilt when they need water). In this lab you will observe the effect of osmosis using a very familiar plant, the potato.

Materials
- 2 clear glass containers
    - Size does not have to be exact, but shallow bowls work best
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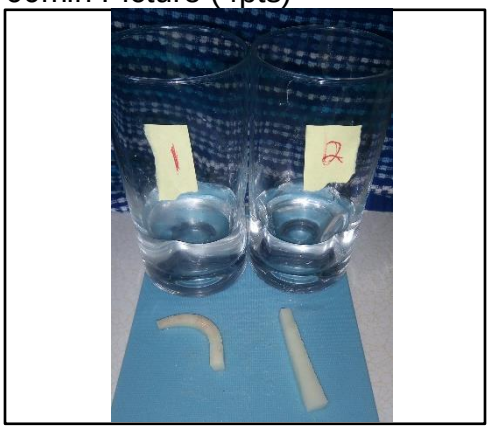
- 1 Potato
- Salt
- Water
- Camera

Procedure
1. Label or mark your containers #1 and #2—Any method works, as long as you can tell them apart.
2. In container 1, mix 15 m (one tablespoon) of salt with 100 ml (~1/2 cup) of water and stir until the salt is completely dissolved.
3. In container 2, fill with 100ml (~1/2 cup) of pure water.
4. Cut 2 strips of potato about the size of a French fry. They should be no thicker than 0.5 cm (~⅓ in). Make sure to remove all of the skin from the potato.
5. Gather preliminary data
    a. Take a picture of both potato strips at the start (0min) of your experiment. Post this picture in the results section.
    b.
    c. Examine each strip and record your observations of the firmness of the strips in the provided data table

8. Place one of the strips in container #1 (salt water) and the other strip in the container #2 (pure water). Make sure that both potato strips are completely submerged.
9. Leave the strips in the water for 60 minutes.
10. Gather Results
    a. Take a picture of both potato strips at the end (60min) of your experiment. Post this picture in the results section.
    b. Examine each strip and record your observations of the firmness of the strips in the provided data table

Results
0min Picture (4pts)

60min Picture (4pts)



Data Table (6pts)

Container	**Firmness @ 0 min**	**Firmness @ 60min**
1 (salt water)	Firm	Limp
2 (Pure water)	Firm	Firm

Part 2 Conclusion Questions

Answer the following questions in **complete sentences**. (5pts. each)

8. **This experiment showed osmosis. Based on your results would you classify the salt water as hypertonic or hypotonic? Why?**

   The salt water was hypertonic and caused the water inside the potato to move out by osmosis.

9. **This experiment showed osmosis. Based on your results would you classify the pure water as hypertonic or hypotonic? Why?**

   The pure water was hypotonic. This made the water retained inside the potato causing cells to swell.

10-18 (3pts each): Hypothetically, use red blood cells to explain osmosis and states of tonicity. Red blood cells naturally are approximately 0.9% salt in content. We introduced red blood cells to the following solutions:

A. 100% water
B. 0.9% saline
C. 10% saline

Match solutions A, B, or C with the criteria (each letter used 3x):

Solution Type	**Solution A, B, or C**	**Net Water Movement**	**Solution A, B, or C**	**Cell Change**	**Solution A, B, or C**
Hypertonic	10. C	Into Cell	13. A	No Change	16. B
Hypotonic	11. A	No Water Movement	14. B	Crenation	17. C
Isotonic	12. B	Out Of Cell	15. C	Swelling/ Lysis	18. A