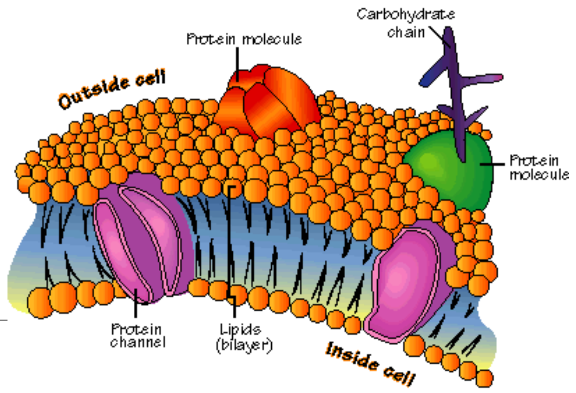
Lab 2: Osmosis and Diffusion



Part 1- Diffusion Across a Membrane

Problem Statement:

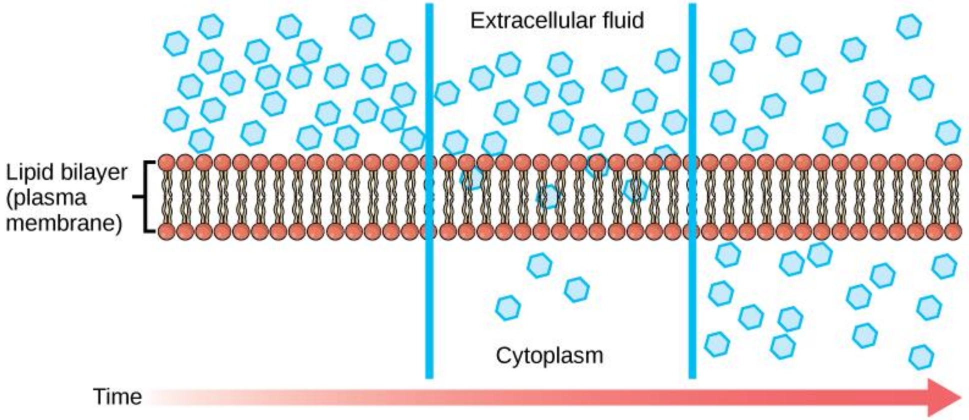
Hypothesis: (Think about what you expect to move through the membrane)

Materials: Iodine, water, dialysis tubing, 2 beakers, starch solution, graduated cylinder.

Procedures:

Variables:

Data: Include a data table & observations.



Lab 2: Osmosis and Diffusion

<u>Part 1- Diffusion Across a Membrane</u>

Analysis: (Complete the questions below)

1. Based on your observations, which substance moved, the iodine or the starch? Explain.

The dialysis bag was permeable to which substance? Explain how you know this.

Discuss how the bag is a model for the cell. Sketch a diagram of your lab, molecules involved and movement across the cell membrane.

Conclusions:

Lab 2: Osmosis and Diffusion

Summarize in bullet points

Part 2- Water Potential in Potato Cells

Background: In animal cells, the movement of water into and out of the cell is influenced by the relative concentration of solute on either side of the cell membrane. If water moves out of the cell, the cell will shrink. If water moves into the cell, the cell may swell or even burst. In plant cells, the presence of a cell wall prevents the cells from bursting, but pressure does eventually build up inside the cell and affects the process of osmosis. When the pressure inside the cell becomes large enough, no additional water will accumulate in the cell even the though cell still has a higher solute concentration than does pure water. So movement of water through the plant tissue cannot be predicted simply through knowing the relative solute concentrations on either side of the plant cell wall. Instead, the concept of water potential is used to predict the direction in which water will diffuse through living plant tissues. In a general sense, the water potential is the tendency of water to diffuse from one area to another under a given set of parameters. Water potential is expression in bars, a metric unit of pressure equal to about 1 atmosphere and measured with a barometer. Water potential is abbreviated by the Greek letter psi and has two major components:

(ψ)

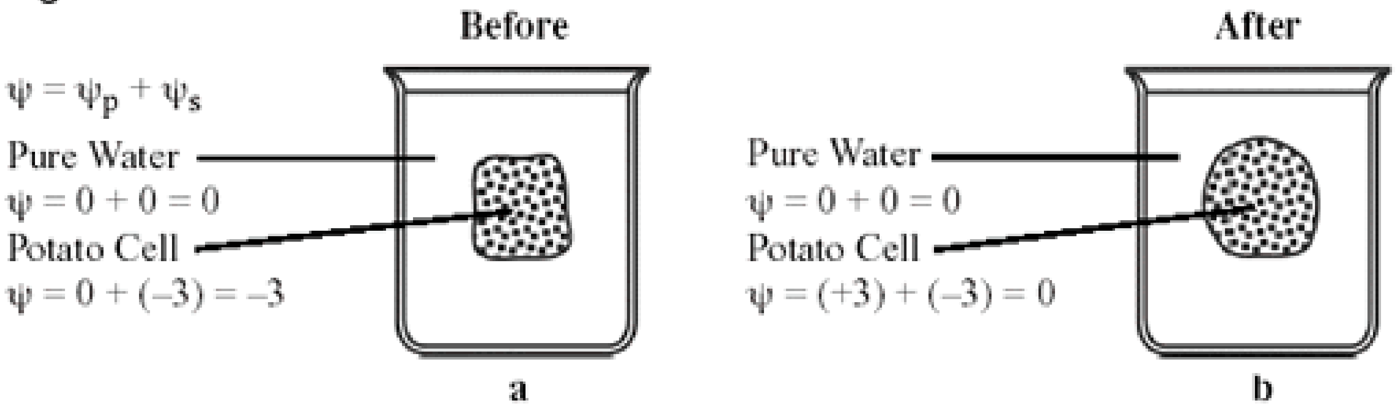
Lab 2: Osmosis and Diffusion

$$\psi = \psi_p + \psi_s$$

Water Potential = Pressure Potential + Solute Potential

In Figure 1.1, a potato cell is placed in pure water. Initially the water potential outside the cell is 0 and is higher than the water potential inside the cell (-3). Under these conditions there will be a net movement of water into the cell. The pressure potential inside the cell will increase until the cell reaches a state of equilibrium.

Figure 1.1



Lab 2: Osmosis and Diffusion

Procedures:

1. Pour 50 ml of each solution into your measuring cup- Make sure your cups are clean.
2. Using the cork boarer, cut out 6 potato cylinders (about the same size), determine the mass and record .
3. Place the cylinders into the beaker one in each of the solutions and cover with plastic wrap. Leave overnight
4. Day 2- Remove the cylinders from the beakers and carefully blot of any excess solution. Record the room temperature in Celsius.
5. Determine the mass of the 4 potato cylinder together and record.
6. Calculate the % change.

Data:

Contents in Beaker	Initial Mass	Final Mass	Mass difference	% Change in Mass
Distilled Water				
0.2 M				
0.4 M				
0.6 M				
0.8 M				
1.0 M				

Lab 2: Osmosis and Diffusion

Analysis:

1. Graph the results for both your individual data and class average on one graph. In order to do so, the 0 axis line should actually be in the middle of your graph. The y axis above this line should be labeled % increase in mass while the y axis below this line should be labeled % decrease. The x axis is the sucrose molarity within the beakers.

Contents in Beaker	Class Average
Distilled Water	
0.2 M	
0.4 M	
0.6 M	
0.8 M	
1.0 M	

1. Determine the molar concentration of the potato cores. This would be the sucrose molarity in which the mass of the potato core does not change. To find this, draw the straight line on your graph that best fits your data. The point at which this line crosses the x axis represents the molar concentration of sucrose with a water potential that is equal to the potato tissue water potential. At this concentration, there is no net gain or loss of water from the tissue. What is the Molar concentration of the cores?

   ____

Lab 2: Osmosis and Diffusion

Analysis:

3. Calculate the solute potential for the sucrose solution using the formula. Show Calculations.

The solute potential of a sucrose solution can be calculated using the following formula:

$$\psi_S = -iCRT$$

where

i	=	ionization constant (for sucrose this is 1 because sucrose does not ionize in water)
C	=	molar sucrose concentration at equilibrium (determined above)
R	=	pressure constant (handbook value R = 0.0831 liter bar/mole°K)
T	=	temperature °K (273 + °C of solution)

4. Explain water potential and describe how it affects osmosis.

Lab 2: Osmosis and Diffusion

Part 3- Plasmolysis in Elodea Cells

Background: The ***cell membrane*** is a structure that forms the outer boundary of the cell and allows only certain materials to move into and out of the cell. Food, oxygen and water move into the cell through the membrane. Waste products also leave through the membrane. Cells that perform photosynthesis (plants and some protists) take in carbon dioxide through the cell membrane instead of oxygen.

Pre-Lab Questions:

- What is the major function of a cell membrane?
- Why is the cell membrane sometimes described as a gate?
- Describe the structure of a cell membrane.
- How is the structure of the cell membrane related to its function?
- What is the major function of the cell wall?
- Describe the structure of the cell wall and its composition.
- How is the structure of the cell wall related to its function?

Lab 2: Osmosis and Diffusion

Part 3- Plasmolysis in Elodea Cells

Procedure: Watch the following video- **https://www.youtube.com/watch?v=OtPaPbVBMbM**

Answer the following questions about the video

Conclusions: Answer the following questions in your lab notebook.

What is the shape of a typical Elodea cell? Draw it. Your drawing should include the cell wall, chloroplasts, and central vacuole. Identify the functions for each structure.

What happens to the cells as the salt water flows under the cover slip?

What is the shape of the Elodea cell after salt solution has been added? Draw it. . Your drawing should include the cell wall, chloroplasts, and central vacuole

Why did the water in the vacuole pass out of the cell?

Why didn't the outer boundary of the cell collapse?