AP Lab 1 – Osmosis and Diffusion Alternative

'Osmosis and the Marvelous Membrane'

Journal of College Science Teaching, Nov. 1985

Objective:

- Use decalcified eggs to demonstrate osmosis and calculate molarity
- Measure the water potential of a solution in a controlled experiment
- Determine the osmotic concentration of living tissue or an unknown solution from experimental data
- Describe the effects of water gain or loss in animal and plant cells
- Relate osmotic potential to solute concentration and water potential

Materials:

- 5 eggs
- Vinegar
- Distilled water
- .5M sucrose
- 1M sucrose
- 1.5 M sucrose
- 2M sucrose

Procedure:

- 1. Place eggs in vinegar for 24-48 hours to decalcify. After that time, rinse well. It may be necessary to gently rub the eggs under running water to remove any remaining shell.
- 2. Mass each egg
- 3. Place one egg in each of the 5 solutions. Let sit for 1 1.5 hours and mass.
- 4. Plot the percentage change in mass vs. time.
- 5. Use the data gathered to determine the molarity of the egg.

Data:

Individual Data													
Sucrose	Initial	Final	Mass	Percent Change									
solution	Mass	Mass	Difference	in Mass									
0.0M													
0.5M													
1.0M													
1.5M													
2.0M													

Class Data

Sucrose solution	Initial Mass	Final Mass	Mass Difference	Percent Change in Mass
0.0M				
0.5M				
1.0M				
1.5M				
2.0M				

Data Analysis:

Graph both your individual data and the class data below. Be sure to label all of your axis and give your graph a title.

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Graph Title:

Independent Variable: ______ Dependent Variable: ______

Calculation of Water Potential

The solute potential of your sucrose solutions can be calculated using the following formula:

 Ψ_s = -iCRT

i = Ionization constant (1.0 for sucrose because it does not ionize in water)

C = Molar concentration

R = Pressure constant (0.0831 liter bars/mole ^oK)

T = Temperature ^oK (273 + ^oC of solution)

The water potential of the solution at equilibrium will be equal to the water potential of the egg. What is the water potential of the egg? Show your calculations below.

Using your data above, calculate the pressure and solute potential of the egg. Show your calculations below.

Analysis of results:

- 1. Explain the relationship between the change in mass of the egg and the molarity of sucrose in its environment .
- 2. Using the data collected, what is the approximate molarity of a chicken egg?
- 3. Give one solution molarity that was hypertonic to the egg and one that was hypotonic to the egg.

Questions:

- 1. If a raw french fry (potato slice) is allowed to dehydrate by sitting in the open air, would the water potential of the potato cells decrease or increase? Why?
- 2. If a plant cell has a lower water potential than its surrounding environment and if pressure is equal to zero, is the cell hypertonic or hypotonic to its environment? Will the cell gain water or lose water? Explain.
- 3. If a red blood cell is placed in distilled water:
 - a. Which would have the higher concentration of water molecules? (rbc or water)
 - b. Which would have the higher water potential? (rbc or water)
 - c. What would happen to the red blood cell? Explain in terms of water potential and concentration gradients.
- 4. In the winter, grass often dies near roads that have been salted to remove ice. What causes this to happen? Use **big kid words** that we have discussed, please.