DIFFUSION and OSMOSIS- "Old" AP BIO Lab 1 NAME _____

EXERCISE 1A:

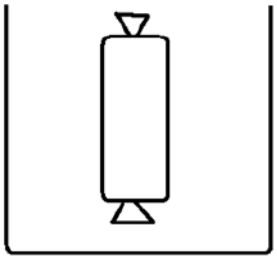
In this experiment you will measure diffusion of small molecules through dialysis tubing, and example of a selectively permeable membrane. Small solute molecules and water molecules can move freely through a selectively permeable membrane, but larger molecules will pass through more slowly, or perhaps not at all. The movement of solute through a selectively permeable membrane is called dialysis. The size of the minute pores in the dialysis tubing determines which substances can pass through the membrane.

PROCEDURE:

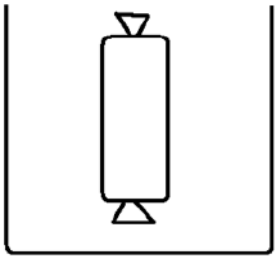
1. Tie off one end of a piece of dialysis tubing provided and fill with 15% glucose/1% starch solution. Test solution with a glucose test strip. Tie end of bag leaving sufficient space for expansion. Complete the table below.
2. Fill cup two-thirds full with distilled water. Add 4 mL of Lugol's iodine (IKI). Test the iodine/water with a glucose test strip Record the color on the table below.
3. Obtain a mass for the bag then immerse the bag in the cup and record on the table below.
4. Allow your setup to stand for approximately 30 min or until you see a distinct color change in the bag or the beaker. Record any color changes below.
5. Test the liquid in the cup and the bag for the presence of glucose. Record the results below.

		Solution Color		Glucose Present?		Mass of Bag	
	Initial contents	Initial	Final	Initial	Final	Initial	Final
Bag	15% glucose 1% starch						
Cup	H_2O iodine					X	X

DRAW a picture to show how the molecules moved during this experiment.



AT START OF EXPERIMENT



AT END OF EXPERIMENT

Use BLUE dots for GLUCOSE
Use RED dots for IODINE.
Use GREEN dots for STARCH.

EXPLAIN what happened to each of the molecules and **WHY**?

(Include words like water potential, concentration, diffusion, osmosis)

GLUCOSE _____

_____

STARCH _____

_____

IODINE _____

_____

WATER _____

_____

Use what you know about the structure of glucose and starch to **EXPLAIN** why glucose was able to pass through the dialysis bag membrane and the starch was not.

_____

_____

PREDICT the results you would expect if the experiment started with glucose and IKI (iodine) solution in the bag and only starch and water in the cup outside.

_____

_____

_____

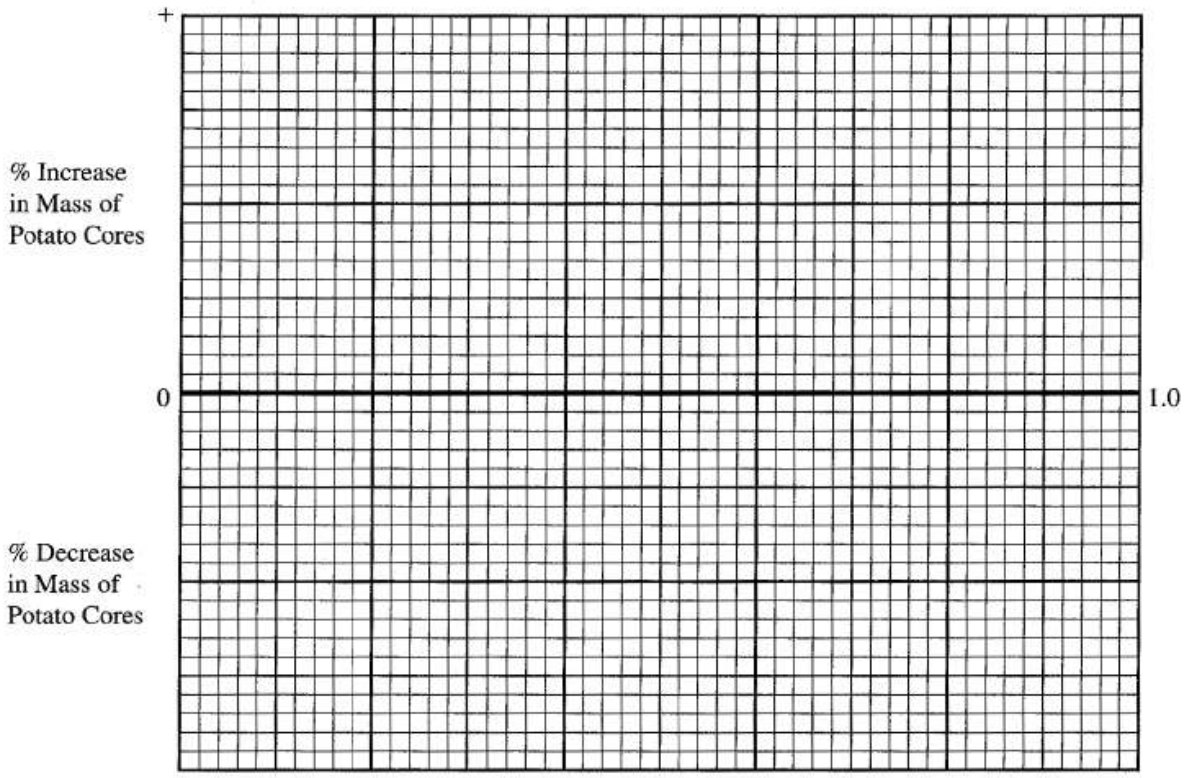
EXERCISE 1B: OSMOSIS WITH POTATO CORES

Contents of beaker	Initial Mass	Final Mass	Mass Differences	Percent Change in Mass
0.0 M Distilled water				
0.2 M Sucrose				
0.4 M Sucrose				
0/6 M Sucrose				
0.8 M Sucrose				
1.0 M Sucrose				
UNKNOWN				

CLASS DATA

GRAPH the class data

1.



Determine the molar concentration of the potato core. This would be the sucrose molarity in which the mass of the potato core does not change. To find this draw a line 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. Indicate this concentration of sucrose below.

Molar concentration of potato cores = _____ M

Molar concentration of UNKNOWN = _____ M

2. Why did you calculate the percent change in mass rather than simply using the change in mass?

_____

_____

_____

EXERCISE 1C: CALCULATION OF WATER POTENTIAL FROM EXPERIMENTAL DATA

$\Psi_S = -iCRT$

$\Psi = \Psi_S + \Psi_p$

I = Ionization constant
C = Molar concentration
R = Pressure constant (R =0.0831 liter bars/mole °K)
T = Temperature °K (273 + °C)

1. Calculate the solute potential of a 1.0 M sucrose solution in an open beaker at 22 °C under standard atmospheric conditions. SHOW YOUR WORK!

2. What is the pressure potential (Ψ_p) of this solution?

3. What is the water potential (Ψ) of this solution? SHOW YOUR WORK

4. PREDICT what would happen if a dialysis bag containing DISTILLED WATER was placed in this solution,

_____

_____

5. Calculate the solute potential of a 2.0 M sucrose solution in an open beaker at 18°C under standard atmospheric conditions. SHOW YOUR WORK!

ANALYSIS QUESTIONS

6. **PREDICT** whether the water potential of the potato cells would decrease or increase if a potato core was allowed to dehydrate by sitting in the open air. EXPLAIN YOUR ANSWER

_____

_____

OSMOSIS WITH DIALYSIS BAGS

DESIGN AN EXPERIMENT TO DETERMINE THE MOLAR CONCENTRATIONS OF THE MYSTERY SOLUTIONS.

EXPERIMENTAL DESIGN

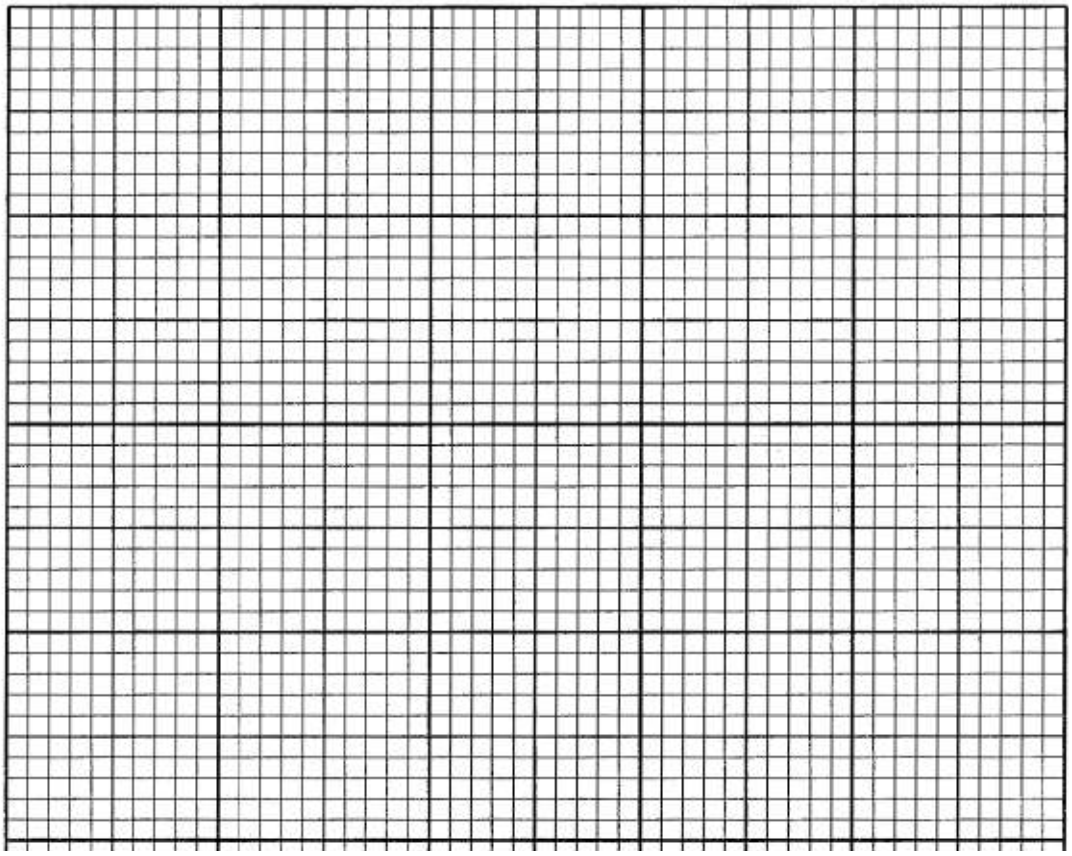
Experimental Design Matrix

Name: _____

Title of Experiment:			
Question you are trying to answer:			
Hypothesis (place in the "If…, then…" format)			
Independent Variable			
Levels of Independent Variable			
Dependent Variable			
Controlled Factors			
Explanation of why this is a controlled experiment			
How you will you measure?			
How will you determine if you accept or refute your hypothesis?			
What will your graph look like? (Title, X axis, Y axis, units)			

DATA COLLECTION:

GRAPH YOUR DATA



IDENTIFY THE MYSTERY SOLUTIONS (A, B, C, D, or E)

0.0M = _____ 0.2M= _____ 0.4M= _____ 0.6M= _____ 0.8M= _____ 1.0M= _____

1. EXPLAIN the relationship between the change in mass and the molarity of sucrose in or out of the dialysis bags.

_____

_____

_____

_____

_____

_____

2. In an experiment 6 dialysis bags are each filled with sucrose solutions of different concentrations. All of the bags (0.0M, 0.2M, 0.4M, 0.6M, 0.8M, 1.0M) are placed in a 0.4M sucrose solution. PREDICT what would happen to the mass of each bag.

_____

_____

_____

_____

_____

_____

_____

3. A dialysis bag is filled with distilled water and then placed in a sucrose solution. The bag's initial mass is 20 g and its final mass is 18 g. Calculate the percent change of mass, **showing your calculations** below.