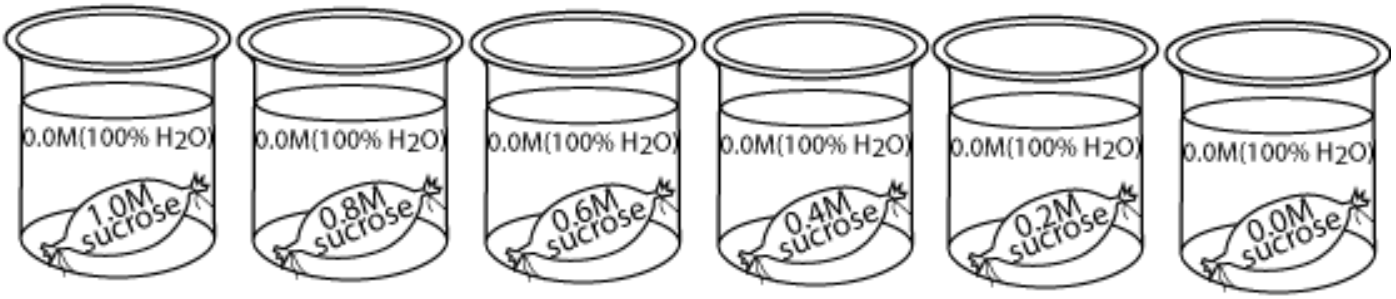
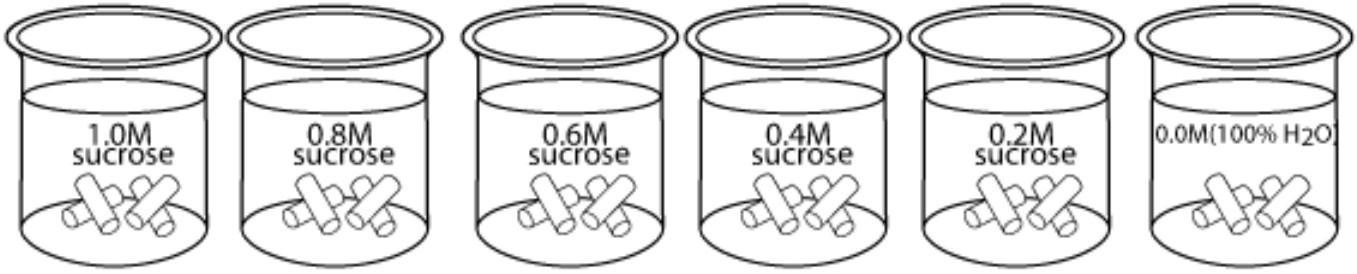
DIFFUSION/OSMOSIS LAB: SETUP INSTRUCTIONS **Name: _____ P. ____**

GOALS for what you should have set up in about 15 minutes:

1) You'll have 6 dialysis bags filled with about 15 mL of 1.0M sucrose, 0.8M sucrose, 0.6M sucrose, 0.4M sucrose, 0.2M sucrose, and tap water. These bags will be immersed, for 30 minutes, in cups filled with tap water. You'll weigh the bags before immersing them in water, and immediately after. When you're done, it'll look like this:



2) You'll take six sets of four potato cores, weigh them, and submerge them in cups containing about 100 mL of 1.0M sucrose, 0.8M sucrose, 0.6M sucrose, 0.4M sucrose, 0.2M sucrose, and tap water. You'll let them sit for a few hours (or overnight) and then remove the potato cores and weigh them again. When you're done with your setup, it'll look like this:



Detailed Instructions (how to achieve these goals)

1) **LABEL YOUR CUPS:** In your kits, you have 13 plastic cups. Label these with your group's initials (something identifiable), and then as follows.

Cups for potato experiment	Cups for dialysis bag experiment
● 1.0 M sucrose solution ● 0.8 M sucrose solution ● 0.6 M sucrose solution ● 0.4 M sucrose solution ● 0.2 M sucrose solution ● Water (0.0 M solution)	● 1.0 M sucrose dialysis bag ● 0.8 M sucrose dialysis bag ● 0.6 M sucrose dialysis bag ● 0.4 M sucrose dialysis bag ● 0.2 M sucrose dialysis bag ● Water dialysis bag
Diffusion Experiment cup	

2) **GET (or MAKE) 100 mL of SOLUTIONS:** *Instructions for making:* In your kit, you have a bottle that's labeled 1.0 M sucrose solution. You also have a bottle labeled "water." Use the table below to make your solutions. M*ake these solutions in the cups for the potato experiment.*

Final molarity of Sucrose solution	**Amount of 1.0 Molar Sucrose**	**Amount of Water**
1.0 molar	100 mL	0mL
0.8 molar	80 mL	20 mL
0.6 molar	60 mL	40 mL
0.4 molar	40 mL	60 mL
0.2 molar	20 mL	80 mL
0.0 molar	0 mL	100 ml

Now, split your lab group into two sub-teams. The first sub-team (TEAM DIALYSIS) continues with step 3. The second team (TEAM POTATO AND DIFFUSION) jumps down to step 6

TEAM DIALYSIS

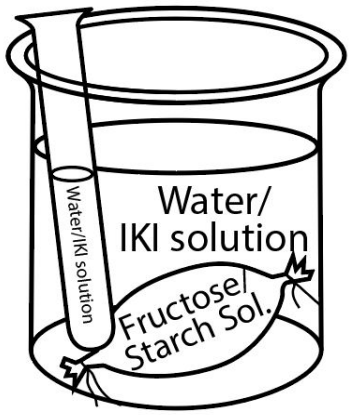
3) **Take 15 mL from each of the cups for the potato experiment and 6 DIALYSIS TUBES WITH each of these solutions (1.0M, 0.8M, 0.6M, 0.4M, 0.2M and 0.0M). Here's how:**
    a) Start with the 1.0 M solution.
    b) Tie off the bottom of a dialysis tube, making it into a dialysis bag.
    c) Use a funnel to pour about 15 mL of this 1.0 M solution inthe potato experiment cups into the bag.
    d) As soon as you've poured the solution, into the bag
        i) Remove most of the air from the bag by drawing the top of the bag together with your fingers
        ii) Tie the top of the bag closed
        iii) Place the bag into the empty cup labeled "1.0 M sucrose dialysis bag."
    e) Repeat steps "i" through "iii" for each solution. At the end you'll have six bags, each in its own empty cup.
    f) Go to a weighing station. Blot off the bags with paper towel to remove any spilled sucrose, weigh the bag, and record the mass in grams.
4) **AFTER WEIGHING ALL THE BAGS, FILL THE DIALYSIS CUPS WITH WATER, AND LET SIT FOR 30 MINUTES.**
    a) Fill all the cups with tap water at about the same time (as close as possible).
    b) Set a timer, and let them sit for 30 minutes.
5) **AFTER 30 MINUTES, TAKE THE BAGS OUT, WEIGH THEM AGAIN, AND RECORD.**

TEAM POTATO AND DIFFUSION

6) **MAKE POTATO CYLINDERS AND PLACE IN SUCROSE SOLUTION CUPS**
    a) Use the potato core devices to make 4 cores in slices of potato that are about 2 cm long.
    b) Weigh all four cores together, and record their mass in grams. *Tare the scale (zero it) so that you're just weighing the potatoes, not the weighing tray. Also, make sure you're measuring grams.*
    c) After weighing and recording, place all four cores in the 1.0 M sucrose solution cup.
    d) If it's available, put some Saran wrap over the cup, and leave it over night.
    e) Repeat steps "a" through "d" for your 0.8, 0.6, 0.4, 0.2, and pure water solutions.

7) SET UP THE DIFFUSION EXPERIMENT

a. Take one piece of dialysis tubing. Tie off the bottom, making it into a bag
b. Shake the fructose/starch solution bottle very well to dissolve the starch. Pour about 15 mL of fructose/starch solution into the bag. Use your fingers to remove any air from the tube. Tie off the top of the bag.
c. Use a test strip to confirm the presence of fructose in the solution in the dialysis bag (note that these glucose test strips work fine for fructose)
d. Put the bag into the diffusion cup.
e. Add about 100 mL of water, and 50 drops of iodine solution
f. Pour off about 10 mL of the iodine solution into a test tube (so that you have a sample of the original concentration of the water/IKI solution.
g. Let the cup sit overnight.



Name:_____ Period: _____

Diffusion/Osmosis Lab: Data Tables

Table 1a: Dialysis Bag Data: Group Data. Mass is in grams.

Molarity of Sucrose Solution in bag	Initial mass (A)	Final Mass (B)	Mass Difference (C)	Percent Change C/A * 100	Standard Deviation $s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$
water					
0.2 M					
0.4 M					
0.6 M					
0.8 M					
1.0 M					

Table 2a: Potato Core: Group Data. Mass is in grams.

Molarity of Sucrose Solution in cup	Initial mass (A)	Final Mass (B)	Mass Difference (C)	Percent Change C/A * 100	Standard Error of the mean $SE_{\bar{x}} = \frac{s}{\sqrt{n}}$
water					
0.2 M					
0.4 M					
0.6 M					
0.8 M					
1.0 M					

Table 1b: Dialysis Bag Data: Class Data

	Group % change											
Molarity of Sucrose Solution in bag	1	2	3	4	5	6	7	8	9	Average Percent Change	Standard Deviation	Standard Error of the mean
water												
0.2 M												
0.4 M												
0.6 M												
0.8 M												
1.0 M												

Table 2b: Potato Core: Class Data

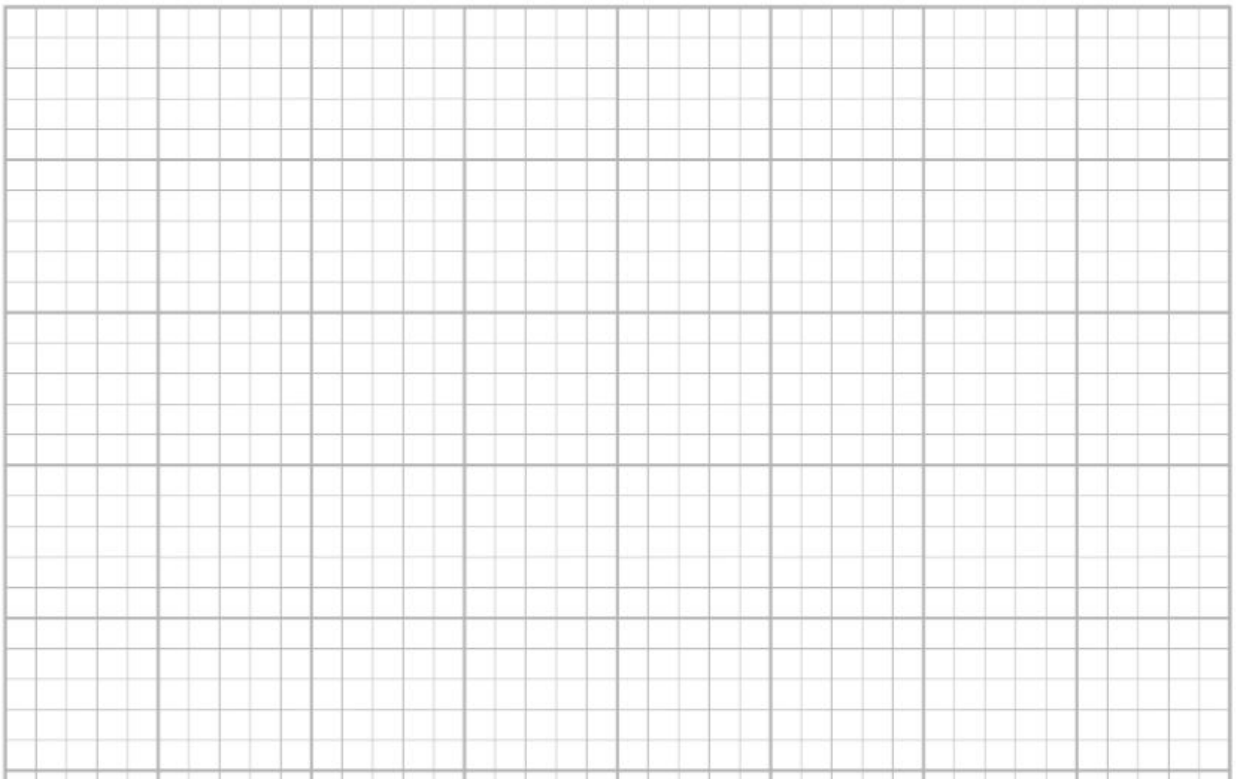
	Group % change											
Molarity of Sucrose Solution in cup	1	2	3	4	5	6	7	8	9	Average Percent Change	Standard Deviation	Standard Error of the mean
water												
0.2 M												
0.4 M												
0.6 M												
0.8 M												
1.0 M												

Name:_____ Period: _____

Lab Part 1: Table 1c: Dialysis Bag Data: My Group's Data, and Class Data

	% Change in Mass		Standard Error of the mean
Molarity of Sucrose Solution in bag	My Group	Class Average	
water			
0.2 M			
0.4 M			
0.6 M			
0.8 M			
1.0 M			

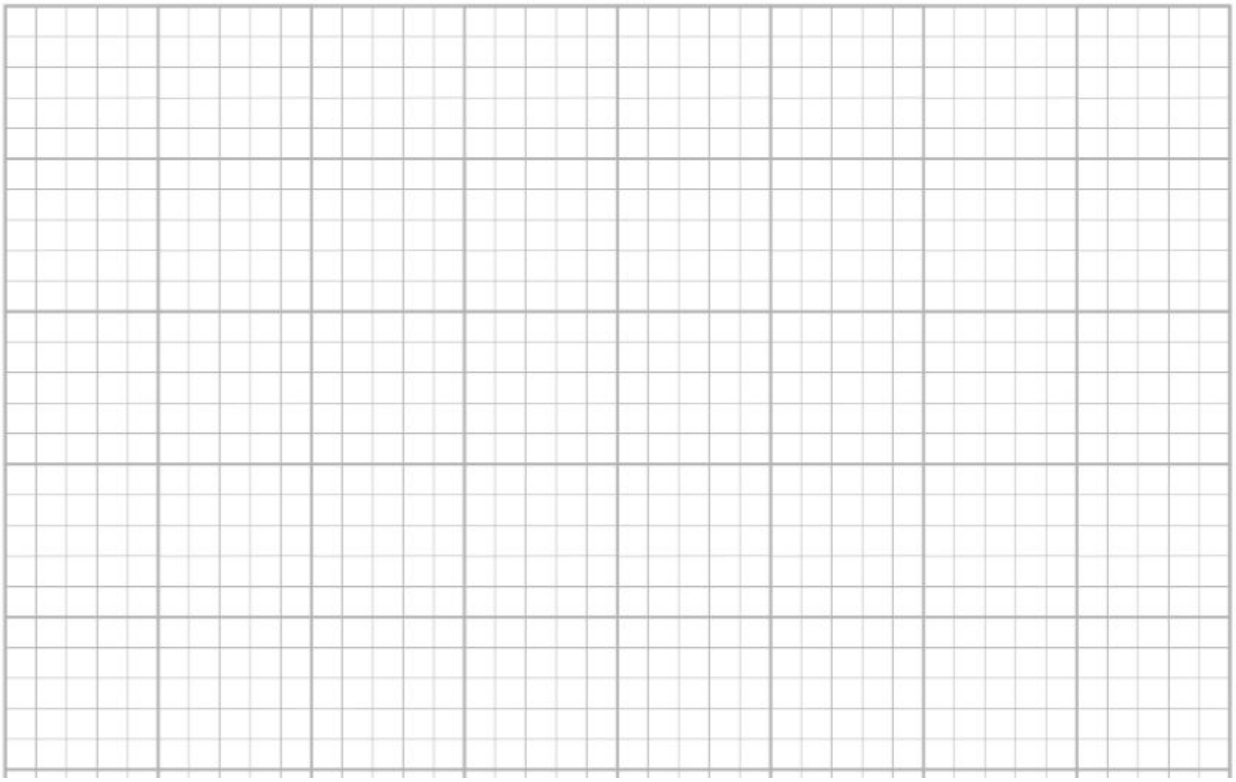
GRAPH (include your data and the class's data): _____



Lab Part 2: Table 2c: Potato Core Data: My Group's Data, and Class Data

	% Change in Mass		
Molarity of Sucrose Solution in cup	**My Group**	**Class Average**	**Standard Error of the Mean**
water			
0.2 M			
0.4 M			
0.6 M			
0.8 M			
1.0 M			

GRAPH (include your data and the class's data): _____



Lab Part 3: Diffusion Lab Data

1. Pour off some of the solution in your cup into a new test tube. Compare the original color of the solution (in the first test tube) to the color of the solution in the cup after 24 hours (the new test tube.
2. Test the solution in the bag for glucose. Interpret and record in *initial*. Test the solution in the cup for glucose. Interprest and record in *final*.

				Glucose Test Results	
	Initial Contents	**Initial color**	**Final Color**	**Initial**	**Final**
Bag	Glucose/Starch				
Beaker	Water and iodine				

Lab Part 4: Plasmolysis.

One of the labs we did while viewing cells under microscopes, putting Elodea leaves in salt water to see its cell membranes, was also a part of this lab. We'll analyze it below.

ANALYSIS QUESTIONS (Answer on a separate sheet)

1. **Lab 1 (dialysis tubing)**
    a. What was the relationship between the molarity of the solution and the percent change in mass of the bags?
    b. What underlying principles explain the change? Use terms like *osmosis*, *hypotonic*, *hypertonic*, and *concentration gradient* in your answer.
    c. Pretend that instead of placing your dialysis bags in tap water, you placed them in .5 M sucrose solution. Explain what would have happened, and draw a graph showing the approximate results (this doesn't have to be on graph paper, but it does have to have labeled axes, lines, a title, etc.)
2. **Lab 2 (potato cores)**
    a. Why did some of the potato cores gain mass, and why did some lose mass? Use terms like *osmosis*, *hypotonic*, *hypertonic*, isotonic and *concentration gradient* in your answer.
3. **Lab 3 (Diffusion/Membrane Model Demonstration)**
    a. **Discussion Questions *(talk these through with your partner)***
        i. At the start of the experiment, where was the starch more concentrated? Based on diffusion, where would the starch "want" to go?
        ii. Did the starch diffuse through the bag? How do you know?
        iii. Is the bag permeable to starch? Explain.
        iv. At the start of the experiment, where was the iodine more concentrated?_____ Based on diffusion, where did the iodine "want" to go?
        v. Did the iodine diffuse through the bag? How do you know?
        vi. Is the bag permeable to iodine? Explain.
        vii. At the start of the experiment, where was the glucose more concentrated?_____. Based on diffusion, where did the glucose "want" to go?
        viii. Did the glucose diffuse through the bag? How do you know?
        ix. Is the bag permeable to glucose? Explain. Think about the molecular makeup of starch, glucose, and iodine (an ion). How can this explain what happened?
        x. If starch, glucose, and iodine were various types of balls, and the bag were like a chain-link fence, then what kind of balls would starch, glucose, and iodine be?
        xi. Since the membrane was permeable to _____ and _____ but not to _____, we can say that it is _____ permeable.
        xii. We did this lab because the dialysis bag is like a cell membrane. How?
    b. **Written Response:** Describe what happened in this diffusion/membrane model lab. Make sure that you cover all the questions below, which should happen if you use the sentence frames in part "c" below.
        i. ___Define the term "diffusion," and explain why diffusion occurs.
        ii. ___Briefly explain how we set up this diffusion demonstration.
        iii. ___Explain what observations we made that told us which substances were diffusing in which direction.
        iv. ___Explain how this lab relates to the concept of *selective permeability.*
        v. ___Explain how this lab relates to the concept of *cell membranes*

        As you complete, what's above, the following sentence frames might be helpful
        - _____ can be defined as… _____ occurs because…
        - In our lab, we first…
        - If the bag had been freely permeable (to anything) then…
        - However, because the bag was selectively-permeable…
        - The connection with cell membranes _____ is that
4. **Lab 4: Elodea Plasmolysis**
    a. The cell membrane of the elodea cells not visible in pure water. When you added salt water to the cells, the chloroplasts all moved to the center of the cell, surrounded by the now visible cell

membrane. Explain what happened. Use *cell membrane*, *osmosis*, *hypotonic*, *hypertonic*, and *concentration gradient* in your answer.

5. **Applications (note that by design, you've seen some of these questions before)**
    a. Why does fresh meat left out become putrid, while beef jerky lasts pretty much forever? Same for fresh fruit v. dried fruit? Use *osmosis, hypotonic, hypertonic*, etc, in your answer.
    b. If I put a raisin in water, it expands. Why? Use *osmosis, hypotonic, hypertonic*, etc, in your answer.
    c. Plants can't grow in soil with too high a salt content. Why? Use *osmosis, hypotonic, hypertonic*, etc, in your answer.

Graphing Practice

6. Zucchini cores are placed in sucrose solutions overnight. The next day, they have the following percent changes in mass

ZUCCHINI CORES	% Change in Mass
Molarity of Sucrose Solution in bag	Class Average
water	20%
0.2 M	10%
0.4 M	-3%
0.6 M	-17%
0.8 M	-25%
1.0 M	-30*

Graph the data, and figure out the molar concentration of solutes in the zucchini tissue