Lab 3 Report Sheet Your Name _____

Diffusion and Osmosis Lab Lab Partners _____

_____

Lab Section ____ Team Number ____ _____

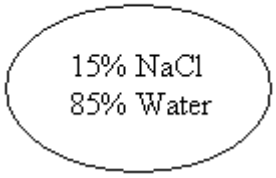
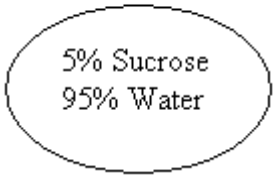
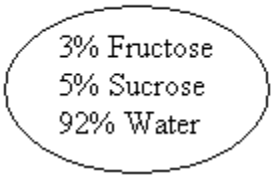
Prelab Assignment

- *Before* coming to lab, to get an overview of this laboratory activity and to use your lab time efficiently, read carefully the introduction and procedures of each part of the experiment in the lab handout. If you and your group members are not familiar with the procedures before coming to lab, you may have difficulty completing this exercise during the lab period.
- *After* reading the Lab 3 handout answer the all parts of questions 1 and 2 in the spaces provided on pages 1 - 2.

Lab 3 Prelab Questions

1. a.) Examine diagrams in experiments 1 – 3 below to determine the concentration gradients and expected direction of net flow for **all** substances in each set-up. Then *draw an arrow* for each substance showing the "expected" **net** movement in each experiment. In all experiments **NaCl** and **fructose** are *permeable*, while **sucrose** is *impermeable* to the membrane. Caution: Be careful with experiment #3!

   b.) For each experiment below determine the tonicity (hypo-, hyper- or isotonic) of the "cell" and its external environment and predict the *net* movement of water and the solutes by circling the appropriate responses.

Experiment	"Cell"	Environment	Net movement of *water*	Net movement of *solute*
#1 100% Water  	Hypotonic or Hypertonic or Isotonic?	Hypotonic or Hypertonic or Isotonic?	Into "Cell" or Out of "Cell or At equilibrium?	**NaCl**: Into Cell Or Out of Cell?
#2 100% Water  	Hypotonic or Hypertonic or Isotonic?	Hypotonic or Hypertonic or Isotonic?	Into "Cell" or Out of "Cell or At equilibrium?	**Sucrose**: Into Cell Or Out of Cell?
#3 5% Fructose 3% Sucrose 92% Water  	Hypotonic or Hypertonic or Isotonic?	Hypotonic or Hypertonic or Isotonic?	Into "Cell" or Out of "Cell or At equilibrium?	**Sucrose**: Into Cell or Out of Cell? **Fructose**: Into Cell or Out of Cell?

Turn the page for more Prelab questions!

Prelab Questions (cont.)

2. **Read the procedure** for each of the three demonstrations performed in this exercise on page 3 of the procedure and then answer the following questions.
   a. Demonstration 1: **Thistle Tube Demonstration.** Finish labeling figure 1 below.

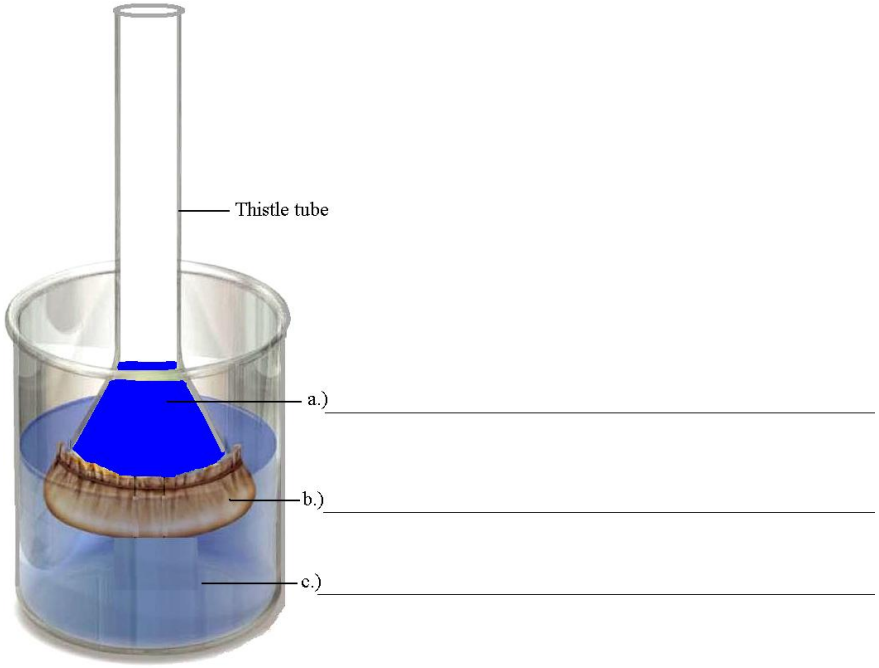


Figure 1. Thistle tube demonstration

   b. The solution in the thistle tube is... (Circle your choice.)
   a.) *hypertonic* b.) *hypotonic* c.) *Isotonic*? d.) Gin & tonic

   c. What do you think will happen in the *thistle tube* demonstration? What will happen to the level of the solutions in the tube and beaker? Answer these questions by proposing a hypothesis using the "If ..., then ..." format!

   d. Demonstration 2: **Dyes in agarose gel**. What do you think will happen in this demonstration? Which dye do you think will move the farthest? Answer these questions by proposing a hypothesis using the "If ..., then ..." format!

   e. Demonstration 3: **Potato slices in salt solutions**. What do you think will happen in this demonstration? What will the potato slices feel like in hypo-, hyper- and isotonic solutions? Answer these questions by proposing a hypothesis using the "If ..., then ..." format!

Activity 1. Demonstrations of Molecular Movements through a semi-permeable membrane, a gel and a living membrane

Instructions: Record your observations and answer the questions as you follow the procedures for this lab.

Demonstration 1. Thistle Tube Demonstration

1. **What** happened to the level of the blue solution in the thistle tube? **What** principle does this demonstration illustrate? *Explain fully*.

Demonstration 2. Movement in a Gel

Table 1. Distance moved by potassium dichromate and aniline blue dyes in the agarose gel.

Dye	Molecular mass (amu)	Diameter of "halo" (mm)
Potassium Dichromate	194	
Aniline blue	738	

2. Complete table 1, above.
3. How far did each dye move? **How** can you explain the differences (if any) in the movement of the two different dyes? **What** principle does this demonstration illustrate? *Explain fully*.

Demonstration 3. Movement through living membranes in potato cells

4. **Why** do you think the slices felt different (if they did.)? **What** could have happened to the potato slices to make them feel the way they do. **What** is the principle demonstrated by the potato slices? *Explain fully*.

Activity 2. Diffusion through a non living membrane

5. Hypothesize what will happen in activity 2 by completing the following table.

Table 2. Hypotheses for Activity 2.

Beaker / Sac No.	What will move into the sac?	What will move out of the sac?	What will happen to the mass of the sac?
1			
2			
3			
4			

Table 3. Weights of Dialysis Tubes. Beginning weights of dialysis sacs containing various solutions and final weights of dialysis sacs after soaking in various solutions for 1 hour.

Treatment	Beginning Mass (grams)	Final Mass after 1 hour (grams)	Change in Mass (g) (final - initial mass)
Sac 1 40% Glucose solution soaked in a beaker of DI water			
Sac 2 40% Glucose solution soaked in a beaker of 40% Glucose			
Sac 3 10% NaCl solution soaked in a beaker of DI water			
Sac 4 Starch solution. soaked in a beaker of I_2KI and DI water			

Activity 2 (cont.)

Table 4. **Chemical Analysis of Dialysis Tubes** Results of Benedicts, Silver nitrate, and Iodine Tests on the various sacs and their solutions.

Sac and Test Performed	Test results for sac contents (present or absent)	Test results for beaker content (present or absent)
Sac 1: Benedicts test for Glucose		
Sac 3: Silver nitrate test for NaCl		
Sac 4: Iodine test for Starch		

Analysis of the Results for Activity 2

Answer the following analysis questions concerning the movement of molecules across a semi-permeable membrane only after having completing the procedures for Activity 3.

6. Consider the results for all 4 sacs in ***Table 3***. In which sacs did **Net Osmosis** occur? (Circle all that apply.)

   a.) Sac 1 b.) Sac 2 c.) Sac 3 d.) Sac 4

   *Cite below specific evidence from **table 3*** to support your response.

7. Consider the results of all 4 sacs in ***Table 4***. In which situations did **Net Simple Diffusion** occur?

   a.) Sac 1 b.) Sac 2 c.) Sac 3 d.) Sac 4

   *Cite below specific evidence from **table 4*** to support your response.

8. What single characteristic of the semi-permeable membrane used in the lab determines which substances can pass through them?

Activity 2 (cont.)

9. Based on the data in ***tables 3 and 4*** and your knowledge of chemical structures list the relative sizes in the order of largest to smallest of the following molecules: Glucose, Starch, NaCl, and water.

10. What is the functional analogue of the dialysis sac in a living cell? _____

11. Summarize the results of activity 2 by completing **table 5** below. Select from the following choices the reason for the net movement of the substance and record its *letter* in the last column of **table 5**.
    a. Osmosis: water moving from a hypotonic to hypertonic solution
    b. Osmosis: water moving from a hypertonic to hypotonic solution
    c. No net osmosis: the solutions are isotonic
    d. Diffusion down the substances concentration gradient
    e. Diffusion against the substances concentration gradient
    f. No concentration gradient, therefore no net diffusion of the substance
    g. Substance has molecules to large to fit through the pores of the dialysis tubing

Table 5. Summary table for the movement of substances in Activity 2.

Beaker/Sac Number	Substance	Direction of Net Movement (Into sac, out of sac or no change)	Letter of the reason for the net movement of the substance
1	Glucose		
	Water		
2	Glucose		
	Water		
3	Salt (NaCl)		
	Water		
4	Iodine		
	Starch		
	Water		

Activity 3. Osmosis in Living Animal and Plant Cells

Table 6. Observations of the changes in cell structure of **Red Blood Cells** in test solutions A, B and C

Solution	Appearance and Condition of Red Blood Cells
D (only blood)	
A	
B	
C	

Analysis Questions for Activity 3

12. Which of the three solutions was *hypertonic* to the **red blood cells**? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    *Cite below specific evidence from **table 6*** to support your response.

13. Which of the three solutions was *hypotonic* to the **red blood cells**? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    *Cite below specific evidence from **table 6*** to support your response.

14. Which of the three solutions was *isotonic* to the **red blood cells**? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    *Cite below specific evidence from **table 6*** to support your response.

15. What conditions within the human body might lead to results similar to those you experienced here?

Activity 3 (cont.)

Table 7. Observations of the changes in cell structure of ***Spirogyra* cells** in test solutions A, B and C

Solution	Appearance and Condition of *Spirogyra* Cells
A	
B	
C	

Analysis Questions for Activity 3

16. Which of the three solutions was *hypertonic* to the ***Spirogyra*** cells? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    Cite below specific evidence from ***table 7*** to support your response.

17. Which of the three solutions was *hypotonic* to the ***Spirogyra*** cells? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    Cite below specific evidence from ***table 7*** to support your response.

18. Which of the three solutions was *isotonic* to the ***Spirogyra*** cells? (Circle your choice.)

    a.) Solution A b.) Solution B c.) Solution C

    Cite below specific evidence from ***table 7*** to support your response.

19. Would you expect pond water to be a.) *isotonic*, b.) *hypotonic*, or c.) *hypertonic* to *Spirogyra* cells> *Circle your choice and* ***explain why*****.**

Activity 3 (cont.)

20. When placed in DI water explain why animal cells might lyse (burst) while plant cells do not.

Application Questions

21. Animals and plants that live in an estuary, an arm of the sea at the mouth of a river, have developed many interesting adaptations that allow them to survive the daily osmotic fluctuations of their environment. Organisms that can't maintain a constant internal water and salt balance will perish. Use the following terms in your responses to questions "a" and "b", below: hypertonic, hypotonic, isotonic, osmosis, water loss, water gain, etc. What osmotic challenges do estuarian organisms (e.g. crabs) face at....

    a.) high tide?

    b.) low tide?

22. One home remedy for treating constipation in babies involves adding Karo syrup, a very concentrated sugar solution, to the baby's milk to help soften the hard and dry stools of the baby and therefore lead to a more regular bowel movements. *Explain how this home remedy works*. **Hint**: The digestive system is lined with epithelial cells.