Name: _____ Date:_____ Period:_____

Cellular Traffic

Osmosis, Diffusion and Plasmolysis

Part A: Diffusion

Purpose: To investigate the diffusion of a substance across a semipermeable membrane.

Background: Dialysis Tubing is a type of ***semi permeable*** membrane tubing made from regenerated cellulose or cellophane used for ***diffusion***. It allows the passage of small molecules but not larger ones. It is used in clinical circumstances to ensure a filtered flow of molecules, preventing the flow of larger solute molecules. Small molecules can be 'washed' out of a solution as it is pumped through the tubing which is surrounded by a solvent, usually water. The small particles diffuse out of the solution through the tubing and into the surrounding water. This is how blood is cleaned in dialysis for people whose kidneys have failed.

Dialysis tubing is semi permeable to glucose, for example, but not to any starches or proteins. This is because the polymer bonds of proteins and starches are too large to pass through the semi permeable dialysis tubing. This same process mimics the function of a cell, which selectively, sometimes through passive transportation or active transportation, allows some molecules to pass through the membrane.

When starch molecules react with iodine molecules the solution turns a blue-black color. Using this information you will be able to tell at the end of this lab what substance has moved where- into the dialysis tubing or into the beaker.

Hypothesis: Based on the background above and after reading the procedure below which molecules do you hypothesize will move where?

_____

_____

Materials:

- 30 cm of Dialysis tubing
- Cornstarch/ water solution
- Iodine
- Small beaker
- Small Erlenmeyer flask
- Small Funnel

Procedure:

1. Fill beaker with 75 ml with water and add 25-30 drops of iodine (until the solution has a dark amber color)
2. In your small Erlenmeyer flask, add one tablespoon of cornstarch and 30 ml of water. Gently swirl to flask to thoroughly dissolve the cornstarch.
3. Your teacher will have prepared you dialysis tubing by soaking it in water the night before. Tie off one end of the tubing as close to the bottom as you can. Open the tubing at the untied end by gently rubbing the top of the tubing between your fingers.
4. Insert the funnel into the opening and slowly add your cornstarch water solution.
5. Before tying off the top of the tubing make sure to get as much air out as possible. It should not have a ballooned appearance.
6. Gently insert the dialysis tubing with solution into the beaker with iodine.
7. Wait approximately 15 minutes and record your observations on the **Data Sheet.**

Analysis and Conclusion:

1. Define selective permeability: _____

   _____

2. Differentiate between osmosis and diffusion:_____
   _____
   _____
3. To which substance is the plastic bag permeable? **Support your answer**.
   _____
   _____
   _____
4. How can you tell you are observing diffusion and not osmosis in this lab?
   _____
   _____
   _____
5. How is the dialysis tubing like the cell membrane?
   _____
   _____
   _____

Extension and Application:

Cut a slice of lemon and drop it in a glass of cranberry juice. Leave it there for about 15 minutes. Remove it and state the color of the lemon slice and explain why it is that color.

- Color of lemon: _____
- Explanation:
  _____

Part B: Osmosis

Background: Believe it or not, an unfertilized egg is actually one single cell. In fact the ostrich egg is the largest single cell one earth! Just inside the shell is the soft, flexible cell membrane. This is a **semi permeable** cell membrane is just like in any other cell membrane in any other cell.

In this investigation you will use a fresh unfertilized egg to determine what happens in osmosis. You will measure the amount of water that passes through the cell membrane that lines the inside of the shell. You will do this by exposing the egg cell to **hypertonic** and **hypotonic** solutions in a beaker and measuring the volume of water left behind.

Materials:

- Fresh egg in cell
- Grease pencil
- (3) 300 ml beakers
- Plastic baggy
- White vinegar
- Clear sugar syrup
- Distilled water
- 200 ml graduate cylinder

Day 1 Procedure:

1. Label the 3 beakers using the grease pencil: vinegar, syrup, water. Also, put the group name on each beaker.
2. Using the “vinegar” beaker measure 150 ml of white vinegar into the beaker.
3. Place your egg in the “vinegar” beaker and cover it with the plastic baggy.
4. Place your beaker in the area indicated by your teacher and wait for Day 2 to move on.

Day 2 Procedure:

5. Observe what has happened to your egg. Record this in **Figure 1** of the **Data Sheet**.
6. Using the "syrup" beaker, measure 150 ml of syrup into that beaker.
7. **CAREFULLY!!!** remove the egg from the vinegar. It is quite fragile now as the shell is dissolved. **VERY GENTLY!!!** Rinse the egg in water and place it in the syrup beaker. Cover the beaker with the plastic bag.
8. Using the graduated cylinder, measure the amount of vinegar left in the vinegar beaker. Record the volume of remaining vinegar in **Figure 1** on the **Data Sheet**.

Day 3 Procedure:

9. Measure 150 ml of water into the "water" beaker.
10. **CAREFULLY!!!** Remove the egg from the syrup beaker. Record your observations of the egg's appearance in **Figure 1** on the **Data Sheet**.
11. Place the egg in the water jar. Cover the jar with the plastic bag.
12. Measure the volume of liquid that remains in the "syrup" beaker and record in **Figure 1** of the **Data Sheet**.

Day 4 Procedure:

13. Remove the egg from the water and record your observations of its appearance. Discard the egg in the container provided.
14. Measure the amount of water that is left in the Jar. Record this in the **Data Sheet**
15. Answer the questions of the **Data Sheet.**

Questions:

1. When the egg was placed in the water, in which direction did the water molecules move? On what evidence did you base this?

   _____
   _____
   _____

2. How do you explain the volume of liquid remaining when the egg was removed from the syrup?

   _____
   _____
   _____

3. When the egg was placed in the water after being removed from the syrup, in which directions did the water move?

   _____
   _____
   _____

4. Which solution was hypertonic, which was hypotonic? On what evidence do you base this?

   _____
   _____
   _____

Part B: Plasmolysis

Purpose: The purpose of this activity is to investigate the effects of a hypertonic solution on the cells of the red onion and elodea.

Materials:

- Red onion epidermis and elodea leaf
- Forceps
- Dropper
- Distilled water
- 5% NaCl solution
- Paper towels
- Microscope
- Slides
- Cover slip

Procedure:

1. Make a wet mount of your specimen (red onion epidermis or elodea)
2. Examine under 100X magnification. When you have a clear view of several cells switch to 400X. Make a colored drawing properly labeled in the first circle on the data sheet **(Figure 2)**.
3. Place 2 drops 5% NaCl on one slide of your cover slip while placing a small piece of paper towel along the opposite edge of the cover slip (Capillary action of the paper towel will suck the NaCl across the slide).
4. Make sure that the salt solution has time to difuse under the cover slip and affect the cells.
5. Observe the effects of the solution on the onion cells. Make a properly labeled, colored drawing of the cell's appearance in the second circle on the data sheet **(Figure 3).**
6. Replace the NaCl solution with distilled water and add it in the same way that the salt solution was added. Make a properly labeled, colored drawing of the Cell's appearance **(Figure 4)**.
7. Repeat the above steps for the elodea leaf making drawings and observations in **Figure 5**, **6** and **7**.

Conclusion and Analysis:

1. What effect did the sodium chloride solution have on the onion cells? What can you attribute this to?

   _____
   _____
   _____

2. What effect did adding water have on the cells? What can you attribute to?

   _____
   _____
   _____

3. Based on your observation in this lab, explain why salt water kills most plants.

   _____
   _____
   _____

Data Sheet

Diffusion Observations:

	Beaker	Dialysis Tubing
Initial		
Final		

Osmosis Observations:

Solution	Initial Volume (Before Egg)	Final Volume (After the Egg)	Egg Observations
Vinegar			
Syrup			
Water			

Figure 1

Solution	Drawing	Qualitive Analysis (Observations)
Vinegar		
Syrup		
Water		

Figure 2 **Figure 3** **Figure 4** **Figure 5** **Figure 6** **Figure 7**