Unit 4: The Cell & Cellular Transport/ Homeostasis - Lab Investigation

INSTRUCTOR:
no_reply@example.com

Introduction

Membranes, whether cell membranes or cellophane dialysis membranes, allow the passage of certain molecules and prevent passage of others. Cellophane dialysis tubing permits slow passage of water and other small molecules, but it will not allow other larger molecules to pass through. This slow passage of water molecules is a type of diffusion (osmosis).

Diffusion is initiated by natural, random molecular movement (Brownian motion). Any molecule may diffuse through a membrane if it is small enough.

Purpose

The purpose is to provide an understanding of diffusion of substances across a semipermeable membrane.

Procedure

1. Tie a knot at one end of a section of dialysis tubing.
2. Fill the dialysis tubing one-half way with equal parts of glucose solution and soluble starch solution.
3. Tie the open end of the tubing very tightly. If there is any leakage the experiment will not work. Do not leave too much air in the tubing, as this will hinder the experiment.
4. Rinse the tubing under running water to remove any solutions from the outside of the dialysis tubing.
5. Dry the tube and determine its mass. Calculate the % change in mass - ***(final-initial)/initial x 100***
6. Place the filled dialysis tubing in a container of water. Add approximately 10 drops of Lugol's iodine solution to the container of water. The development of a dark blue or purple color is a positive indicator for the presence of starch.
7. After approximately 10 minutes, record any observations of the cellophane tubing and water in the container. Make sure to explain your results.

Cellophane tubing: Describe

Initial Mass	Final Mass	Mass Change	% Change in Mass

8. Using Benedicts Solution and test the solution in the container for the presence of sucrose. Explain why there was or was not sugar present in the solution.

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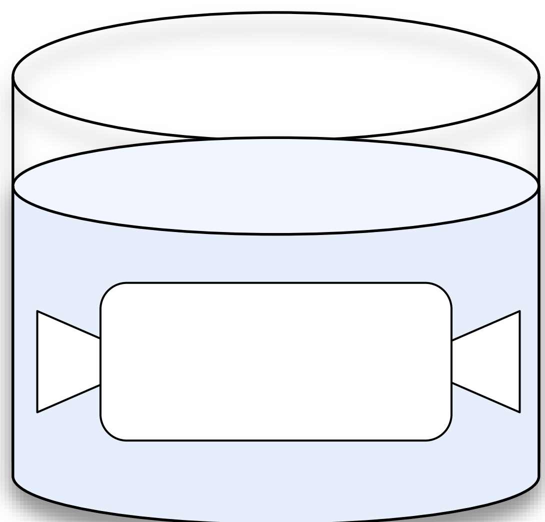
9. Did the water move into or out of the dialysis tubing? Use diagrams and words to explain your answer. Careful! Trick question!

LABELED DIAGRAM



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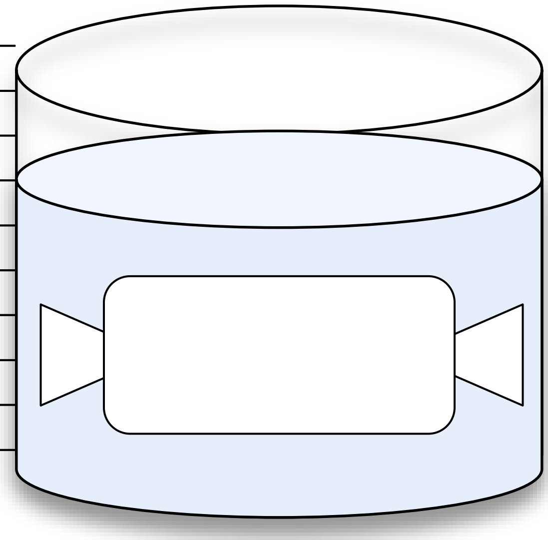
10. Complete the chart below.

Moved Into The Dialysis Tubing	Moved Out Of The Dialysis Tubing

11. If the dialysis tubing were allowed to sit in the beaker indefinitely, would diffusion ever cease? Explain your answer fully, using diagrams and words.



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12. What is a subjective way to determine if the bag gained or lost water?

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13. What is an objective way to determine if the bag gained or lost water?

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14. Define the following words:

- **Diffusion**: ____

- **Osmosis**: ____

15. Why are diffusion and osmosis defined as passive transport?

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16. Explain the concept of active transport.

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17. How do cells change if placed in solutions with similar salt concentrations?

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18. What will happen to a red blood cell in plasma?

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19. How do cells change if placed in solutions with more salt concentrations?

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20. What will happen to a red blood cell placed in salt water?

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21. How do cells change if placed in solutions with lower salt concentrations (distilled water)?

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22. What will happen to a red blood cell placed in distilled water?

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23. What is equilibrium and when is it reached?

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24. If a cell with a 0.9% salt concentration is placed in distilled water, will the cell gain or lose water? Explain your answer in words and a diagram showing the concentrations of salt and water inside and outside the cell.

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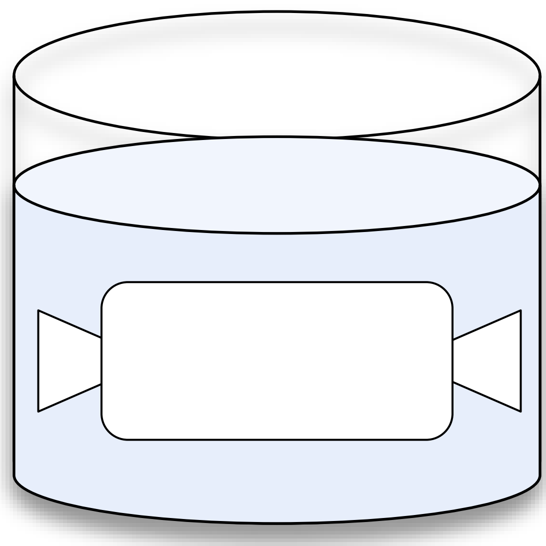

25. Why was the starch unable to pass through the dialysis tubing and the sugar able to pass through the tubing? Explain your answer in words and a diagram.

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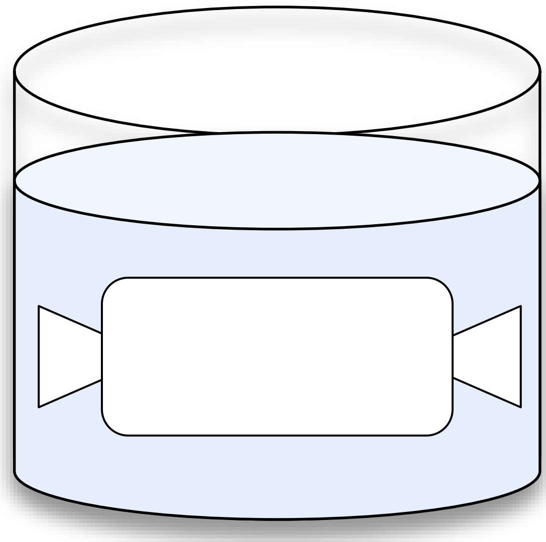

26. Describe the test for starch. What determines a positive test?

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27. Describe the test for glucose. What determines a positive test?

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Example problem: Diffusion of Water in Varying Concentrations of Sucrose Solution

A student filled 6 separate dialysis tubes with the respective concentrations (M = molar concentration) of sucrose solution and massed each of them. She then placed each tube into distilled water and let it stand for 30 minutes. She then removed each tube and massed them. Her data is shown below:

Contents in Bag	Initial Mass	Final Mass	Mass Difference	Percent Change in Mass
Distilled water	28.0 g	28.0g		
0.2M sucrose	26.9g	28.5g		
0.4M sucrose	27.0g	29.4g		
0.6M sucrose	28.4g	32.6g		
0.8M sucrose	28.2g	32.7g		
1.0M sucrose	29.9g	34.8g		

a. Calculate the Difference in Mass
b. Calculate the Percent Change in Mass

The class results are shown below:

	Group 1	**Group 2**	**Group 3**	**Group 4**	**TOTAL**	**Class Average**
Distilled water	0%	0%	0.71%	0.38%	1.09%	0.27%
0.2M sucrose	5.95%	4.01%	5.41%	1.75%	17.12%	4.28%
0.4M sucrose	8.89%	8.63%	8.89%	8.42%	34.83%	8.71%
0.6M sucrose	14.79%	-8.06%	10.69%	9.61%	27.03%	6.76%
0.8M sucrose	15.95%	15.19%	12.33%	15.70%	56.70%	14.10%
1.0M sucrose	16.39%	7.29%	15.13%	12.50%	51.31%	12.83%

a. Create a line graph comparing the students' group results with the rest of her class (AVG). Remember – **T.A.L.K.S**
b. Label both the dependent and independent variable