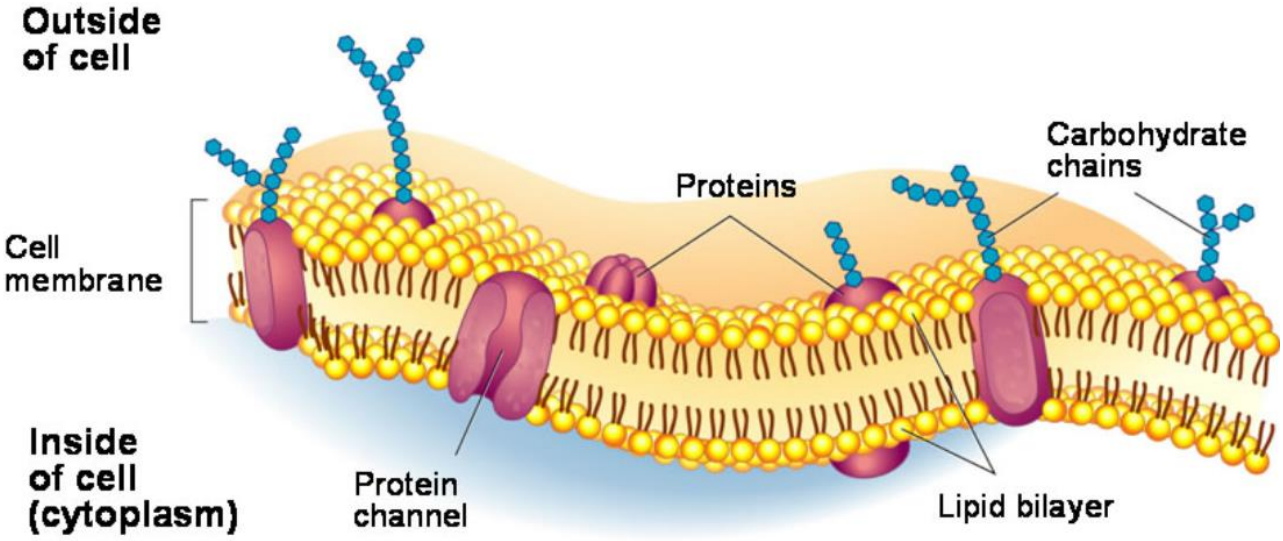
CELL MEMBRANES AND TRANSPORT

NAME _____

BLOCK _____



The Plasma Membrane and the Fluid Mosaic Model

https://www.youtube.com/watch?v=CNbZDcibegY

1. All cells have a _____ _____ that acts as a _____ between the outside and inside of the cell.

2. Cell membranes are primarily made of _____ which are large _____ molecules.

3. It is made of one _____, two _____ _____ and one _____.

4. The phosphate group is _____ which means it interacts _____ with water.

5. The fatty acid tails are _____ so they _____ _____ interact well with water.

6. Phospholipids tend to arrange themselves into a _____ _____.

7. Only the _____ _____ interact with the watery environment.

8. The _____ _____ crowd inward away from the water.

9. There are a number of different _____ embedded in the membrane.

10. Some of these proteins _____ substances across the membrane.

11. Some of these proteins help in cell to cell _____

12. Short V are attached to some of these proteins forming _____ which serve as recognition to other cells.

13. _____ supplies _____ and regulates _____.

14. The cell membrane has the general consistency of _____ _____

15. The flexible pattern of the cell membrane is referred to as the _____ _____ _____.

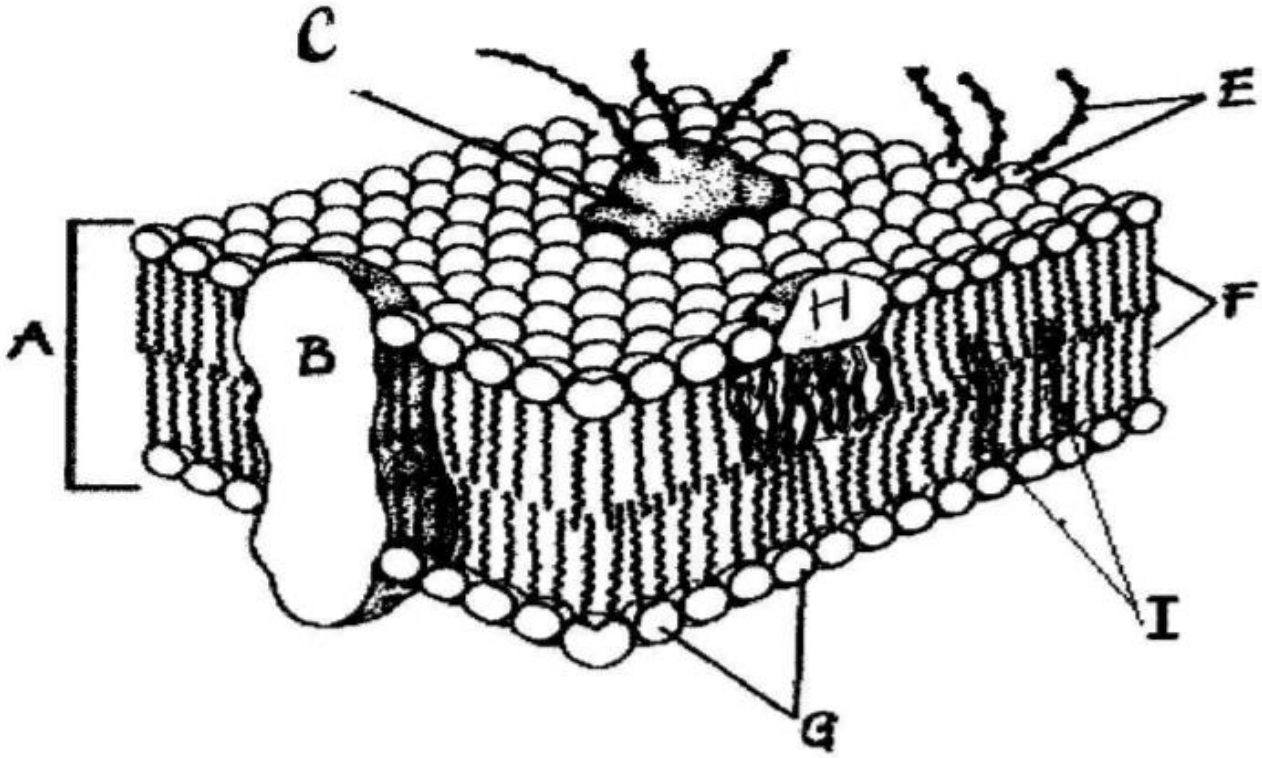
Cell Membrane Coloring Worksheet

SKETCH AND LABEL a phospholipid coloring the heads red and the tails blue.

PHOSPHOLIPID

Correctly ***color code and identify*** the name for each part of the cell membrane.

Letter	Name/Color	Letter	Name/Color
_____	Phospholipid bilayer (no color)	_____	Peripheral protein (red)
_____	Integral protein (pink)	_____	Cholesterol (blue)
_____	Fatty acid tails (orange)	_____	Glycoprotein (green)
_____	Phosphate heads (yellow)	_____	Glycolipids (purple)



Match the cell membrane structure or its function with the correct letter from the cell membrane diagram.

Letter	Structure/Function	Letter	Structure/Function
_____	Attracts water	_____	Repels water
_____	Helps maintain flexibility of membrane	_____	Make up the bilayer
_____	Involved in cell-to-cell recognition	_____	Help transport certain materials across the cell membrane

CELL TRANSPORT

https://www.youtube.com/watch?v=Ptmlvtei8hw

1. _____, _____ and _____ are found in almost all cells.

2. Keeping a stable environment in cells is called _____

3. The _____ _____ controls what goes in and out of the cell and helps regulate _____

4. The cell membrane is made of a _____ _____.

5. Bilayer means _____ layers.

6. In a phospholipid bilayer, bilayer means _____ layers.

7. The head of a phospholipid molecule is _____

8. The tails of a phospholipid molecule is _____

9. Some molecules can go right through the phospholipid bilayer. They are _____, nonpolar molecule. Examples are _____ and _____

10. Simple diffusion is called passive transport because it does not require _____

11. Simple diffusion "moves with the flow" which means molecules move _____ the concentration gradient. This means molecules move from _____ concentration to _____ concentration.

12. Some proteins are _____ proteins

13. In facilitated diffusion, molecules move _____ the concentration gradient through protein molecules. This is also passive transport because it does not require _____

14. Movement of molecules from low to high concentration requires _____

15. Active transport forces molecules to move _____ the concentration gradient

16. Endocytosis moves large molecule _____ the cell

17. Exocytosis moves large molecules _____ the cell.

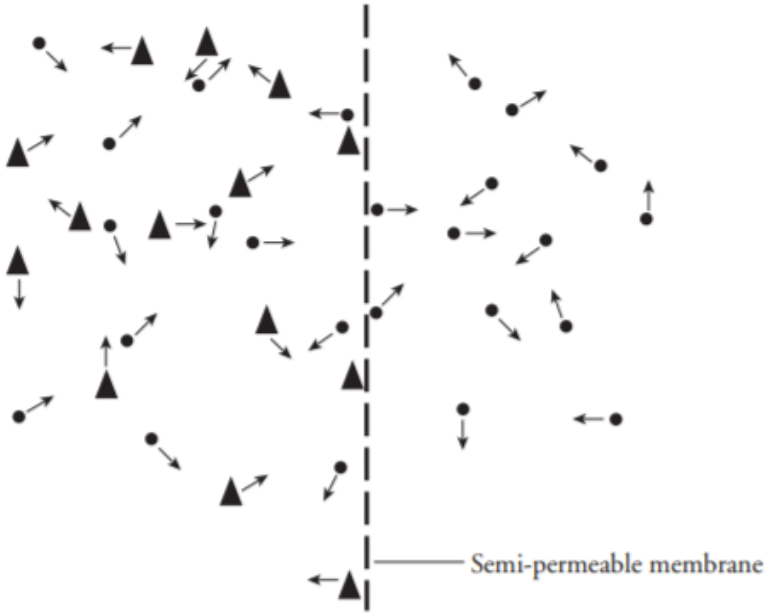
Membrane Structure and Function

How do substances move in and out of cells?

Why?

Advertisements for sports drinks, such as Gatorade®, PowerAde®, and Vitaminwater™, etc. seem to be everywhere. All of these drinks are supposed to help your body recover and replenish lost electrolytes, fluids, and vitamins after exercise. But how do the essential molecules contained in these drinks get into your cells quickly to help you recover after exercise?

Model 1 – Simple Diffusion



1. How many different types of molecules are shown in Model 1?

2 Count and record the number of triangles and circles found on each side of the membrane.

3. Which shape is larger?

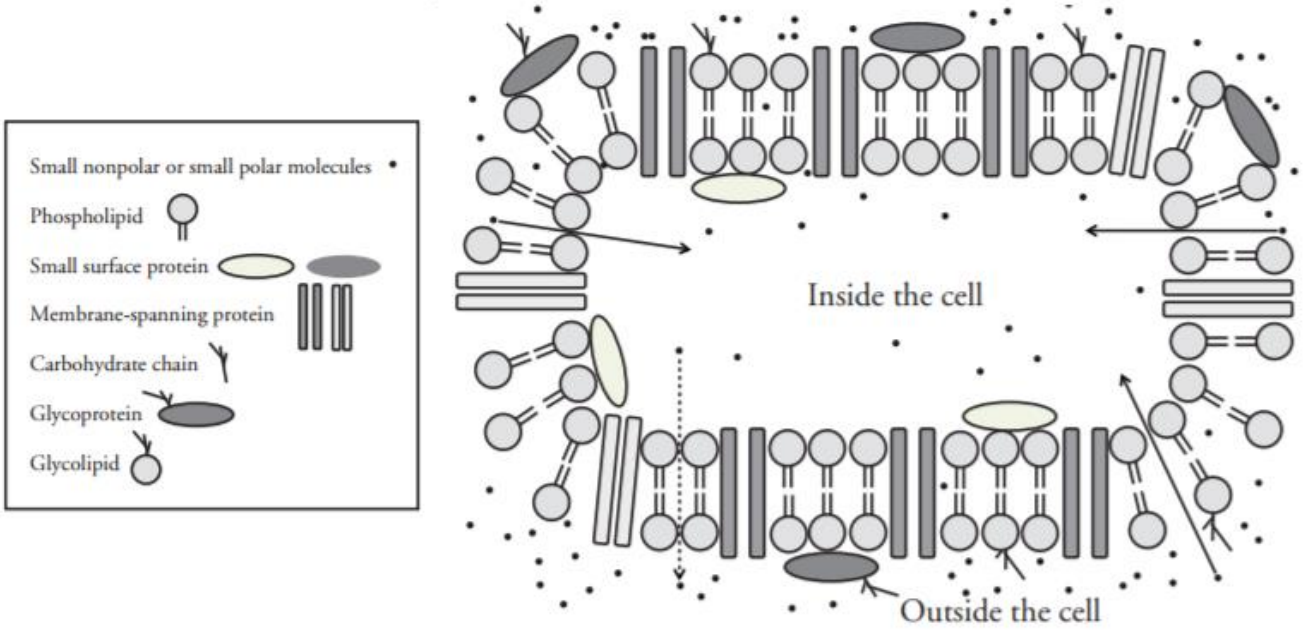
4. Describe the direction of the movement of the molecules in Model 1?

5. Which molecules are able to pass through the semi-permeable membrane? Justify your answer.

6. If you left this "system" for an extended period of time and then viewed it again, would you expect to find any changes in the concentrations of the molecules on either side of the membrane? Justify your answer.

STOP

Model 2 – The Selectively Permeable Cell Membrane



7. What two major types of biological molecules compose the majority of the cell membrane in Model 2?

8. How many different protein molecules are found in Model 2?

9. What is the difference between the position of the surface proteins and the membrane-spanning proteins?

10. When a carbohydrate chain is attached to a protein, what is the structure called?

11. When a carbohydrate is attached to a phospholipid, what is the structure called?

12. What types of molecules are shown moving across the membrane?

13. Where exactly in the membrane do these molecules pass through?

14. How does the concentration of the small molecules inside the cell compare to that outside the cell?

15. Because particles move randomly, molecules tend to move across the membrane in both directions. Does the model indicate that the molecules are moving in equal amounts in both directions? Justify your answer using complete sentences.

Read This!

When there is a difference in concentration of a particular particle on either side of a membrane, a **concentration gradient** exists. Particles move along the concentration gradient from high to low concentration until a state of **equilibrium** is reached. At that point, there is no more net movement in one direction, although the particles continue to move randomly across the membrane, often called **dynamic equilibrium.** The net movement of particles along the concentration gradient is called **diffusion**.

16. Look back at Models 1 and 2. Which particles are moving by diffusion across the membranes shown?

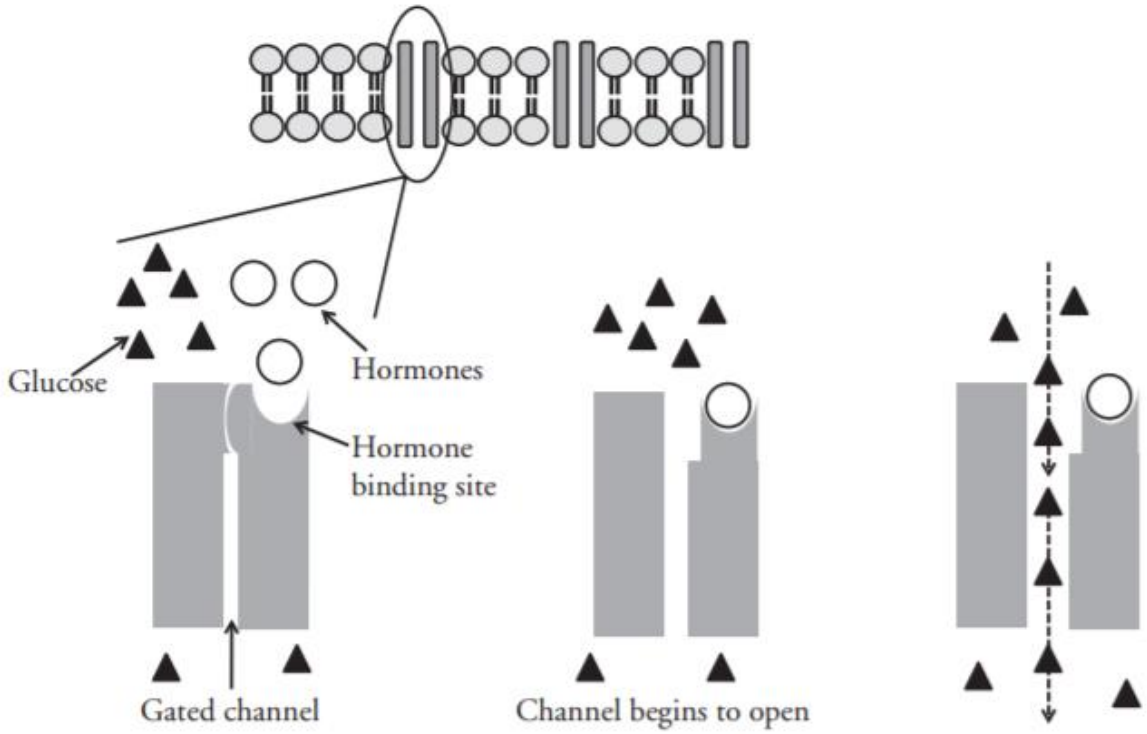
17. Using all the information from the previous models and questions circle the correct response to correctly fill in each blank.

    a. Diffusion is the net movement of molecules from an area of (low/high) concentration to an area of (low/high) concentration.

    b. The molecules will continue to move along this (semi-permeable membrane/ concentration gradient) until they reach (diffusion/equilibrium).

    c. Once equilibrium is reached, molecules will continue to move across a membrane (randomly/in one direction).

Model 3 – Facilitated Diffusion



18. Which part of the cell membrane is shown in more detail in Model 3?

19. What is the gap between the proteins called?

20. What type of molecules attach to the protein?

21. Explain in detail what happened that allowed the glucose molecules to pass through.

Read This!

Some molecules, such as glucose, use gated channels as shown in Model 3; however, not all channels are gated. Some channels remain permanently open and are used to transport ions and water across the cell membrane.

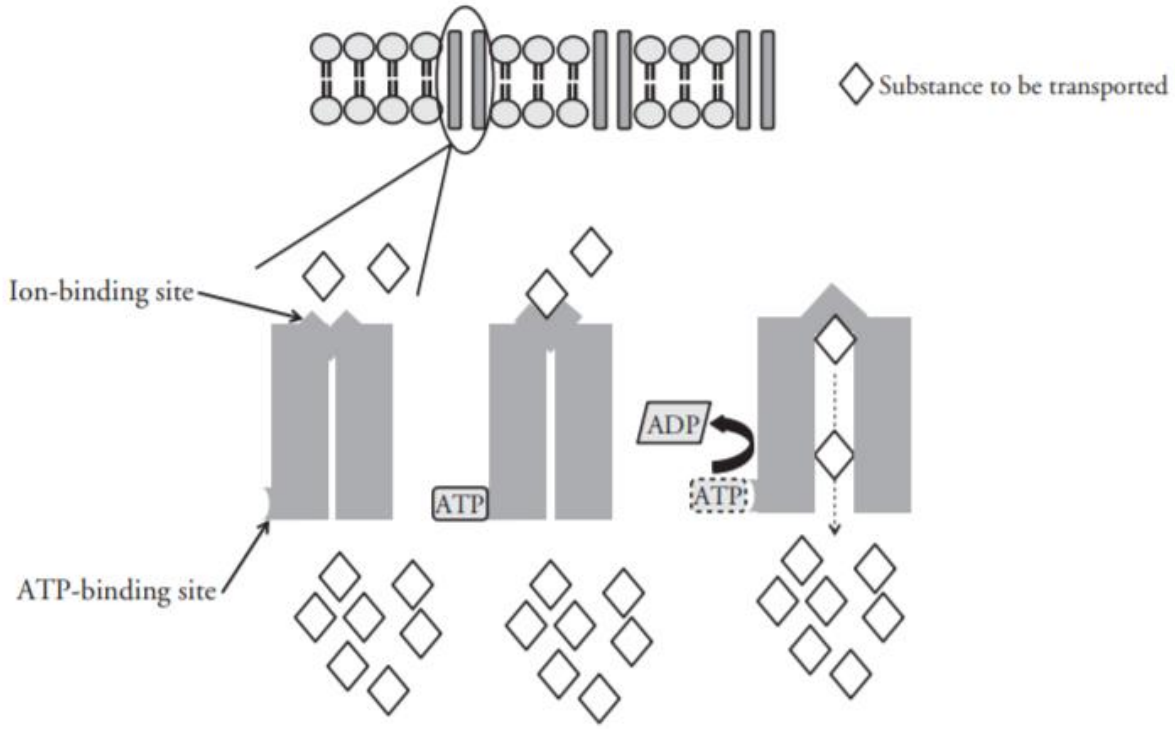
22. Discuss with your group why the type of protein channel in Model 3 is called a gated channel. Write your group's responses below.

23. To **facilitate** means to help. Explain why this type of diffusion is called facilitated diffusion.

24. The "tails" of phospholipids are nonpolar; therefore, they do not readily interact with charged particles such as ions. How can this explain why facilitated diffusion is necessary for the transport of ions such as Na^+ and K^+ across the cell membrane? In other words, why would these ions not cross by simple diffusion?

STOP

Model 4 – Active Transport



26. What shape represents the substance being transported across the membrane in Model 4?

27. List two binding sites found on the protein.

28. In which direction is the transported substance moving—from an area of high concentration to low or from an area of low concentration to high? Support your answer.

29. Is the substance being moved along (down) a concentration gradient? Justify your answer.

30. ATP is a type of molecule that can provide energy for biological processes. Explain how the energy is being used in Model 4.

31. What happens to the ATP after it binds to the protein?

STOP

32. The type of transport shown in Model 4 is called **active transport**, while diffusion and facilitated diffusion are called **passive transport**. Given the direction of the concentration gradient in active and passive transport examples, explain why active transport requires energy input by the cell.

33. With your group, complete the table below to show the difference between active and passive transport.

	Active Transport	Passive Transport	
		Diffusion	Facilitated Diffusion
Requires energy input by the cell			
Molecules move along (down) a concentration gradient			
Moves molecules against (up) a concentration gradient			
Always involves channel (membrane-spanning)proteins			
Molecules pass between the phospholipids			
Moves ions like Na^+ and K^+			
Moves large molecules			
Moves small nonpolar and polar molecules			

34. With your group develop a definition for active transport.

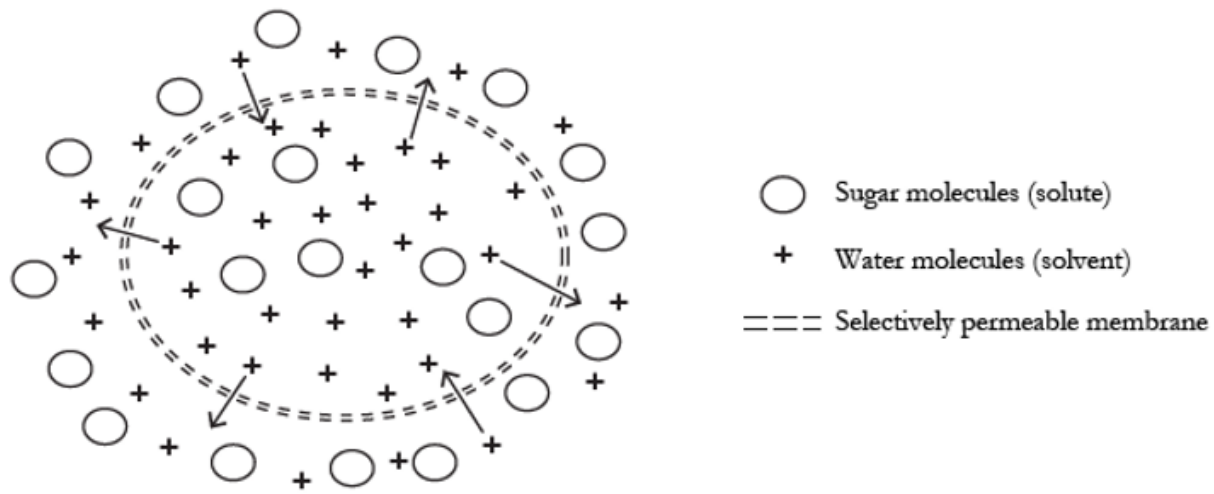
Transport in Cells

How do water molecules move in and out of cells?

Why?

Water accounts for over 70% of the human body. If water levels are not regulated and maintained in an organism the consequences can be disastrous. Cells and tissues may swell, blood cells burst, or the brain may expand so much it pushes on the skull, leading to brain damage and death. So what exactly is the process that allows organisms to regulate and maintain their water content?

Model 1 – Movement of Water In and Out of Cells



1. A solution consists of a solute and a solvent mixed together. For the solution in Model 1 identify and provide the symbol for the

   a. solute.

   b. solvent

   .

2. Consider the size of the sugar and water molecules in Model 1. Which molecules in the diagram in Model 1 are able to move through the selectively permeable membrane?

3. Complete the table below by counting the molecules in Model 1.

	Inside the Cell	**Outside the Cell**
Number of sugar molecules		
Number of water molecules		
Ratio of water to sugar		

4. Which solution in Model 1 is more concentrated—the solution inside the cell or outside of the cell? Explain your answer in terms of the ratio of solute to solvent particles.

5. Consider the arrows indicating movement of water across the membrane.

   a. In which direction are water molecules moving—into or out of the cell?

   b. Are more water molecules moving into or out of the cell?

   c. Is the net direction of water movement into or out of the cell?

6. Circle the correct word below to indicate the change in the concentration of the sugar solution on each side of the membrane as water molecules move.

   a. The solution inside the cell will become (more/less) concentrated with the net movement of water.

   b. The solution outside the cell will become (more/less) concentrated with the net movement of water.

7. Applying what you already know about the random movement of molecules, what will eventually happen to the concentration on both sides of the membrane?

8. The definition of **diffusion** is the movement of molecules across a membrane from an area of high concentration to an area of low concentration. According to this definition, is the cell in Model 1 undergoing diffusion? Explain.

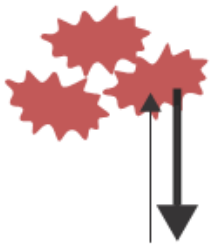
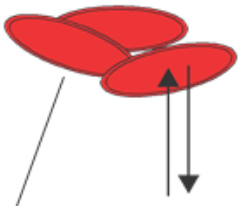
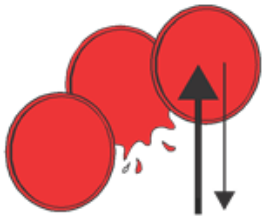
9. In the cell diagram in Model 1, where is the higher concentration of water—inside or outside of the cell?

10. Is the cell in Model 1 undergoing diffusion if you consider the concentration of water on either side of the selectively permeable membrane? Explain.

Read This!

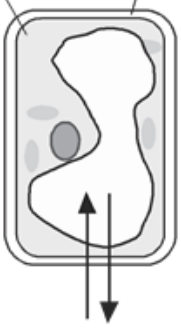
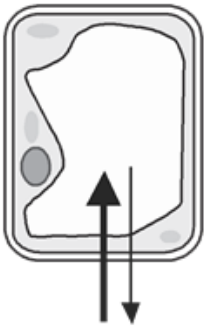
Osmosis is the movement of water from high water concentration to low water concentration across a semi-permeable membrane.

Model 2 – Osmosis in Plant and Animal Cells

	External solution:		
	Hypertonic	**Isotonic**	**Hypotonic**
Animal Cell	**A** 	**B** 	**C** 
	Crenated	Normal	Lysed

Cell membrane

Cell wall

Plant Cell	**D** 	**E** 	**F** 
	Plasmolysed	Normal	Turgid

11. Using your knowledge of cells, which type of cells in Model 2—animal or plant—have

    a. a selectively permeable membrane?

    b. a permeable, rigid cell wall?

12. The arrows in Model 2 show movement of water into and out of the cells. What does the thickness of the arrow indicate?

13. For each question use diagrams A–F in Model 2. Which cells show

   a. a net increase in water?

   b. a net decrease in water?

   c. no net change in water?

14. Consider the definition for osmosis and the net movement of water from a dilute solution (high concentration of water) to a concentrated solution (low concentration of water).

   a. Describe the concentration of the solution surrounding cells A and D (**extracellular**), relative to the concentration of the solution inside cells A and D (**intracellular**).

   b. Describe the concentration of the extracellular solution of cells C and F, relative to the intracellular solution of cells C and F.

   c. Describe the concentration of the extracellular solution of cells B and E, relative to the concentration of the intracellular solution of cells B and E.

15. Using the diagrams in Model 2 and the answers to the previous question, develop definitions for the following words.

   a. A hypertonic extracellular solution is _____.

   b. A hypotonic extracellular solution is _____.

   c. An isotonic extracellular solution is _____.

16. Consider the cells in Model 2 that are in hypertonic solutions.

   a. Describe what has happened to the plant cell.

   b. What word is used to summarize these changes to the plant cell?

   c. What word would be used if the cell were from an animal?

17. Consider the cells in Model 2 that are in hypotonic solutions.

   a. Describe the changes to the plant cell.

   b. What word summarizes these changes to the plant cell?

   c. What word would be used if the cell were from an animal?

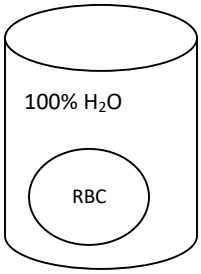
18. When animal cells are in a hypotonic solution they can undergo **lysis**. However, plant cells do not, they only become turgid.

   a. Define lysis based on the diagram in Model 2.

   b. What structure on the plant cell prevents lysis from occurring in a hypotonic solution?

Osmotic Solution

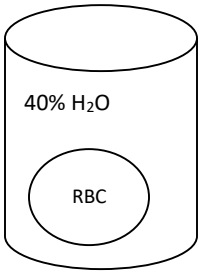
Note: A RBC is 85% H_2O and15% Solutes.

1. 

Osmotic Solution: _____

Direction of the Movement of Water _____

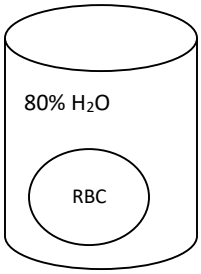
What will happen to the cell? _____

2. 

Osmotic Solution: _____

Direction of the Movement of Water _____

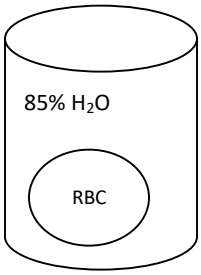
What will happen to the cell? _____

3. 

Osmotic Solution: _____

Direction of the Movement of Water _____

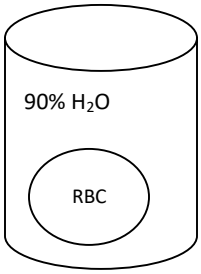
What will happen to the cell? _____

4. 

Osmotic Solution: _____

Direction of the Movement of Water _____

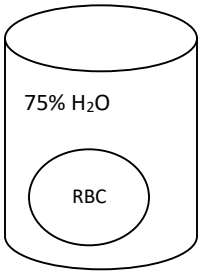
What will happen to the cell? _____

5. 

Osmotic Solution: _____

Direction of the Movement of Water _____

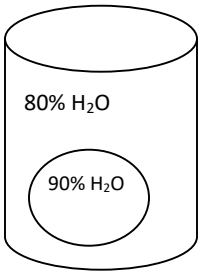
What will happen to the cell? _____

6. 

Osmotic Solution: _____

Direction of the Movement of Water _____

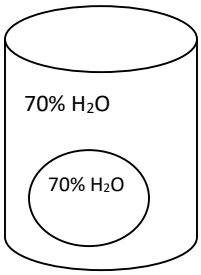
What will happen to the cell? _____

7. 

Osmotic Solution: _____

Direction of the Movement of Water _____

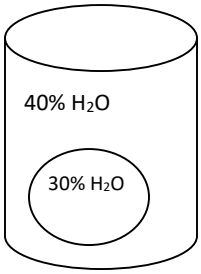
What will happen to the cell? _____

8. 

Osmotic Solution: _____

Direction of the Movement of Water _____

What will happen to the cell? _____

9. 

Osmotic Solution: _____

Direction of the Movement of Water _____

What will happen to the cell? _____

Gummi Bear Osmosis

Background Information:

Molecules are in constant motion, and tend to move from areas of higher concentrations to lesser concentrations. Diffusion is defined as the movement of molecules from an area of high concentration to an area of low concentration. **The diffusion of water molecules through a selectively permeable membrane is known as OSMOSIS;** water molecules move from an area of high concentration to an area of low concentration.

Question: How will soaking Gummy Bear candies in distilled water affect the size of the candy?

Hypothesis:

Materials:

- Plastic cup
- Tap water
- Saturated salt solution
- 1 Gummy bear
- Ruler
- Permanent marker
- Balance
- 1 drain screen

Procedure:

Day 1:

1. Label your plastic with your names and mods, using the permanent marker.
2. Find the mass of your bear using the balance and record your data.
3. Use the ruler to measure your bear top to bottom (length), side to side (width) and front to back. Calculate volume (L x W x H) and record your data.
4. Fill your plastic cup ½ way full with tap water.
5. Put your candy bear in the water.
6. Set the cup aside for one day.

Day 2

1. After the candy bear has been in the tap water overnight, pour the water with your gummi bear over an aluminum screen into the sink. Be very careful because the candy is now extremely breakable.
2. Blot the screen dry by placing it on a paper towel.
3. While the bear is on the screen, measure your bear top to bottom (length), side to side (width) and front to back. Calculate volume (L x W x H) and record your data.
4. Find the mass of the bear. Do this by placing the entire screen with the bear on the balance. Record the total mass. Then carefully slide the bear back into the empty cup.

a. Find the mass of the screen alone and calculate the mass of the bear. Record your data.

5. Cover the bears with the saturated salt solution. Set aside overnight.

Day 3

1. Find the mass and dimensions of the bear using the same procedure as noted on Day 2.
2. Record all data. Calculate volumes.

Data:

Data Table for Mass

Mass (g)	Before Soaking (Day 1)	After Tap Water (Day 2)	After Salt Water (Day 3)
Mass: screen & gummi bear			
Mass: screen			
Mass: gummi bear			

Data Table for Volume

Dimensions	Before Soaking (Day 1)	After Tap Water (Day 2)	After Salt Water (Day 3)
Length (cm)			
Width (cm)			
Depth (cm)			
Volume (cm^3)			

Questions & Analysis:

1. What happened to the candy after soaking in tap water overnight? Why?

2. Do you think you would get different results if you used distilled water instead of tap water? *(Distilled water has fewer solutes than tap water).*

3. What happened to the candy after soaking it in salt water overnight? Why?

4. What do you think would have happened to the bears if, after the last day, they were placed again in tap water?

5. Calculate the percent change in volume after each step of the experiment.
    a. % change in volume = (final volume – initial volume) / initial volume x 100
    b. Record calculates below

	% Change in Water	**% Change in Salt Water**
Bear 1		

The Egg Osmosis Lab

Lab Report

Procedure:

- Briefly describe the osmosis egg lab. Describe what you did. You do not have to recopy the written lab procedure step by step, just give a general overview of what you did in the lab.

Data:

Solution	Egg Initial Mass	Egg Final Mass	Initial Egg Measurements	Final Egg Measurements	Egg Observations	Solution Final Volume
Vinegar						
Syrup						
Colored Water						
Salt Water						

Conclusion:

- With respect to the tonicity of each solution, describe what should occur if the egg is placed in a hyper-, hypo-, or iso- tonic solution. Provide your scientific reasoning in your conclusion.

Lab Questions:

1. When the egg is first placed in vinegar, bubbles began appearing around it. What can be inferred about the cause of these bubbles?
2. Use a bar graph to show how each solution affected a change in the egg's mass. (Y-axis for mass, X-axis for solution type, and two bars for each solution: one bar for initial mass and the second bar for its mass after 24 hours)
3. How did the mass of the egg change after it had been sitting in each of the different solutions for 24 hours? What caused the egg's mass to change? (include a separate two-part answer for each solution type: vinegar, corn syrup, salt water, and plain tap water)
4. Explain the changes of the egg's mass in terms of osmosis.

Potato Discovery

Objective:

- Understand Diffusion and Osmosis
- Be able to determine the solute concentration of a potato

Materials:

- 25mL 0.0 M Sucrose
- 25mL 0.5M sucrose
- 25mL 1.0M sucrose
- 3 small plastic cups
- Plastic wrap

Procedure:

1. Pour 25mL of each solution in a small plastic cup
2. Use a Number 2 borer to cut 5 potato cylinders into 2cm sections. Remove all of the skin
3. Determine the mass of the three cylinders and record the mass in table 1.2
4. Put the 3 cylinders in the cup with water, cover with plastic wrap and let stand overnight.
5. Repeat procedure 2-4 for each remaining cup (0.5M and 1.0M)
6. Remove the cores from the beaker, blot them gently on a paper towel, and determine their total mass.
7. Record the final mass in the table below.
8. Graph your data on graph on the next page.

Data:

Contents in Beaker	**Initial Mass**	**Final Mass**	**Mass Difference (initial mass – final mass)**	**Percent change in mass (mass difference/initial mass)X 100**
0.0 M Sucrose				
0.5 M Sucrose				
1.0 M Sucrose				

9. 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, add a line of best fit to your graph. Then, the point at which your line crosses 0% change.

Molar concentration of sucrose _____M.

10. Your friend asks you to determine the molar concentration of Gatorade. Design an experiment to test this.