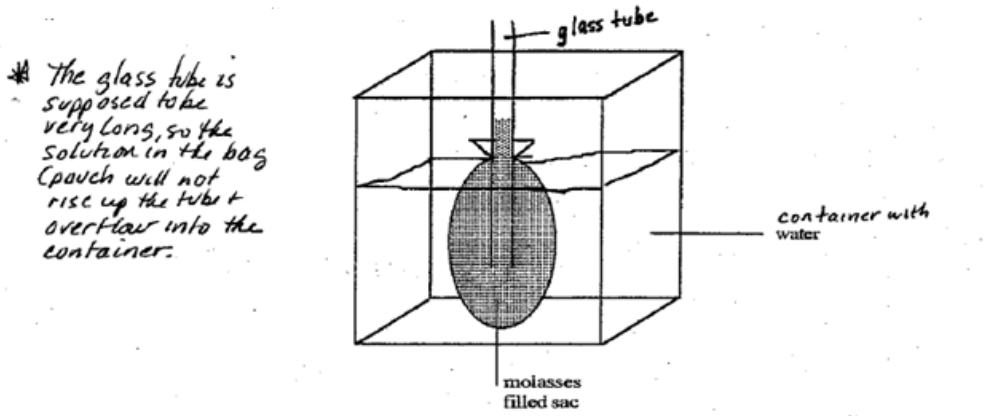
Honors Biology Name_____

Cell Transport Questions

The next set of questions are based on the diagram and information below:
A pouch into which an open glass tube is inserted is filled with molasses. The molasses extends a short distance up the tube. The pouch and tube are then put in a container of water. The membrane is permeable to water but impermeable to molasses.



1. Which particle(s) is(are) in random, kinetic motion?
   A. Molasses B. water C. both D. neither

2. Which particle(s) will move through the membrane of the pouch?
   A. Molasses B. water C. both molasses and water D. neither molasses nor water

3. Movement of particles across the membrane is the result of
   A. Osmosis B. active transport C. energy use D. neither osmosis nor diffusion

4. After 24 hours, the size of the pouch will probably be
   A. Smaller B. Larger C. the same D. unable to be determined

5. After 24 hours, the container will contain
   A. Water only C. both water and molasses
   B. B. molasses only D. neither water nor molasses

6. After 24 hours, the pouch will contain
   A. Water only C. both water and molasses
   B. molasses only D. neither water nor molasses

7. After 24 hours, the level of the liquid in the glass tube
   A. Will be lower C. will be the same
   B. Will be higher D. cannot be determined

8. *Amoeba*, a single celled protist, has a specialized structure called a contractile vacuole whose function is to collect excess water from the cell and discharge this water into the environment. From this information you can deduce that *Amoeba* lives in an environment that is (*hypertonic, isotonic, hypotonic)* to the cytoplasm of *Amoeba*. Thus, you would expect to find *Amoeba* living in:

   A. a freshwater pond B. the ocean C. Great Salt Lake D. a bottle of unpasteurized milk

In the following situations, you are given some information. You must supply the rest.

I. Identify the <u>type of solution</u> the cell has been placed into (isotonic, hypotonic or hypertonic).
II. Shot the <u>resulting direction of water movement</u> (into the cell, out of the cell or equal movement in or out of the cell) in or out of the cell.

1) A cell with 3% solute is placed into a solution of 5% solute.

_____% solute _____% salt The solution is _____

_____% water _____% water Water will move _____

2) A cell with 20% solute is placed into a solution of 20% solute.

_____% solute _____% salt The solution is _____

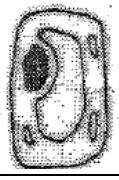
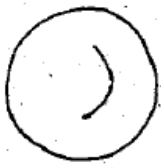
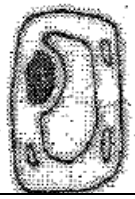
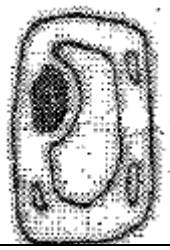
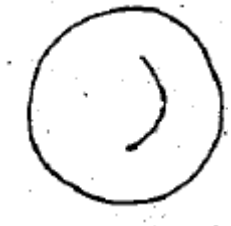
_____% water _____% water Water will move _____

4) A cell with 80% water is placed into a solution of 95% water.

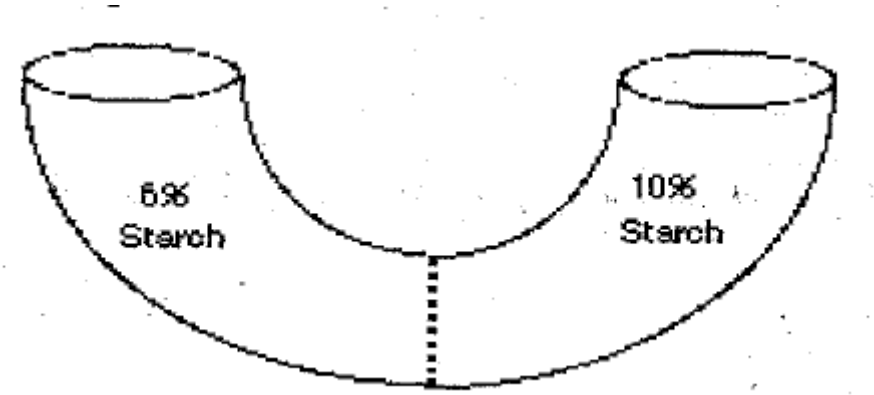
_____% solute _____% solute The solution is _____

_____% water _____% water Water will move _____

Diagram what the cells would look like after being placed in the environment shown

Conditions	**Plant Cell (leaf cell)**		**Animal Cell (blood cell)**	
Environment	**Before**	**After**	**Before**	**After**
Isotonic solution:				
Hypertonic Solution				
Hypotonic Solution				

The U-tube in the figure below is divided in the middle by a membrane that is impermeable to starch put permeable to water. A 10% starch solution is put into the right-hand half of the tube and an equal amount of 6% starch solution is put into the left-hand half of the tube.



9. In this solution:
   A. Water will move from the right to the left
   B. Water will move from the left to the right
   C. Starch will move from the right to the left
   D. Water will move in both directions, but more from left to right than right to left
   E. Water will move in both directions, but more from right to left than left to right

10. Carrot sticks that are left in a dish of freshwater for several hours become stiff and hard. Similar sticks left in a salt solution become limp and soft. From this we can deduce that the cells of the carrot sticks are
    A. Hypotonic to both freshwater and the salt solution
    B. Hypertonic to both freshwater and the salt solution
    C. Hypertonic to freshwater but hypotonic to the salt solution
    D. Hypotonic to freshwater but hypertonic to the salt solution
    E. Isotonic with freshwater but hypotonic to the salt solution

Use the following information to answer questions 11 to 13.

A *paramecium* is a freshwater (close to pure water), unicellular organism that has special organelles called **contractile vacuoles**, which remove excess water (they use active transport to pump water out of the cell). The plasma membrane of a paramecium is permeable to water, but not to salt.

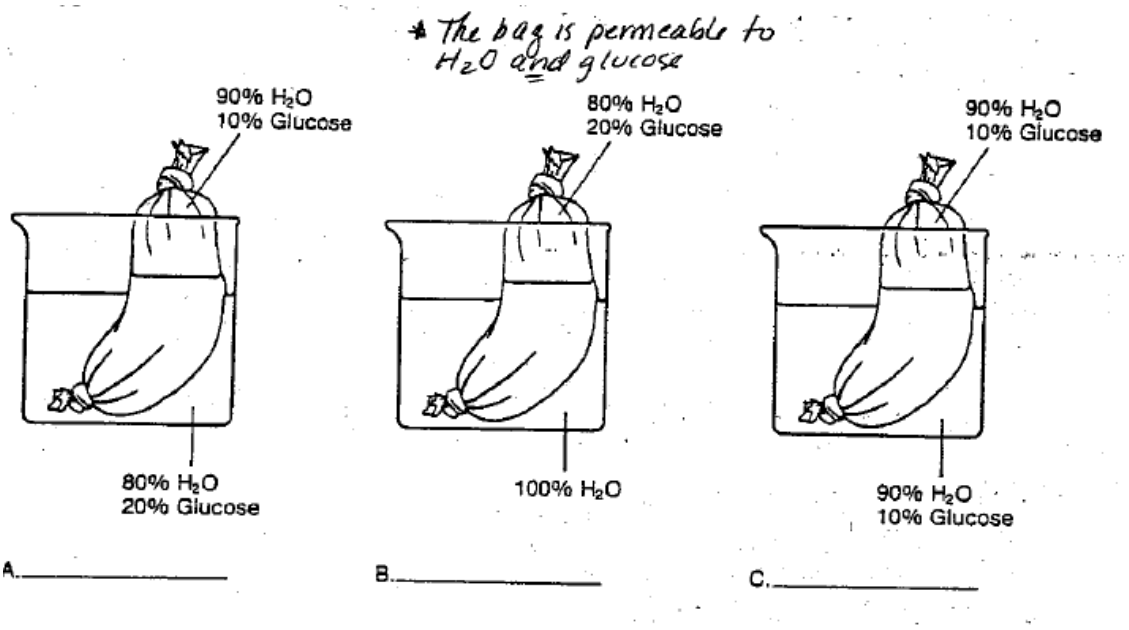
11. Water enters the paramecium because of
    A. Phagocytosis B. osmosis C. plasmolysis D. active transport

12. If the contractile vacuole failed to operate, the *paramecium* would eventually
    A. Burst B. shrink D. undergo plasmolysis D. use active transport

13. If salt were added to the environment of the *paramecium*, the contractile vacuole would contract
    A. More rapidly C. at the same rate as in freshwater
    B. More slowly D. eliminating excess salt that enters the cell

CRITICAL THINKING: ANOTHER LOOK AT OSMOSIS

The direction in which water molecules move during osmosis depends on where the water molecules are more highly concentrated. Study the diagrams below. Decide whether the solution in each beaker is hypotonic, isotonic, or hypertonic in relation to the solution inside the cellulose bag. Draw arrows to indicate the direction in which the water will move in each case. *The bag is permeable to H_2o and glucose.



1. Intravenous solutions must be prepared so that they are isotonic to red blood cells. A 0.9 percent salt solution is isotonic to red blood cells.

   A. Explain what will happen to a red blood cell placed in a solution of 99.3 percent water and 0.7 percent salt.
   _____
   _____

   B. What will happen to a red blood cell placed in a solution of 90 percent water and 10 percent salt? Explain.
   _____
   _____

2. What keeps plant cells from bursting when they are placed in a hypotonic solution?_____
   _____

3. How does being placed in a hypertonic solution affect a plant? _____
4. _____

5. In regard to the solutions in the bags and in the beakers, what is meant by equilibrium? _____
   _____
   _____

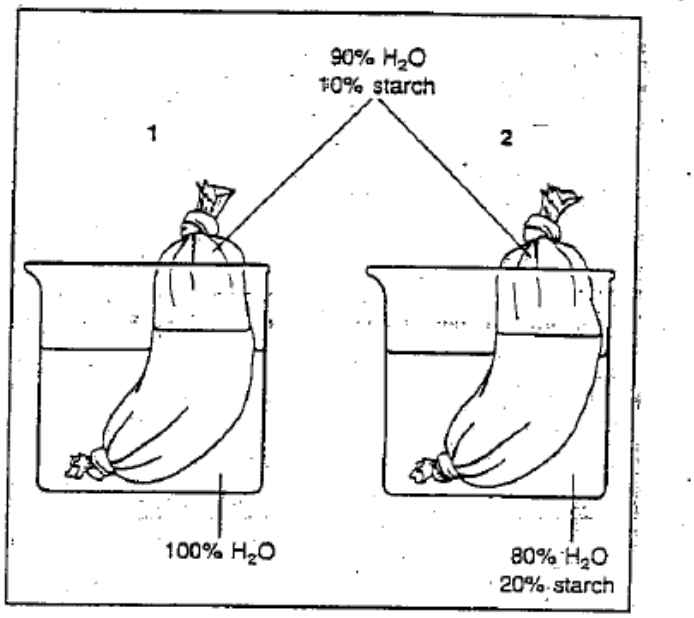
6. What happens to the motion of molecules after equilibrium is reached? _____
   _____

7. What is turgor pressure in a plant cell?_____
   _____

PASSIVE TRANSPORT

Textbook reference: Sections 5-10; 5-13

Cells maintain homeostasis by passive and active transport across their membranes. Study the diagrams of the beakers right, noting the concentrations of various substances in the beakers and in the cellulose bags. Water molecules can pass through the cellulose, but starch cannot. Draw arrows in the diagrams to show the direction in which water will move. Then answer the questions that follow.



1. Which of the beakers contains a solution that is hypertonic relative to the bag's contents?
   _____

2. What will eventually happen to the concentrations beaker 2?_____
   _____
   _____

3. Will the same thing happen in beaker 1? Why or why not? _____
   _____
   _____

4. In which beaker will the bag experience in a rise in turgor pressure? _____ What will eventually happen as the pressure rises? _____

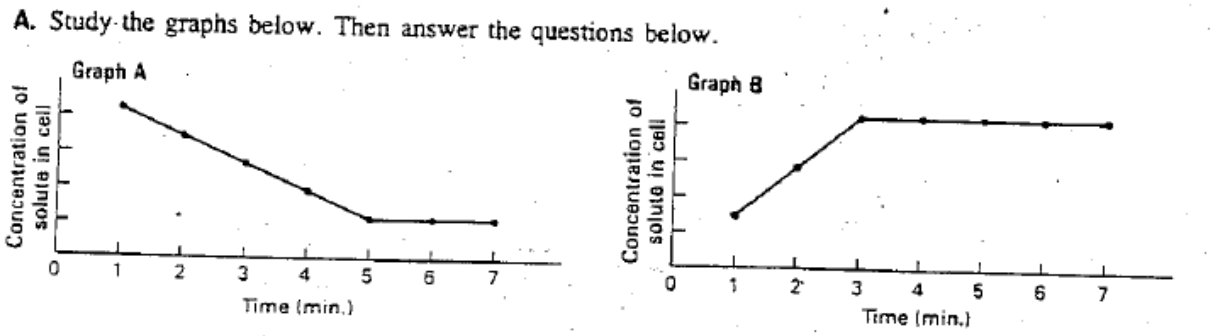
Name_____ Date_____ Period_____

Cellular Transport-Examining Cause and Effect

Cells regulate the kinds of amounts of materials that enter and leave the cytoplasm. This regulation maintains the cytoplasm's chemical balance.

1. What is another term for the *cell's chemical balance?* _____

A. Study the graphs below, each graph corresponds to a different cell both of which are placed in the same solution. Then answer the questions below.



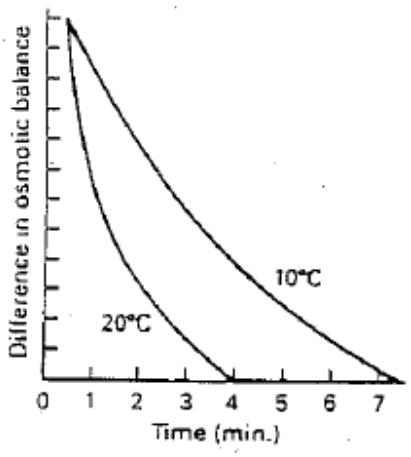
2. Which graph illustrates an initially **hypertonic cell**? _____

3. Which graph illustrates an initially **hypotonic cell**?_____

4. In graph **A**, what may have caused the drop in the line from one to five minutes. _____
_____

5. In graph **B**, the line continues horizontally for several minutes. What might this indicate? _____
_____

B. Study the graph below and then answer the following question.

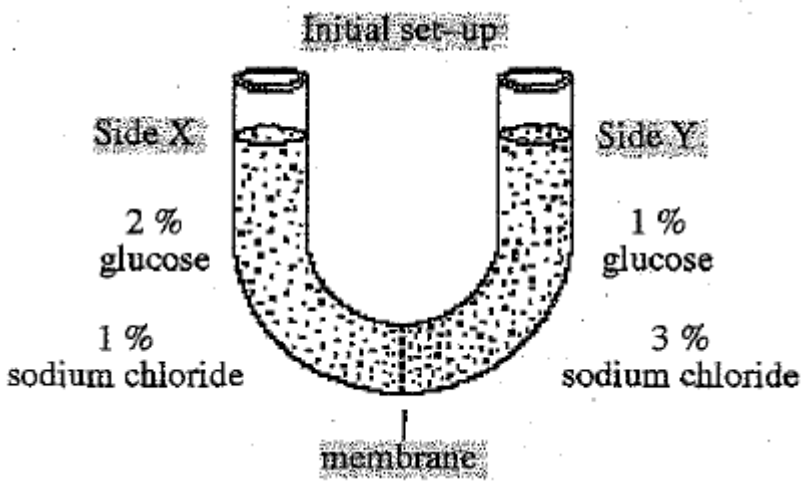


This graph shows the effect that temperature has on time required to reach equilibrium in a cell placed in a **hypertonic** solution. At 10^{o} the concentration of solutes in cell and the solution become equal in 7.5 minutes. Describe how raising the temperature of the solution to 20^{0} affects the time necessary for equilibrium._____
_____
_____
_____

Extra Cell Transport Questions

When answering these questions first figure out what will happen to the movement of the solute that CAN pass across the membrane, then figure out what will happen in terms of water movement.

Questions 1 to 4 refer to the following situation. The solutions in the tow arms of the U-Tube are separated at the bottom of the tube by a selectively permeable membrane. At the beginning of the experiment, the level of the liquid in the 2 arms is at the same height. The membrane is permeable to water and to sodium and chloride ions, but not to glucose. The apparatus is allowed to stand for three days. At this time a dynamic equilibrium will have been reached.



Indicate whether the following statements are true or false and then explain your answer.

1. The sodium chloride on the side X will become more concentrated and that on side Y less concentrated.

   _____

   _____

2. The concentrations of the glucose solutions on sides X and Y will remain unchanged.

   _____

   _____

   _____

3. The concentration of sodium chloride on side X will eventually equal that on side Y.

   _____

   _____

4. The fluid level will increase on side Y and decrease on side X.

   _____

   _____

5. Water molecules will move only from side Y to side X and not from side X to side Y.

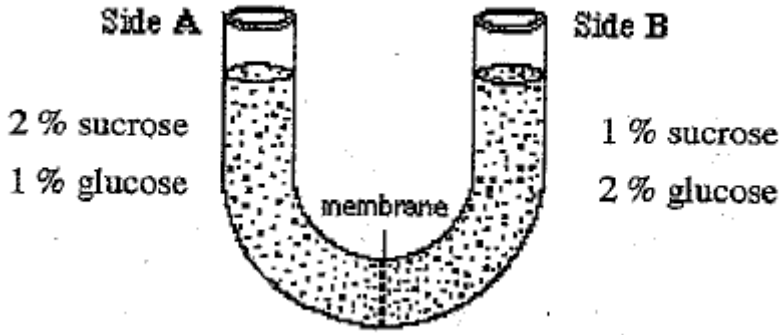
   _____

6. The number of glucose molecule will be the same on both sides.

   _____

   _____

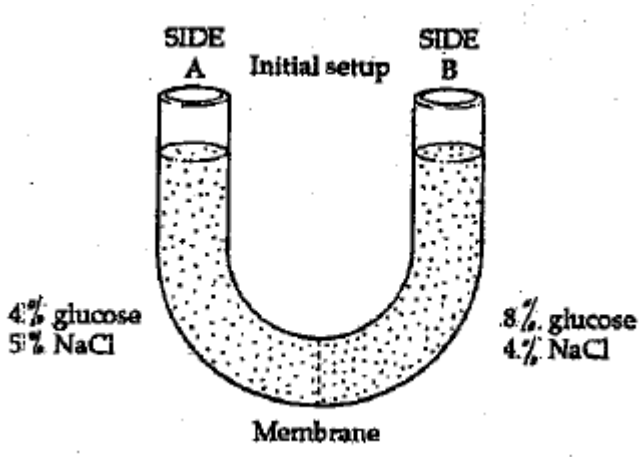
Use the diagram of the U-tube setup below to answer the next 2 questions. The solutions in the two arms of this U-tube are separated by a membrane that is semipermeable. It is permeable to water and glucose but not to sucrose. Side A is filled with a solution of 2% sucrose and 1% glucose. Side B is filled with 1% sucrose and 2% glucose.



7. Initially the solution in side A, with respect to that in side B, is
   A. Hypotonic B. isotonic C. hypertonic

8. If you examine this U-tube in 3 days after the system reaches equilibrium, what changes are observed? ***Fill in all correct answers.***
   A. The concentration of sucrose and glucose will be equal on both sides.
   B. The concentration of glucose will be higher in side A than in side B.
   C. The concentration of sucrose will have decreased in side A.
   D. The water level will be unchanged.
   E. The water level will be higher in side A than in side B.

Refer to the following figure to answer the next question. The solutions in the arms of a U-tube are separated at the bottom of the tube by a differentially permeable membrane. The membrane is permeable to sodium chloride but not to glucose. Side A is filled with a solution of 4% glucose and 5% sodium chloride (NaCl), and side B is filled with a solution containing 8% glucose and 4% sodium chloride. Initially the volume in both arms is the same.



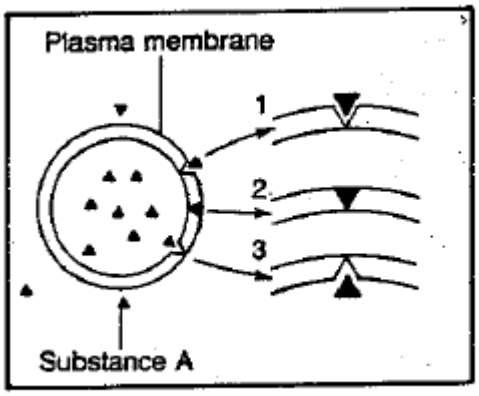
9. If you examine side A after 3 days, you should find: **(fill in 2 correct answers)**
   A. A decrease in the concentration of NaCl
   B. A decrease in the concentration of glucose
   C. An increase in the water level.
   D. No net movement of water
   E. The same number of glucose molecules as on side B

* note: after 3 days the system should reach an equilibrium.

ACTIVE TRANSPORT

Textbook reference: Sections 5-13 to 5-15

Active transport requires the use of carrier proteins to carry the molecules against the diffusion gradient. Energy is needed for the process. Study the diagram below, which shows a model of active transport. Then complete the accompanying paragraph, and answer the questions that follow.



Molecules of substance A are shown by triangles. This substance is in greater concentration_____ the cell. The notches in the plasma membrane represent _____. The sequence 1-2-3 shows how a _____ aids the _____ of a molecule of substance A into the cell. This process requires the cell to _____

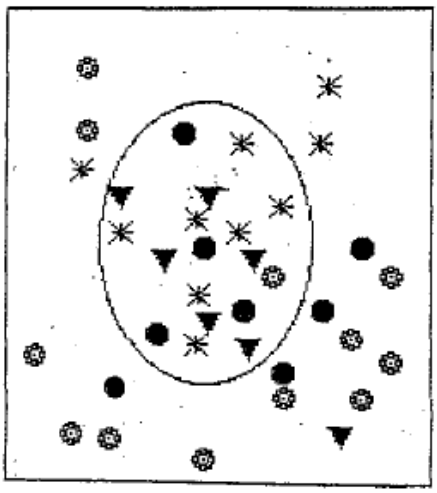
1. How does passive transport differ from active transport? _____
   _____
2. Contrast facilitated diffusion with active transport. _____
   _____
   _____
3. Cells behave much like the cellulose bag. When such movements occur across the cell membrane, are they considered to be passive or active transport? _____
4. How can a small particle or liquid droplet enter a cell? _____
   _____
   _____
   _____
   _____
5. How does a large particle enter a cell? _____
   _____
   _____

Both of these refer to the process of endocytosis

Complete the following table, comparing various means by which substances cross the cell membrane.

PROCESS	**ATP NEEDED?**	**MEMBRANE Carrier protien**	**MOLECULES MOVE <u>AGAINST</u> OR <u>DOWN</u> THEIR CONCENTRATION GRADIENT**
SIMPLE DIFFUSION			
OSMOSIS			
FACILITATED DIFFUSION			
ACTIVE TRANSPORT			
(endo & exocytosis)			

The diagram below represents a cell in volume of water <u>equal to itself</u>. For different molecules are shown in the cell and the surrounding water. Examine the diagram to decide how each kind of molecule will move <u>into</u> the cell. Write your answers in the chart to the right of the diagram and include an explanation of your answer.



Molecule	**Process**	**Explanation**
1. ▼		
2. ●		

What type of transport is being shown in the diagram?
Explain what is taking place.

_____
_____
_____
_____
_____
_____
_____
_____