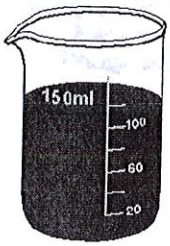
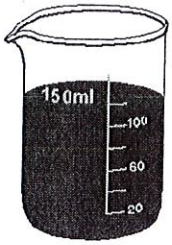
Name Key Period ____

Cellular Transport Problem Set

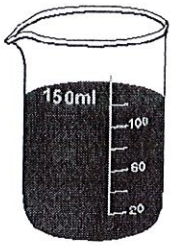
1.



Beaker A
100 % Water



Beaker B
10% Sugar
90 % Water

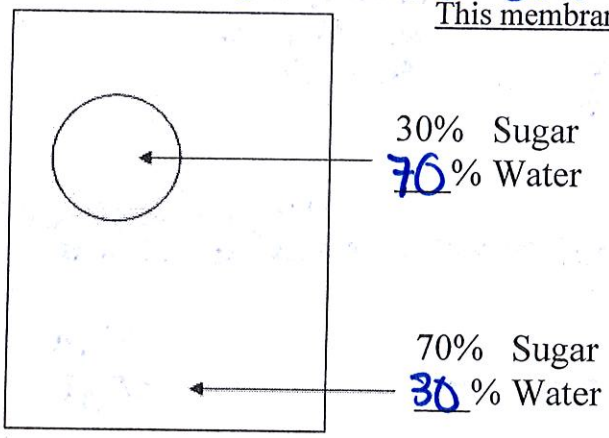


Beaker C
40% Sugar
60 % Water

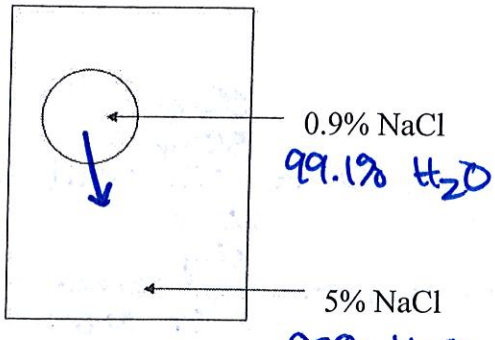
a. What is the solute concentration of Beaker A? 0%
b. What is the solvent concentration of Beaker C? 60%
c. What would the solvent concentration be for a solution that is isotonic to Beaker B? 90%

2. Below is a diagram of a cell submerged in a solution.
   a. Describe the *solution* in this example – hypotonic, hypertonic or isotonic?
   b. How do you know? b/c there is a higher conc. of sugar outside the cell compared to inside the cell
   c. What *process* is going to take place in this example? (diffusion or osmosis)
   d. Describe exactly what is going to happen to the cell in this example. water will leave the cell & the cell will shrink

This membrane is **NOT** permeable to sugar



3. The cell in this beaker is bathed in a 5% NaCl solution. The membrane is permeable to water but not to NaCl.

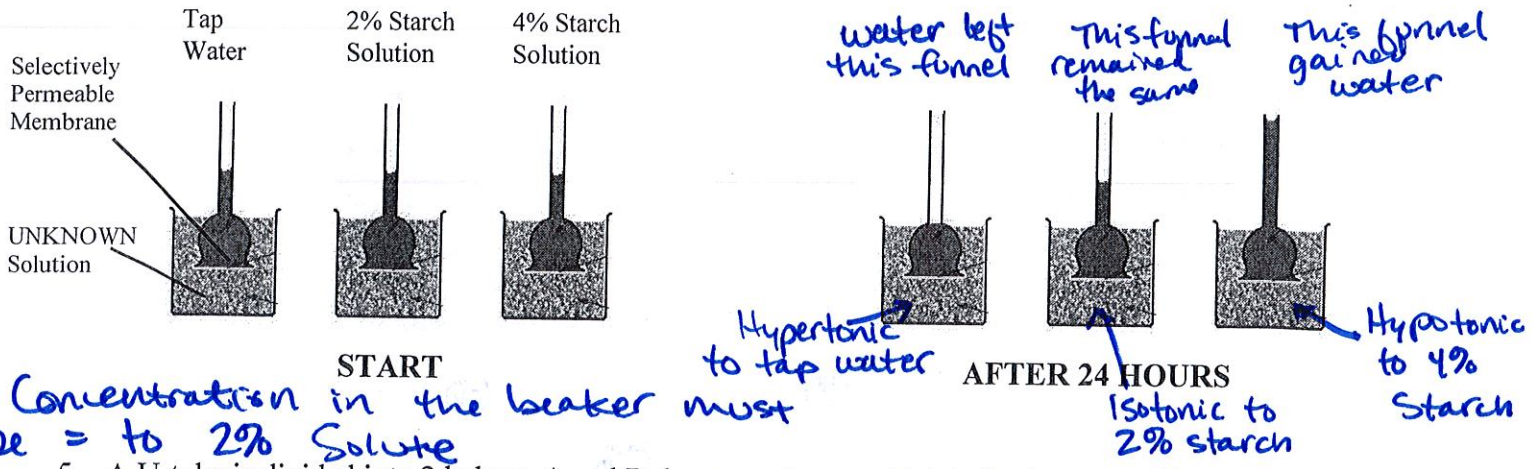


i. In which direction is the net movement of water here?
Out of the cell

ii. How will this affect the cell? the cell will shrink or shrivel (crenate)

4. Three funnels containing three different starch solutions were placed for 24 hours into a beaker that contained a starch solution of UNKNOWN concentration. The end of each funnel was covered by a selectively permeable membrane.

   a. What can you say about the *concentration of the solution in the beaker* based on the results shown in the diagram? the beaker ~~would be~~ hypotonic to the funnel bc water entered the funnel

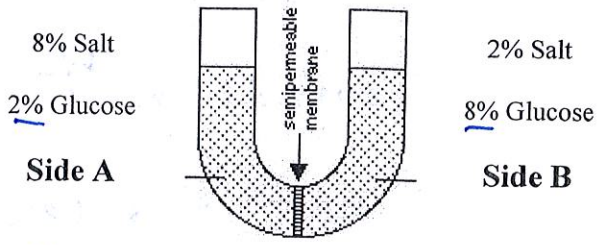


Concentration in the beaker must be = to 2% Solute

5. A U-tube is divided into 2 halves, A and B, by a membrane which is freely permeable to water and salt, but NOT to glucose. Side A is filled with a solution of 8% salt and 2% glucose, while side B is filled with 2% salt and 8% glucose.

   a. In terms of glucose concentration, which side is a hypotonic solution? Side A

   b. What could you say about the water concentration on side A relative to side B? H_2O conc. starts equal, but after ~~[illegible]~~ Salt reaches equilibrium

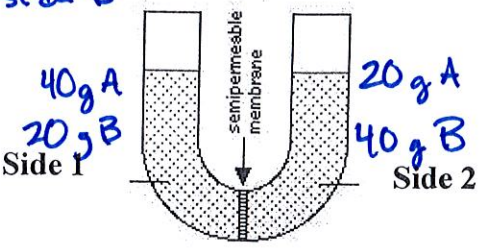


   c. Which molecule(s) will move across the membrane and in which net direction(s)? Side A has ↑ conc. of H_2O

Salt moves from A to B
H_2O moves from A to B

   d. Notice that the levels of liquid in both A and B are equal. Do you think they will appear this way when the system reaches equilibrium? **Explain.** No, at equilibrium side B will be higher than A bc water moved to side B

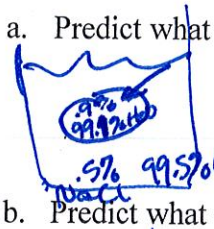
6. The solutions in the arms of the U-tube (at right) are separated by a selectively permeable membrane that is *permeable to water and solute A, but not to solute B*. 40g of solute A and 20g of solute B have been added to the water on side 1 of the U-tube. 20g of solute A and 40g of solute B have been added to the water on side 2 of the U-tube. Assume that after a period of time, equilibrium is reached.



   a. How many grams of solute A will be in solution on side 1 of the U-tube? 30g
   b. How many grams of solute A will be in solution on side 2 of the U-tube? 30g
   c. Explain your answers to questions a & b. A can move, so it will until equil. is reached
   d. How many grams of solute B will be in solution on side 1 of the U-tube? 20g
   e. How many grams of solute B will be in solution on side 2 of the U-tube? 40g
   f. Explain your answers to questions d & e. B can't move across the membrane so it doesn't change
   g. What has happened to the water level in the U-tube? Explain your answer. Water will move from side 1 to side 2 to reach equilibrium bc the conc. of H_2O is higher in side 1 than side 2 to start.

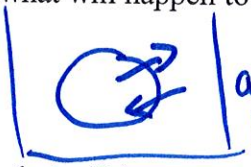
7. Flasks X, Y, and Z contain solutions with different concentrations of the solute NaCl. Flask X has 0.5% NaCl, flask Y has 0.9% NaCl, and flask Z has 1.5% NaCl. Red blood cells (0.9% NaCl) will be placed into each flask.

a. Predict what will happen to the red blood cells in flask X (hint: draw out the situation).



Water moves into cell. Conc. of H_2O is higher outside the cell than inside the cell. Cell will probably lyse (break)

b. Predict what will happen to the red blood cells in flask Y (hint: draw out the situation).

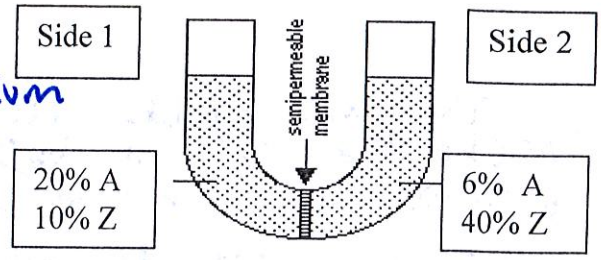


Cell will not change. Equal amts of water is entering & exiting b/c cell & solution are isotonic

c. Predict what will happen to the red blood cells in flask Z (hint: draw out the situation).

Cell will shrivel b/c H_2O will leave cell. Conc. of H_2O is higher in cell than in the solutn. Cell crenates.

8. In the U-tube diagram below, the membrane is permeable to solute A; however, it is NOT permeable to solute Z.

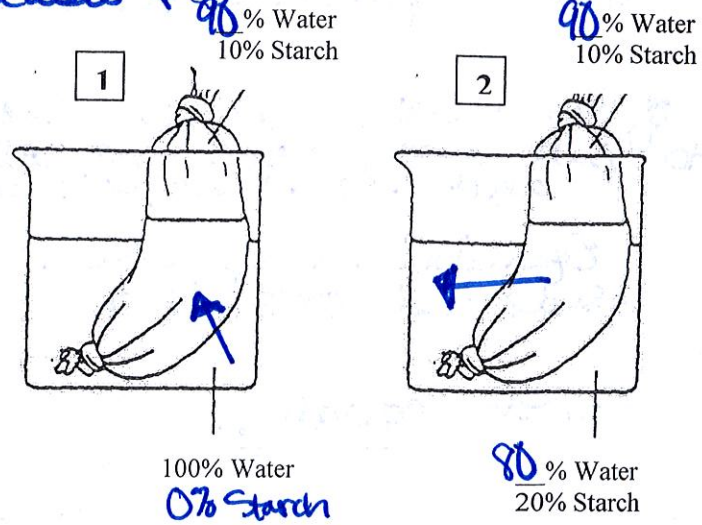


a. What is going to happen to solute A (both direction and percentages)? A will move to side 2 to reach equilibrium (13% on each side)

b. What is going to happen to solute Z (both direction and percentages)? Z will not move but % will change b/c H_2O will move. H_2O moves until 25% Z on each side

c. What is going to happen to the water levels, specifically? Water level on side 1 decreases & side 2 increases

9. Study the diagrams of the beakers to the 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 pass through.



a. Draw arrows in the diagrams to show the direction in which water will move.

b. Which of the beakers contains a solution that is hypertonic relative to the bag's contents? Beaker 2

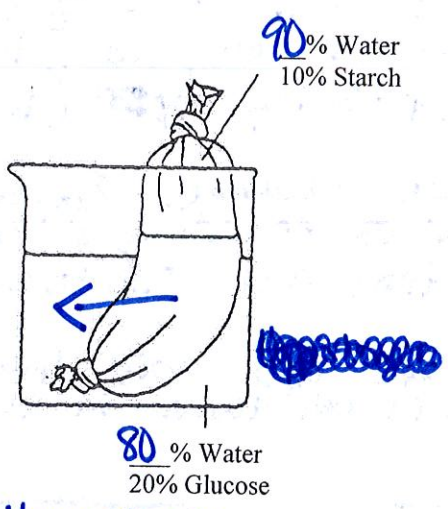
c. What will eventually happen to the concentrations in beaker 2? The conc. will reach equilibrium & be 15% starch

10. Name two ways that active transport is different from passive transport.

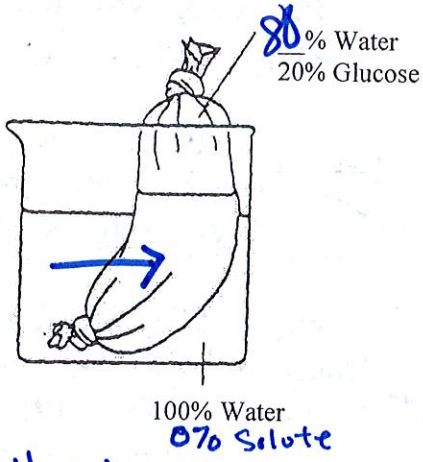
(1) Active transport is against the conc. gradient (low to high) while Passive transport molecules move with the conc. gradient (high to low)

(2) Active transport requires energy & Passive transport does not.

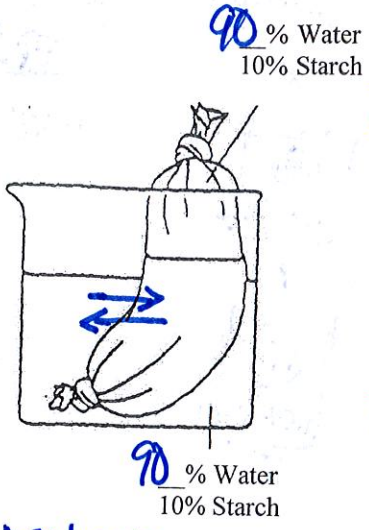
11. The direction in which water molecules move during osmosis depends on where the water molecules are more highly concentrated. Study the diagrams below.
    a. Decide whether the solution in each beaker is hypotonic, isotonic, or hypertonic in relation to the solution inside the cellulose bag, then write your answer below each beaker.
    b. Draw arrows to indicate the direction in which the water will move in each case.



Hypertonic



Hypotonic



Isotonic

12. Intravenous solutions must be prepared so that they are isotonic to red blood cells. A 0.9% 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% water and 0.7% salt.

The H_2O outside cell is at a higher conc. than inside the cell so H_2O will move into the cell and potentially cause the cell to burst or lyse.

    b. What will happen to a red blood cell placed in a solution of 90% water and 10% salt?

H_2O conc. outside cell is lower than inside the cell so water will move out a cause the cell to shrivel or crenate.

13. What keeps plants cells from bursting when they are placed in a hypotonic solution?

The cell wall stops the cell membrane from expanding enough to lyse.

14. How does being placed in a hypertonic solution affect a plant cell? It pulls water out of the vacuole, which then causes the cell membrane to pull away from the cell wall. Turgor pressure decreases and the plant will wilt.

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

Equilibrium is when conc. of solutes is the same inside and outside of the bags.

16. What happens to the motion of molecules after equilibrium is reached? they move back + forth equally.

17. What is turgor pressure in a plant cell? The pressure caused by water entering a cell + results in cell membrane pushing against the cell wall. Allows more support for a plant to stand up tall.