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**Osmosis and Water Potential Worksheet**

*Answer all questions on a separate sheet of paper.  Show all work in order to receive any credit.*

1.  If a cell’s ΨP = 4 bars and its ΨS = -5.5 bars, what is the resulting Ψ?

2.  The cell from question #1 is placed in a beaker of sugar water with ΨS = -6.0 bars.  In which direction will the net flow of

 water be?  Show work, then explain.

3.  The original cell from question # 1 is placed in a beaker of sugar water with ΨS = -0.20 MPa (megapascals).  We know

 that 1 MPa = 10 bars.  In which direction will the net flow of water be?  Show work, then explain.

4.  The value for Ψ in onion root tissue was found to be -3.5 bars.  If you take the root tissue and place it in a 0.1 M

 solution of sucrose at 20°C in an open beaker, what is the Ψ of the solution, and in which direction would the net flow

 of water be?

5.  NaCl dissociates into 2 particles in water: Na+ and Cl-. If the solution in question 4 contained 0.1M NaCl instead of 0.1M

 sucrose, what is the Ψ of the solution, and in which direction would the net flow of water be?

6.  A plant cell with a Ψs of -8.5 bars keeps a constant volume when immersed in an open-beaker solution that has a Ψs of

 -4 bars.  What is the cell’s ΨP?

7.  At 20°C, a cell containing 0.6M glucose is in equilibrium with its surrounding solution containing 0.5M glucose in an

 open container.  What is the cell’s ΨP?

8.  At 20°C, a cell with ΨP of 3 bars is in equilibrium with the surrounding 0.5M solution of sucrose in an open

 beaker.  What is the molar concentration of sucrose in the cell?

**TRUE/FALSE Problems**

***Choose one of the three problems below.*** *On a separate sheet of paper, identify if each numbered statement made is true, false, or that you do not have enough information to answer. If you choose B or C, rewrite the statement so that it is complete and true.*

**A = TRUE     B = FALSE        C = NOT ENOUGH INFORMATION**

**PROBLEM ONE:**The initial molar concentration of the cytoplasm inside a cell is 2M and the cell is placed in a solution with a concentration of 1.5M.

1. Initially, free energy is greater inside the cell than outside
2. It is possible that this cell is already in equilibrium with its surroundings.
3. Initially, solute concentration is greater outside the cell than inside.
4. Water will enter the cell because solute potential is lower inside the cell than outside.
5. The cell will become flaccid because the pressure potential is greater outside the cell  than inside.
6. The cell is already in equilibrium with its surroundings because of the combination of pressure potential and solute potential inside and outside the cell.
7. Initially, the cytoplasm is hypertonic to the surrounding solution.
8. Initially, the numerical value of the solute potential is more negative inside the cell than outside.
9. Net diffusion of water will be from inside the cell to outside the cell.
10. At equilibrium, the molarity of the cytoplasm will have increased.
11. At equilibrium, the pressure potential inside the cell will have increased.

**PROBLEM TWO:**The initial molar concentration of the cytoplasm inside a cell is 1.3 M and the surrounding solution is 2.3M.

1. The cell could already be in equilibrium with the surrounding solution.
2. If the cell is already in equilibrium with its surroundings, there must be pressure potential inside the cell.
3. If the cell is initially flaccid, osmosis will cause the free energy inside the cell to increase.
4. If the cell is initially flaccid, there will be a net gain of turgor during osmosis.
5. If the cell is initially flaccid, diffusion will proceed until solute potential inside the cell equals solute potential outside the cell.
6. At equilibrium, the cytoplasm and the surrounding solution will be isotonic.
7. At equilibrium, water potential inside and outside the cell will be equal.
8. If the cell is initially flaccid, water will move down its free energy gradient and out of the cell.
9. If the cell is initially flaccid, the molarity of the cytoplasm will increase during osmosis.
10. If the cell is initially flaccid, then both solute potential and pressure potential inside the cell will increase during osmosis.
11. At equilibrium, free energy inside and outside the cell will be equal.

**PROBLEM 3:**A cell is in equilibrium with its environment.  The solute potential of the cell’s cytoplasm is –0.45MPa.  The water potential of the surrounding solution is –0.32Mpa.  When the cell was first put into the solution, it was flaccid.

1. Since the cell was put into this solution, its solute potential and pressure potential have both risen.
2. The pressure potential of the cell is now +0.32MPa.
3. The cell has a higher solute potential than the surrounding solution
4. The cell’s water potential is now lower than that of the surrounding solution.
5. Initially, the cell’s solute potential was lower than that outside.
6. Initially, the cell’s water potential was lower than that outside.
7. There is still a concentration gradient that tends to draw water into the cell.
8. The cell is still flaccid.
9. The pressure potential of the cell is equal to that outside the cell
10. There is lower free energy inside the cell than outside.
11. There is lower molarity inside the cell than outside.
12. The cell is isotonic to its surroundings.