Practice Problems – Osmosis and Water potential

Use this key to answer all the problems below. If you choose B or C, rewrite the statement so that it is complete and true.

T = TRUE    F = FALSE    N = 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 2.5M.

1. It is possible that this cell is already in equilibrium with its surroundings.

2. Initially, solute concentration is greater outside the cell than inside.

3. Water will enter the cell because solute potential is lower inside the cell than outside.

4. The cell will become flaccid because the pressure potential is greater outside the cell than inside.

5. The cell is already in equilibrium with its surroundings because of the combination of pressure potential and solute potential inside and outside the cell.

6. Initially, the cytoplasm is hypertonic to the surrounding solution.

7. Initially, the numerical value of the solute potential is more negative inside the cell than outside.

8. Net diffusion of water will be from inside the cell to outside the cell.

9. At equilibrium, the molarity of the cytoplasm will have increased.

10. 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 .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, there will be a net gain of turgor during osmosis.

4. If the cell is initially flaccid, diffusion will proceed until solute potential inside the cell equals
solute potential outside the cell.

5. At equilibrium, the cytoplasm and the surrounding solution will be isotonic.

6. At equilibrium, water potential inside and outside the cell will be equal.

7. If the cell is initially flaccid, the molarity of the cytoplasm will increase during osmosis.

8. If the cell is initially flaccid, then both solute potential and pressure potential inside the cell will increase during osmosis.

**PROBLEM 3:** A cell is in equilibrium with its environment. The solute potential of the cell’s cytoplasm is $-0.45\text{MPa}$. The water potential of the surrounding solution is $-0.32\text{Mpa}$. 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 $+0.32\text{MPa}$.

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 pressure potential of the cell is equal to that outside the cell.

9. There is lower molarity inside the cell than outside.

10. The cell is isotonic to its surroundings.

**PROBLEM 4:** A cell is in equilibrium with its surroundings. The molarity of the surrounding solution is $0.5\text{M}$. To convert molarity to solute potential in MPa, use the formula: $\Psi_S = - (i \ CRT)$ where $i =$ ionization constant (assume that is 1)
C=molar concentration (given above)
$R =$ pressure constant ($R=0.00831$ liter MPa/mole °K)
1. Calculate the solute potential of the surrounding solution.

\[ \psi_S = \]

2. Find the water potential of the surrounding solution.

\[ \psi = \]

3. What is the water potential of the cytoplasm of the cell?

\[ \psi = \]

4. **True, false, or not enough information:** The cell’s molar concentration is equal to the molar concentration of the surrounding solution.