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Osmotic Pressure

Definitions: Osmosis: -movement of water (solvent) to the solution side to lower its free energy.

-movement of water from high water potential to lower potential down the concentration gradient.

Osmotic pressure:

-It is the pressure that is applied to a solution to stop the flow of solvent through a semipermeable membrane. The semipermeable membrane is impermeable to the solute.

-To visualise this definition, is to assume a U-shaped tube glass with same amount of water on both sides of the tube. Each side is separated by a semipermeable membrane. Sugar is added on one of the sides. The membrane is impermeable to sugar molecules (solutes), so they can't move to the other side of the tube. Due to osmosis, the pure water will move to the sugar solution due to the difference in water potentials in both sides of the tube. The water level of the sugar solution will raise due to the osmotic pressure. It will continue to raise until the pressures of the sugar water and the pure water towards the semipermeable membrane become equal.

The osmotic pressure can be found by using the Morse equation. Morse is named after Harmon Northrop Morse.

The equation:

$$\pi = MRT$$

π = Osmotic pressure (atm) M= Molarity of the solute (M) R= The gas constant =0.08206 L atm K⁻¹ mol⁻¹ T = Temperature (Kelvin)

The Effect of Osmotic Pressure on Red Blood Cells: 1)Hypertonic solution When the osmotic pressure of the solution outside the cell is higher than the osmotic pressure inside the red blood cell, this solution is hypertonic. The water inside the cell will move out down the water potential gradient, due to osmosis. This occurs to equalise the osmotic pressure. Because of this situation, the red blood cells will shrink.

2)Isotonic Solution When the osmotic pressure outside the cell is the same than the osmotic pressure inside the red blood cell, then the solution is called isotonic. This is the normal condition for the cells in the plasma and they are in their normal size. 3)Hypotonic solution This is when the osmotic pressure inside the cell is higher than the osmotic pressure outside the cell. Due to osmosis, the water from outside environment moves inside the cytoplasm down the water potential gradient to equalise the osmotic pressure. This causes the cells to swell and burst. The term called for this situation is osmotic lysis. Osmotic pressure in plants: Osmotic pressure is important for plants functions. It causes turgor pressure on the cell wall, which allows plants to stand upright.