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B.Sc. PART- II
(BOTANY SUBSIDIARY).
[GROUP- C]

(i) OSMOTIC PRESSURE
(ii) TURGOR PRESSURE.
(iii) WALL PRESSURE.
(iv) DIFFUSION PRESSURE.
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B.Sc. Part -II [Botany Subsidiary]

Group-'c'

Osmotic Pressure [O.P.], Turgor Pressure [T.P.] Wall Pressure [W.P.] and Diffusion Pressure Deficit [D.P.D.]

Osmotic Pressure [O.P.]

The osmotic pressure of a solution is equivalent to the pressure needed to prevent the passage of pure water (or any solvent) molecules into the solution of highest concentration (from a solution of lower conc.) through a semi-permeable membrane thereby preventing an increase in the volume of the solution.

In other words the maximum amount of pressure that can be developed in a solution separated from pure water by a semipermeable membrane is termed as osmotic pressure, e.g.; a molar solution of sucrose separated from pure water by a semipermeable membrane has an osmotic pressure of app. 22.4 atms. (22.7 bars) at 0°C

Osmotic pressure is calculated by the following relationship

$$OP = CRT$$

Where, C is molar concentration of solution

R is gas constant which is 0.082
T is absolute temperature 273°C

Turgor Pressure (T.P) and Wall Pressure (W.P)

Cytoplasm and different cell organelles embedded in it are enclosed by plasmalemma. Outside the plasmalemma rigid wall made up of cellulose is present. When a cell is kept in water, there is endosmosis of water molecules due to which the plasmalemma exerts a pressure on the rigid cell wall. Pressure exerted by cell contents on the cell wall is called turgor pressure. The pressure that develops in a cell time to time due to osmotic diffusion of water molecules into a cell that causes stretching of the cell wall is called Turgor pressure (T.P.).

Due to turgor pressure rigid cell wall offers resistance. This resistance which works in a direction opposite to turgor pressure but equal in strength to turgor pressure is termed as wall pressure.

It means pressure inserted by cell wall on contents is called wall pressure.

At equilibrium turgor pressure is equal to wall pressure.

TP = WP

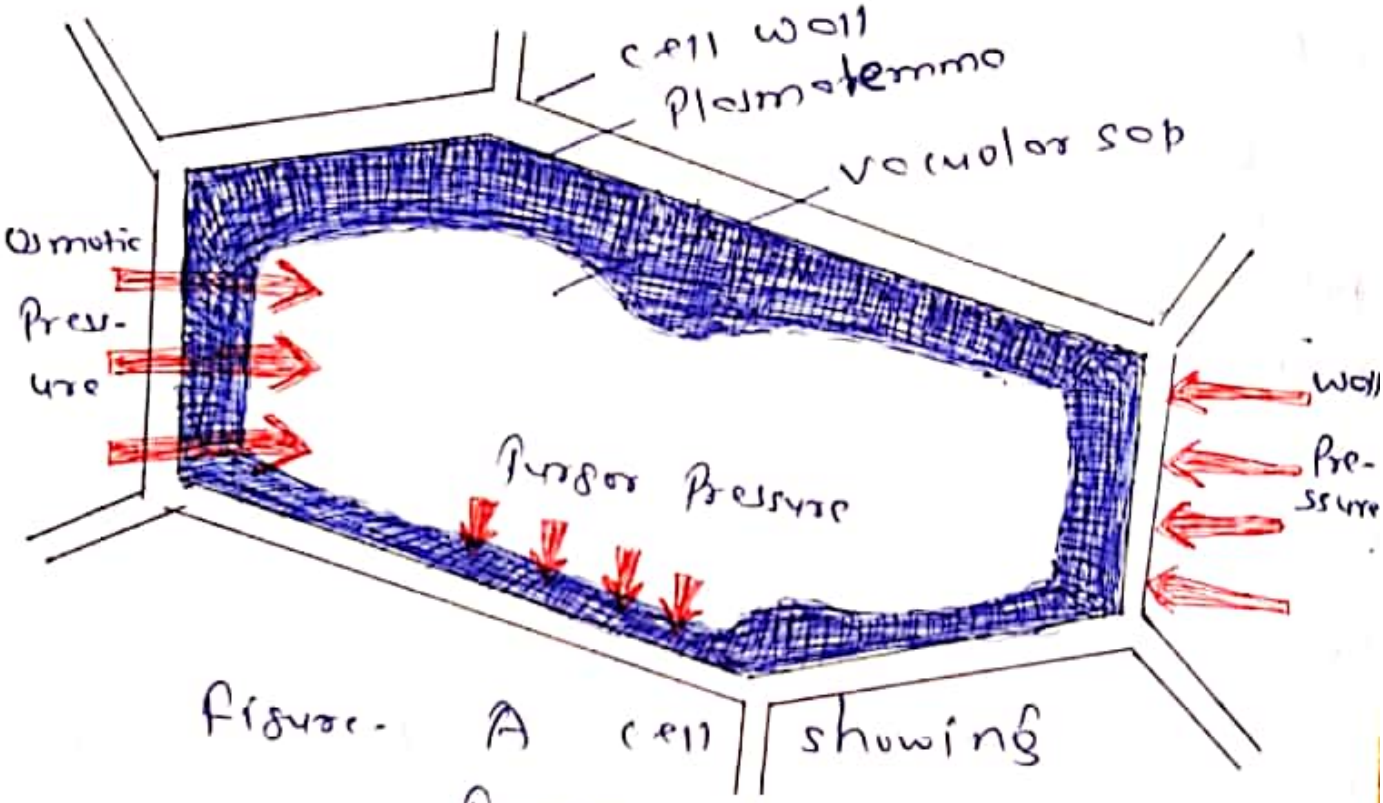

figure. A cell showing Turgor pressure, wall pressure and osmotic pressure.

Diffusion Pressure Deficiet [DPD] or Suction Pressure [SP]

Every liquid has a definite diffusion pressure. The diffusion pressure of pure solvent is always more than of its solution i.e., in a solution of sugar or

NaCl is prepared in water the diffusion pressure of water will be more than that of solution. The ormant by which the diffusion pressure of a solution is lower than that of its solvent is called Diffusion pressure deficiet. It is the index of observing power of a solution. It is also called suction pressure.

Interrelation ship of OP, TP(WP) and DPD (SP).

The difference in the concentration of solutions on two sides of a semipermeable membrane results in the flow of water from solution of low concentration to solution of higher concentration i.e., cell sap. As water enters into the cell the turgor pressure of cell is increased. As a result of increase in TP the wall pressure of the cell is also increased (equal in magnitude but opposite in direction). Therefore the actual force responsible for entry of water into the cell will be: OP-WP.

i.e., DPD (SP) = OP - WP (as WP = TP) or write OP - TP

In a flaccid cell the TP is zero therefore, DPD = OP - 0 = OP

Thus ∆PD will be equal to OP of the cell and the water will enter the cell with a force equal to the OP of the cell.

In a turgid cell the value of

OP = TP

i.e; ∆PD = OP − WP

∆PD = 0

Thus there will be no absorption of water by a cell in a fully turgid cell.

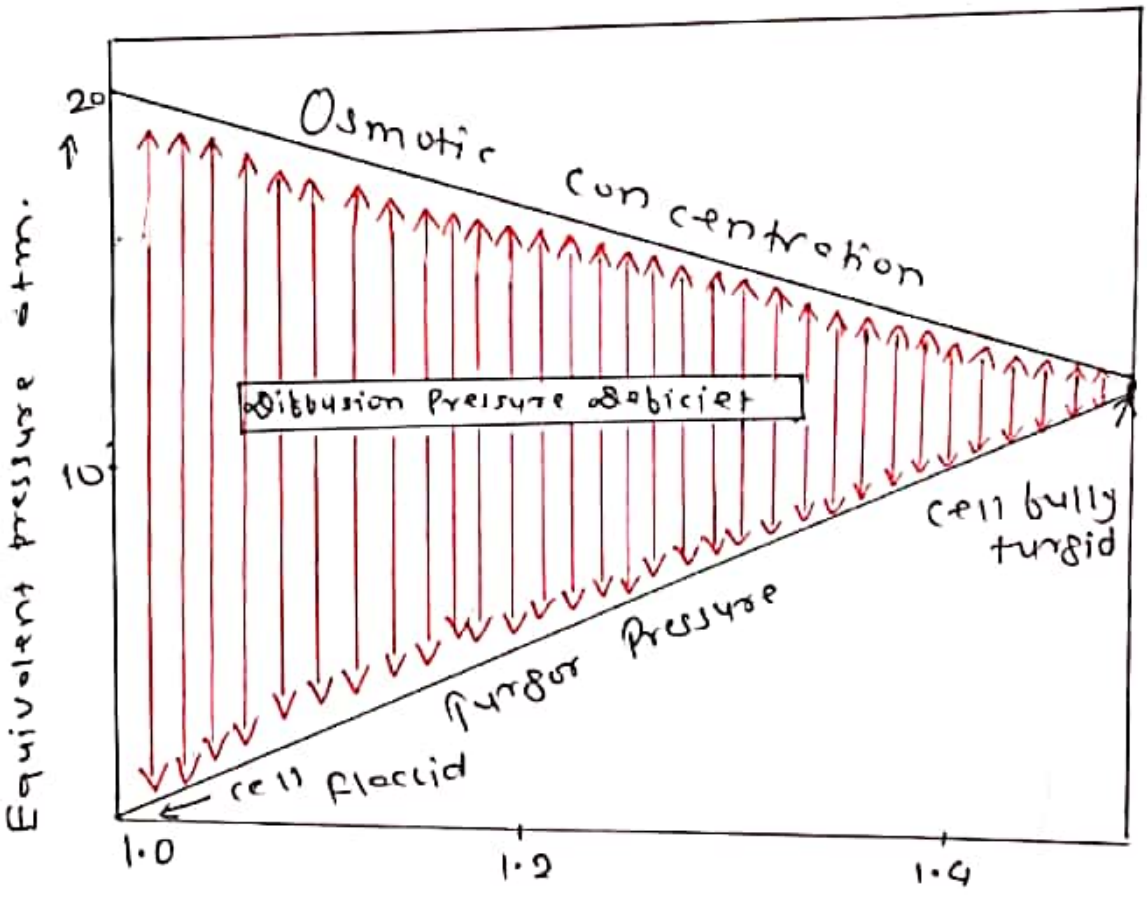

Figure → Diagram illustrating the changes that occurs when a plant cell takes up water. Note that when OP and TP are equal in magnitude, the diffusion pressure deficiet is zero.