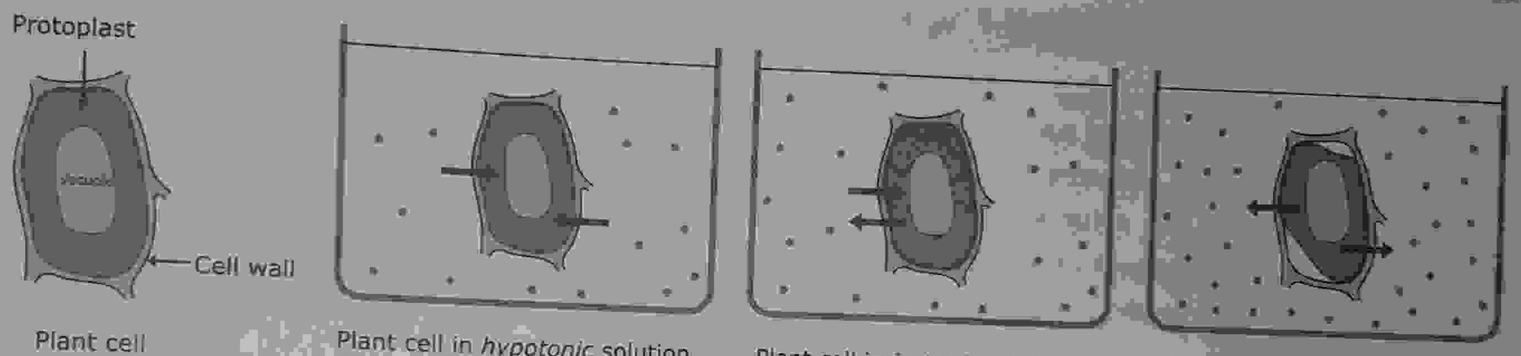
Tonicity

Tonicity is the measure of the osmotic pressure gradient of two solutions separated by a semipermeable membrane. There are three types of tonicity that one solution can have relative to another: hypertonic, hypotonic and isotonic. A solution with a lower solute content than another solution is referred to as *hypotonic*. A *hypertonic solution* has a higher solute content than another solution. An *isotonic* solution has the same solute content as another solution. When a plant cell is placed in hypotonic solution, water enters into the cell protoplast and cell becomes turgid. On the other hand, when a plant cell is placed in hypertonic solution, water moves out and protoplast shrinks and cell becomes flaccid. When the cell is placed in an isotonic solution, there is no net flow of water towards the inside or outside.



Plant cell

Plant cell in *hypotonic* solution, water moves in, creating outward pressure; cell turgid.

Plant cell in *isotonic* solution, no net water movement.

Plant cell in *hypertonic* solution, water moves out and protoplast shrinks, cell flaccid.

Turgor pressure

A plant cell is surrounded by cell wall and plasma membrane. The cell wall is freely permeable to water and solutes. The plasma membrane is selectively permeable membrane and determines the movement of molecules in or out of the cell. When a plant cell is placed in a hypotonic solution, water diffuses into the cell causing the protoplast to build up a pressure against the wall. The pressure exerted outwardly against the cell walls by the expanding protoplast is known as **turgor pressure**. An equal but opposite inward pressure by the cell wall on protoplast is called **wall pressure**. A cell experiencing turgor pressure is said to be **turgid**. A cell that experiences water loss to the point where turgor pressure is reduced to zero is called **flaccid**.

When a cell is placed in a hypertonic solution, water actually flows out of the cell into the surrounding solution. This causes the protoplast to shrink away from the cell wall, a condition known as **plasmolysis**. The cell is said to be *plasmolysed*. When water moves out; it is first losses from the cytoplasm and then from the vacuole. The stage of plasmolysis at which the first sign of shrinkage of protoplast from cell wall becomes detectable is called *incipient plasmolysis*. At incipient plasmolysis, the protoplast does not exert pressure against the wall, nor is it separated from the wall. Consequently, turgor pressure is zero. The process of plamolysis is usually reversible. When the cells are placed in a hypotonic solution (dilute solution as compared to the cytoplasm), water diffuses into the cell causing the protoplast to build up a pressure against the wall, that is called turgor pressure.

3.1.2 Chemical potential of water and water potential

The chemical potential of water is expressed in terms of free energy associat mole of wat chemical chemical potential is the energy per mole of substance. In plant physiol the conc we use a related parameter called *water potential*. Slatyer and Tayl volum which is defined as the chemical potential of water divided by th s pot J/ mol of water). The word *potential* in the term *water potential* ms of the free energy of water per unit volume. It is commonly e potential of pure water at standar