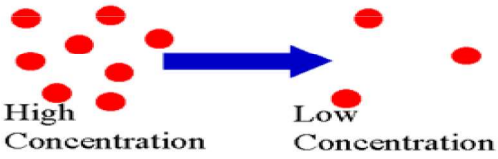
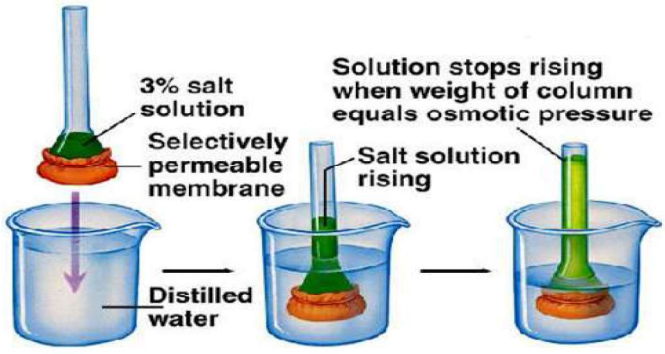
Osmosis

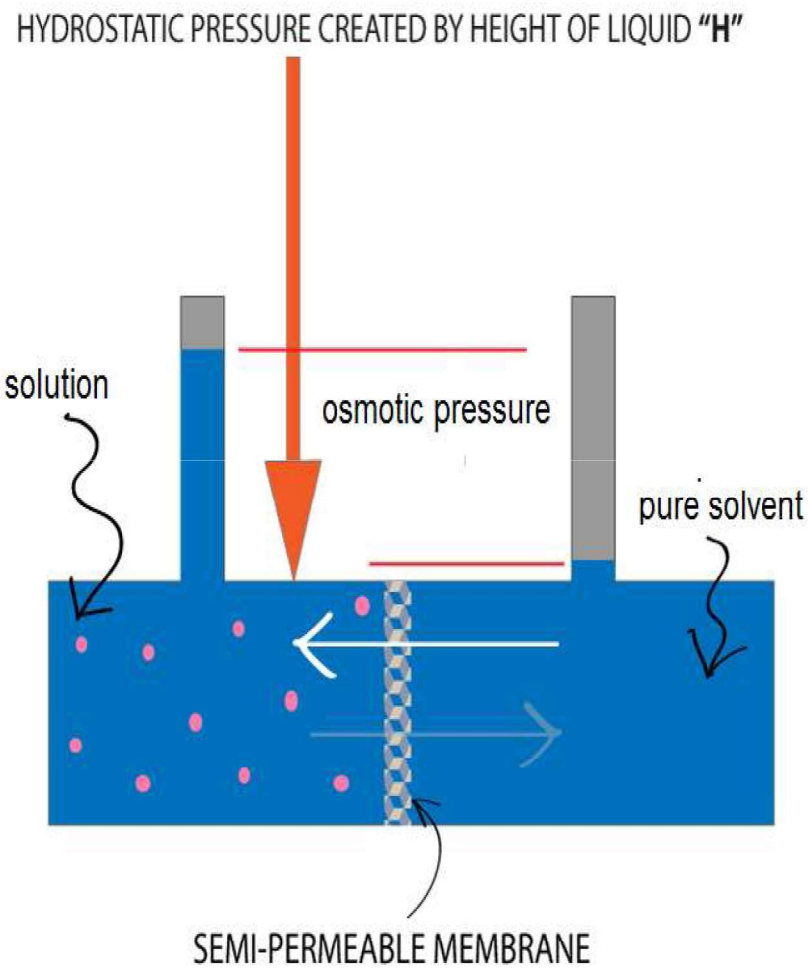
- Diffusion - Natural tendency that movement of solute particles from more concentrated to a less concentrated solution to bring uniform concentration
- If solution of different concentration separated by semipermeable membrane there is movement of solvent from less concentrated solution to more concentrated solution i.e from dilute solution to concentrated solution!
- Semipermeable membrane (SPM) – membrane which allows free passage to solvent molecules but not the solute molecules. Eg. Cellulose acetate, polymethacrylate, polyamides, polysulphonates etc.

Diffusion



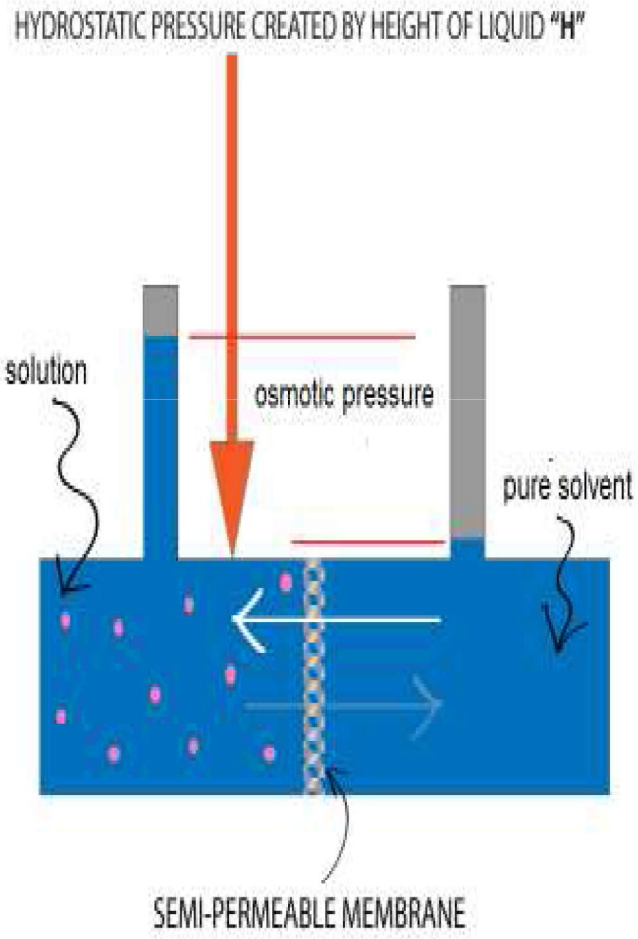


- Since vapor pressure and chemical potential of pure solvent is greater than those of the solvent in solution there is movement of solvent through SPM towards solution until the chemical potential become equal.
- This process is known as osmosis and extra pressure developed on the solution side is known as osmotic pressure (π).

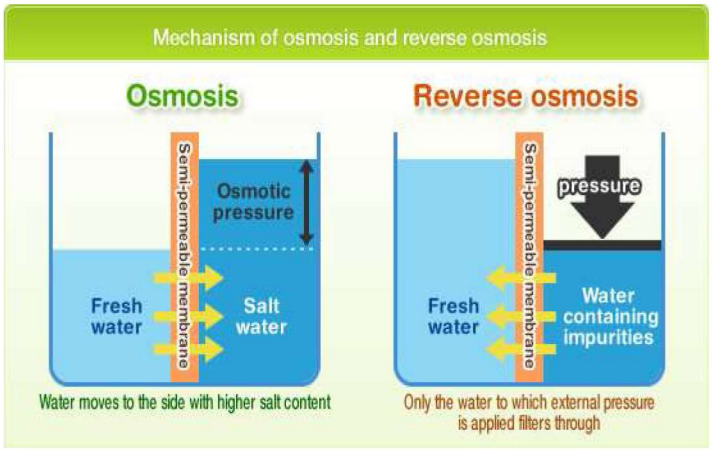


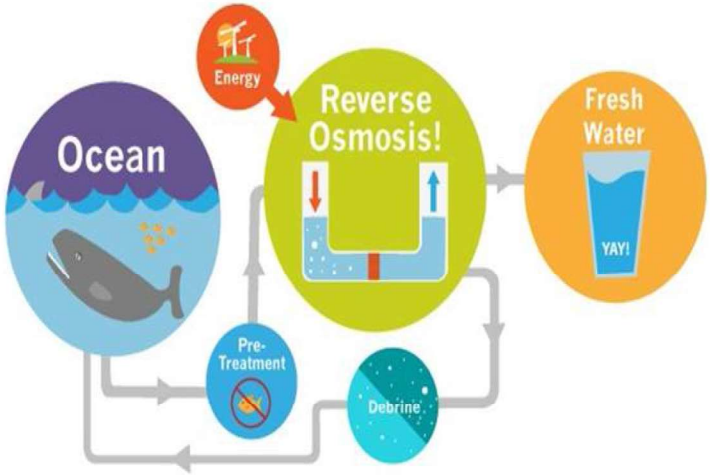
Reverse osmosis (RO)

- If a pressure of π is applied on solution side, movement of solvent can be stopped.
- If pressure applied is greater than π, the solvent will start flowing from the solution towards the pure solvent – Reverse osmosis (RO).
- RO – pure solvent (water) is removed from contaminants, rather than removing contaminants form water.
- RO is known as "super-filtration" or "hyper-filtration" i.e it can remove particles as small as dissolved individual ions.



- RO techniques is extensively used to getting drinking water from the sea water in Gulf countries.
- Depending on salt concentration the osmotic pressure of sea water varies. Generally it vary from 4000 to 5500 kPa (Pa = Pascal = 0.009 atm).
- For RO the applied pressure should be about 1400 kPa more than the osmotic pressure.
- A pressure of 5400 – 6900 kPa is applied to the sea water to force its pure water out through semipermeable membrane. Leaving behind ions and molecules.





Advantages of RO

- Remove ionic, non-ionic, high m.wt organic matter, dyes, sugars, proteins, colloidal silica and micro-organisms.
- Replacement of semipermeable membrane – entire maintenance cost.
- Life time of membrane is quite high, about 2 years.
- Membrane can be replaced within a few minutes, thereby provide uninterrupted water supply.
- Low capital cost, low operating cost and high reliability.
- The water obtained from RO can be used for high-pressure boilers.