Calgon's method : Calgon is sodium hexa metaphosphate ($Na_6P_6O_{18}$). This Calgon when added to hard water form soluble complex.

$$2CaSO_4 + Na_2[Na_4(PO_3)_6] \longrightarrow 2Na_2SO_4 + Na_2[Ca_2(PO_3)_6]$$

Similarly, Mg^{+2} can also be precipitated as $Na_2[Mg_2(PO_3)_6]$ and water becomes free from Ca^{+2} and Mg^{+2} ions.

By synthetic resins : There are two types

1. Cation exchange resins : These are big molecules containing sulphonic acid group ($-SO_3H$). It is first exchanged into sodium salt with general formula R^-Na^+. The hard water is passed through it so Ca^{+2} and Mg^{+2} are exchanged and removed.

$$2R^-Na^+ + Ca^{+2} \longrightarrow R_2Ca + 2Na^+$$

$$2R^{-}Na^{+} + Mg^{+2} \longrightarrow R_2Mg + 2Na^{+}$$

The resins like permutit can be regenerated with a solution of Nacl.

2. Anion exchange resins : These are also big molecules and can exchange anions. They contain an amino group.

$$RNH_2 + H_2O \longrightarrow R\overset{+}{N}H_3\,\overset{-}{O}H$$

$$2RNH_3^{+}OH^{-} + CO_3^{-2} \rightleftharpoons (R\overset{+}{N}H_3)_2CO_3 + 2OH^{-}$$

$$2RNH_3^{+}OH^{-} + Cl^{-} \rightleftharpoons RNH_3^{+}Cl^{-} + OH^{-}$$

The water is first passed through cation resins and then through anion resin and pure distilled water is obtained.

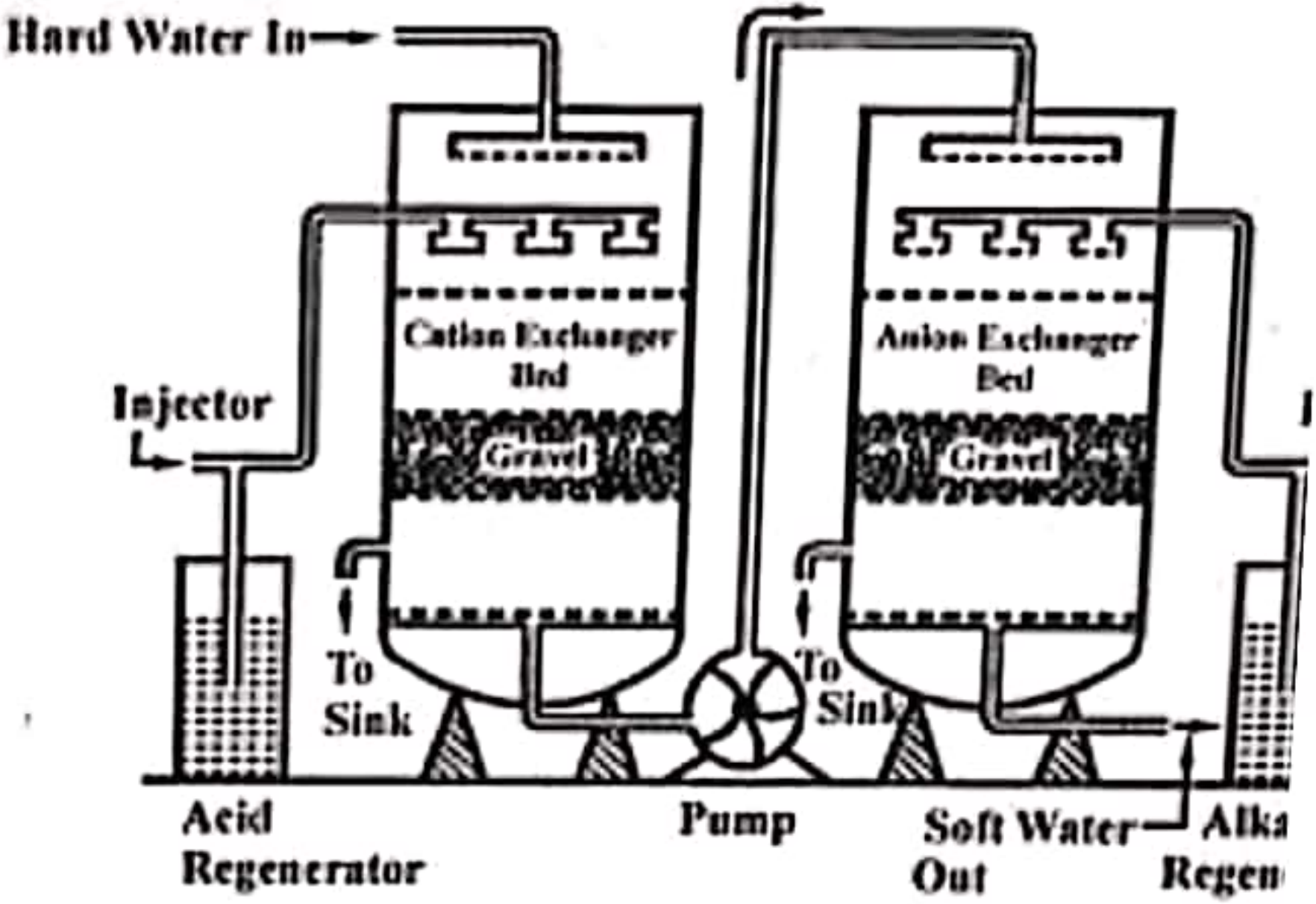


Fig. Demineralization of Water

What is Reverse Osmosis?

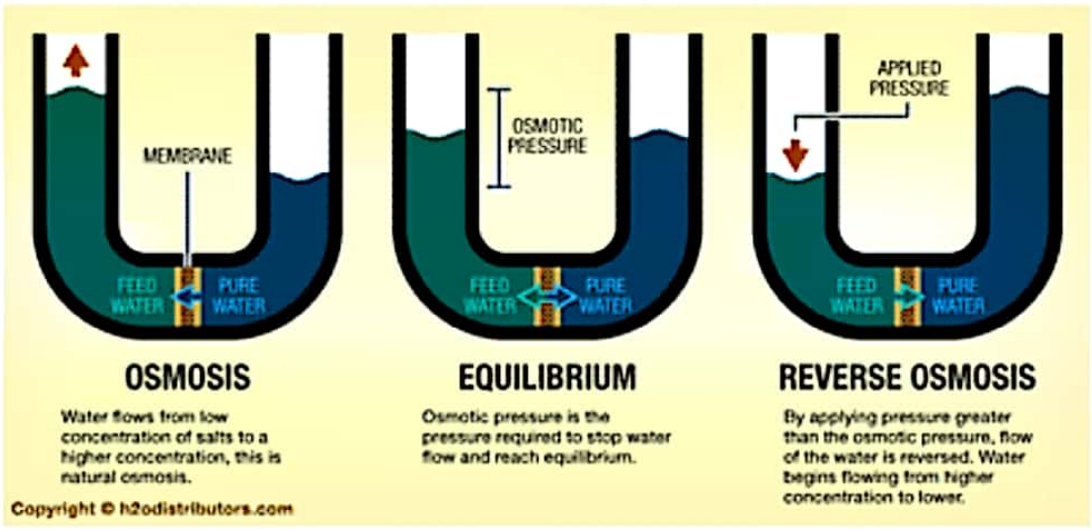
Source: Wikipedia

Reverse osmosis (RO) is a membrane-technology filtration method that removes many types of large molecules and ions from solutions by applying pressure to the solution when it is on one side of a selective membrane. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side.

How Reverse Osmosis Works

In the normal osmosis process, the solvent naturally moves from an area of low solute concentration (High Water Potential), through a membrane, to an area of high solute concentration (Low Water Potential). The movement of a pure solvent to equalize solute concentrations on each side of a membrane generates osmotic pressure. Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The

process is similar to other membrane technology applications. However, there are key differences between reverse osmosis and filtration. The predominant removal mechanism in membrane filtration is straining, or size exclusion, so the process can theoretically achieve perfect exclusion of particles regardless of operational parameters such as influent pressure and concentration.



Reverse osmosis, however, involves a diffusive mechanism so that separation efficiency is dependent on solute concentration, pressure, and water flux rate. Reverse osmosis is most commonly known for its use in drinking water purification from seawater, removing the salt and other substances from the water molecules.

The efficiency of a reverse osmosis water filter is affected by the water pressure coming into the system and the temperature of that water. Membranes are tested at 65 psi of pressure and temperature of 77 degrees. For each incremental change in either variable, membrane performance changes accordingly. Higher pressures increase production and vice versa. The optimal pressure is 65 PSI and temperature is 77°, as seen here on our reverse osmosis pressure/temperature chart.

Chemistry

Assignment No. 1.

Attempt all questions. M.M = 10

Each question is of 2 marks.

1. What do you mean by air pollution? Discuss different types of air pollutants.

2. Write down the Chemical reaction taking place in acid rain.

3. Write short notes on OZONE HOLE.

4. Differentiate between Hard & Soft water.

5. Discuss ~~the~~ Ion exchange resin method for softening of Hard water.