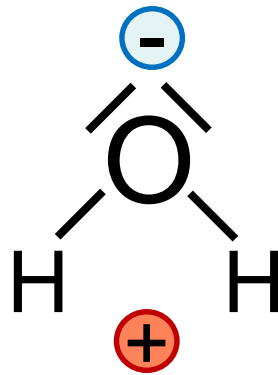


Water I.

Chemistry

1) H-O-H („V” shape)



2) **Polar** (slightly negative and positive sites because of different affinities for electrons)

3) H-bond formation (1 water/4 neighbouring water or with other molecules)

H-bond:

-is a secondary bond,

between:

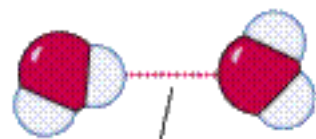
- a H atom covalently attached to an electronegative atom (atom with a high affinity for electrons) e.g. O, N, F

and

an electronegative atom of another molecule or another part of the same molecule.

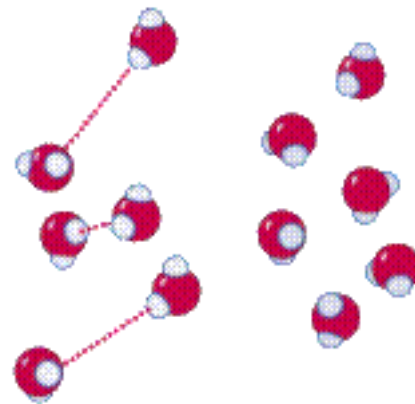
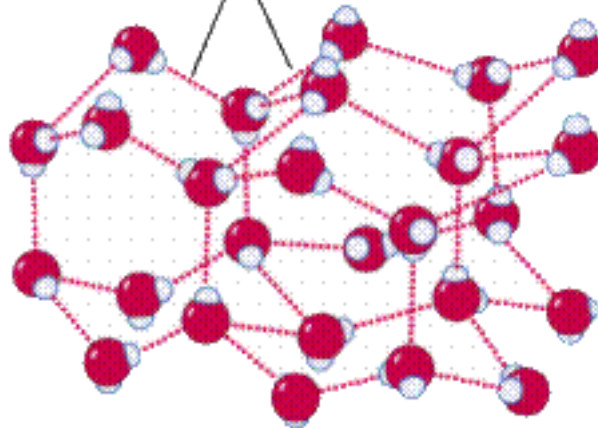
-weaker than covalent bonds

-e.g. between water molecules, inside protein molecules



Hydrogen
bond
between
water
molecules

Hydrogen bonds
in ice



Ice \longrightarrow Melting \longrightarrow Water
ice

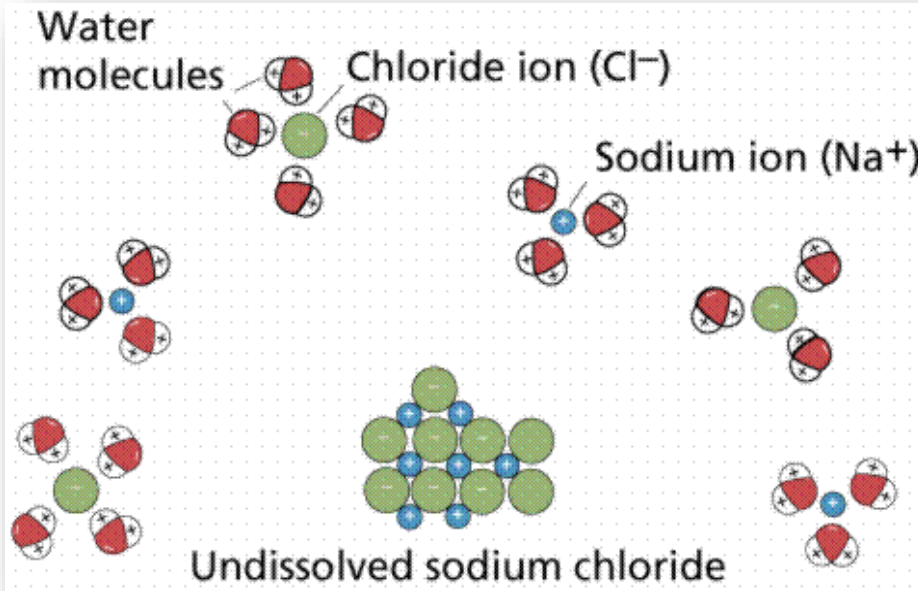
4) Solvent of ions and polar substances (hydrophilic substances) eg. Glucose, NaCl, alcohols,... (hydrophilic functional groups)

Solution: A homogeneous mixture of two or more substances. A solution may exist in any phase.

Solute is the substance that is dissolved in a solution (eg. NaCl).

Solvent is the substance in which the solute is dissolved (eg. water). The solvent is present in greater amount than the solute.

4) Solvent of ions and polar substances (hydrophilic substances) eg. Glucose, NaCl, alcohols,... (hydrophilic functional groups)



A **hydration shell** is formed around the dissolved ions. This makes the solving process faster, and keeps the ions in the solution.

The dissolved molecules or ions are traveling to everywhere within the solution by diffusion, so the concentration of the solute will be equal everywhere.

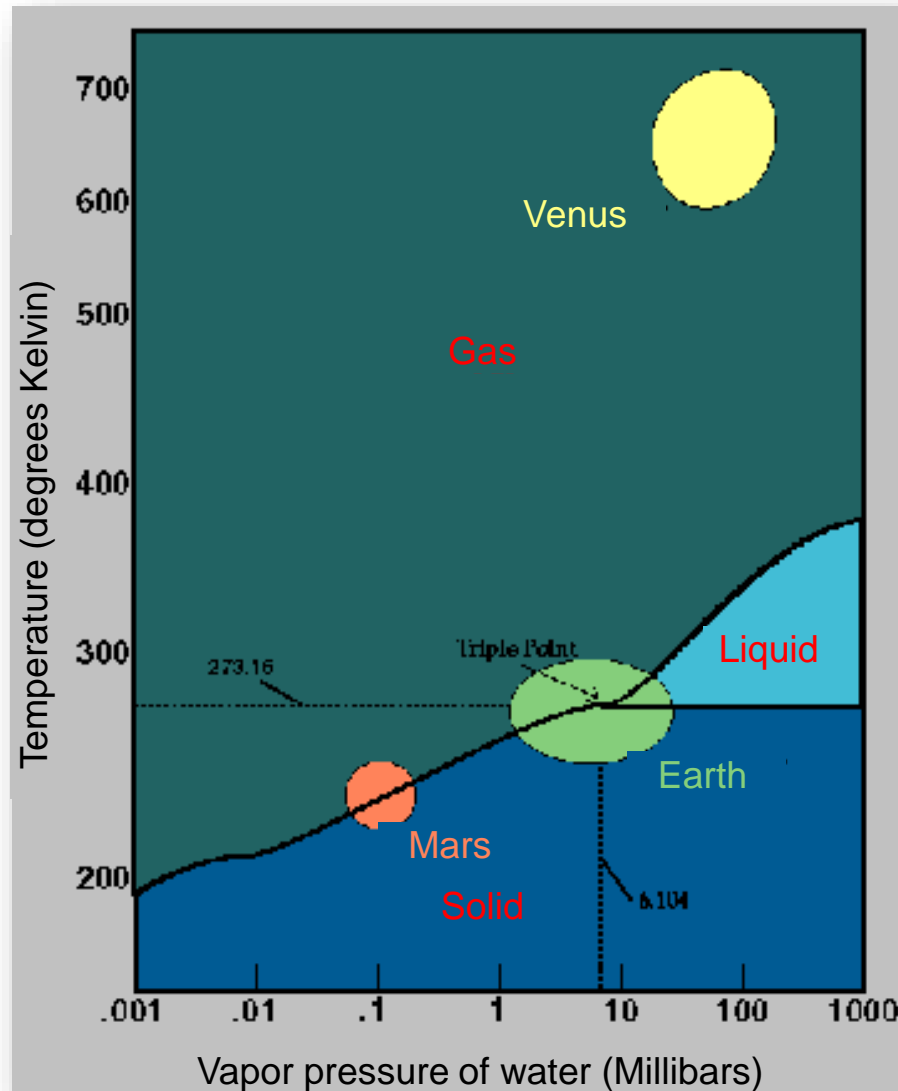
Water I.

Chemistry

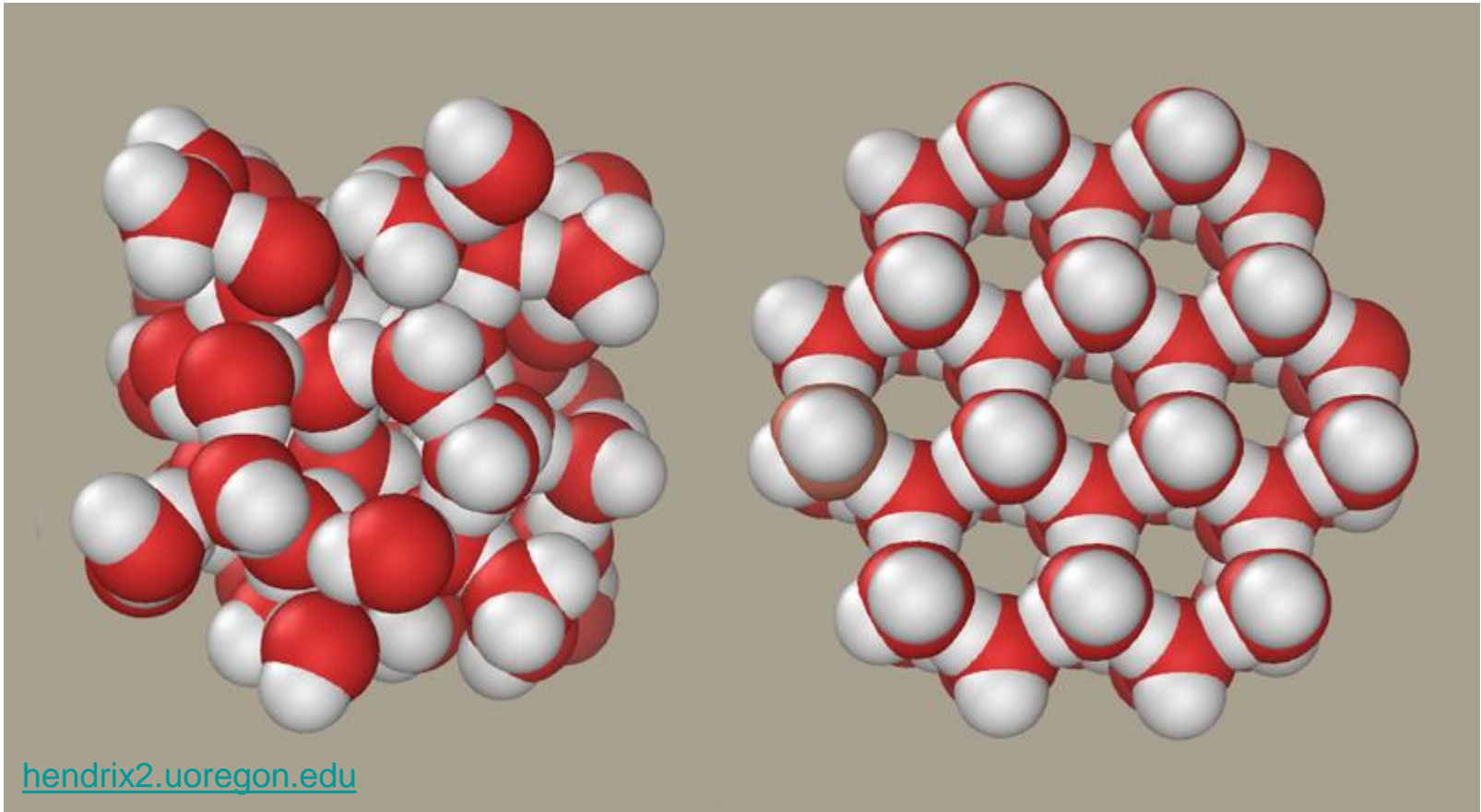
5) Tendency to dissociate into H^+ and OH^- in liquid state

acidic or alkalic nature of solutions

6) Existence in all three states of matter (gas, liquid, solid)



7) Expansion upon freezing leading to lower density

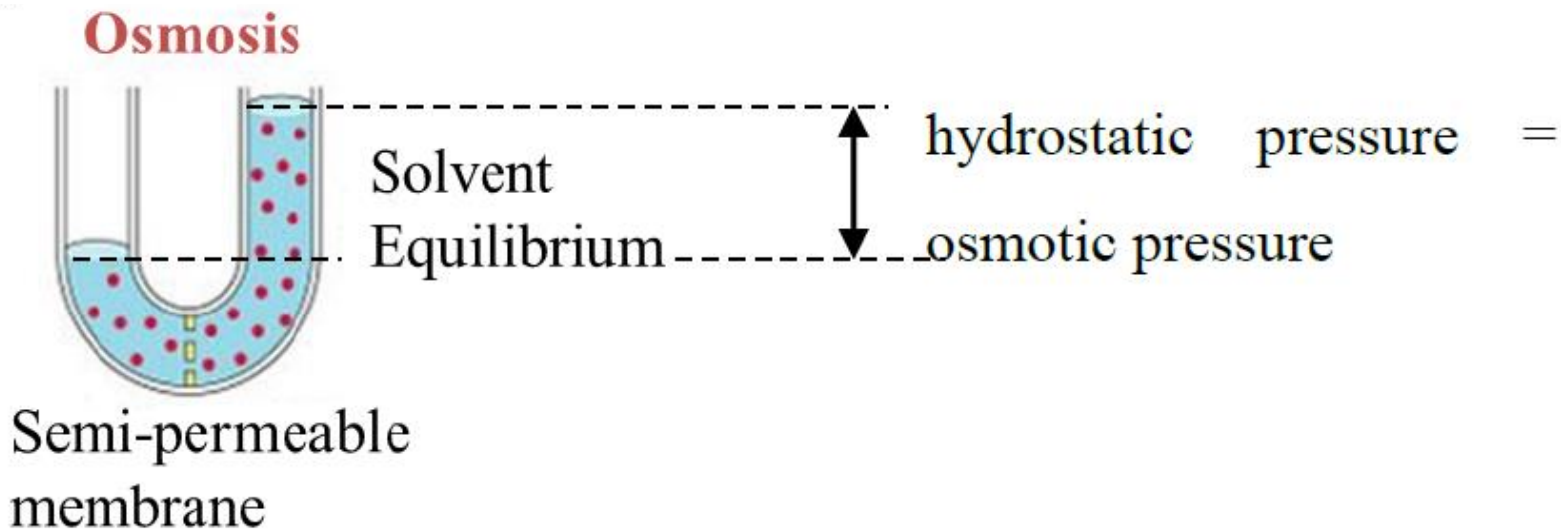
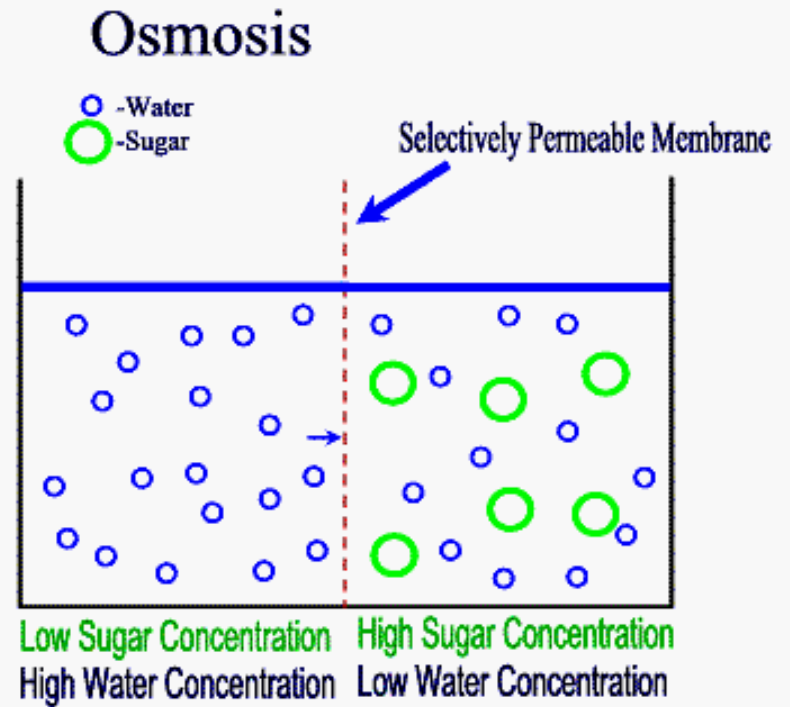


Water II.

Role in biology

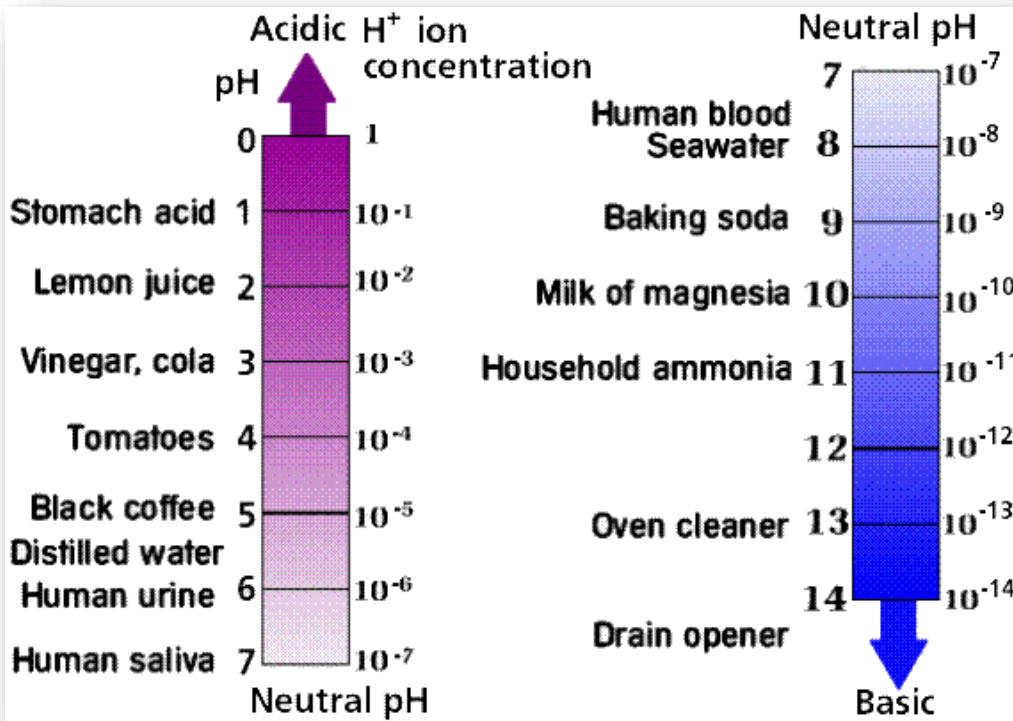
- 1) environment for life
 - a. cohesive behavior (H-bonds!)
 - b. stabilisation of temperature (high specific heat capacity and heat of vaporization)
 - c. expansion upon freezing
 - d. dissolving capability
 - e. weak viscosity (medium for transport, reactions)
 - f. transparency
- 2) partner in biochemical reactions as either substrate or endproduct
 - a) condensation (dehydration)
 - b) hydrolysis (hydration)
- 3) role in photosynthesis (photolysis of water)
- 4) free movement through biological membranes without energy requirement (osmosis)
- 5) pH (negative logarithm (to the base 10) of H^+ concentration in a solution): 0-14

Osmosis: The solvent (water) is flowing through a semipermeable (selectively permeable) membrane, towards the higher concentration of solute. The pressure, which is needed to be exerted to reach a dynamic equilibrium state, where the solvent is flowing in both directions with the same intensity, is called **osmotic pressure**.



Water IV.

pH



$$\text{pH} = -\log_{10}[\text{H}_3\text{O}^+] = -\lg[\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log_{10}[\text{H}^+] = -\lg[\text{H}^+]$$

Blood: pH 7,35-7,45

Skin: pH 5-5,5