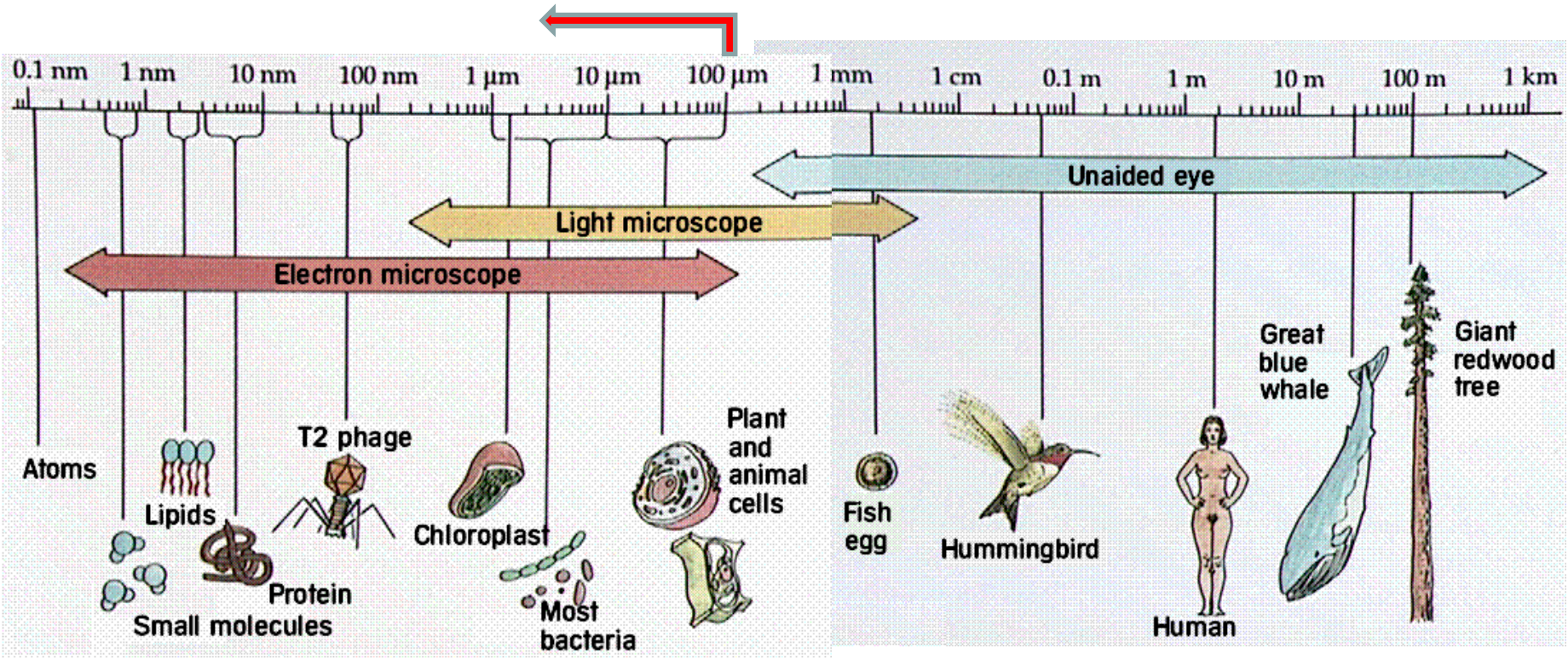
SIZE-SCALE

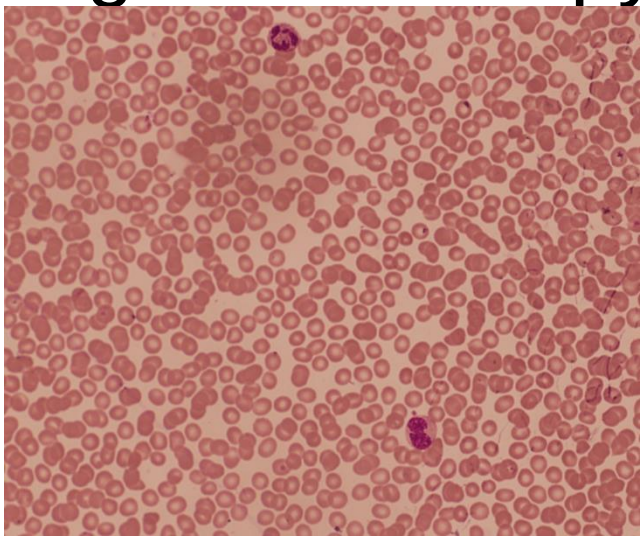
Metric = in meter/in metre

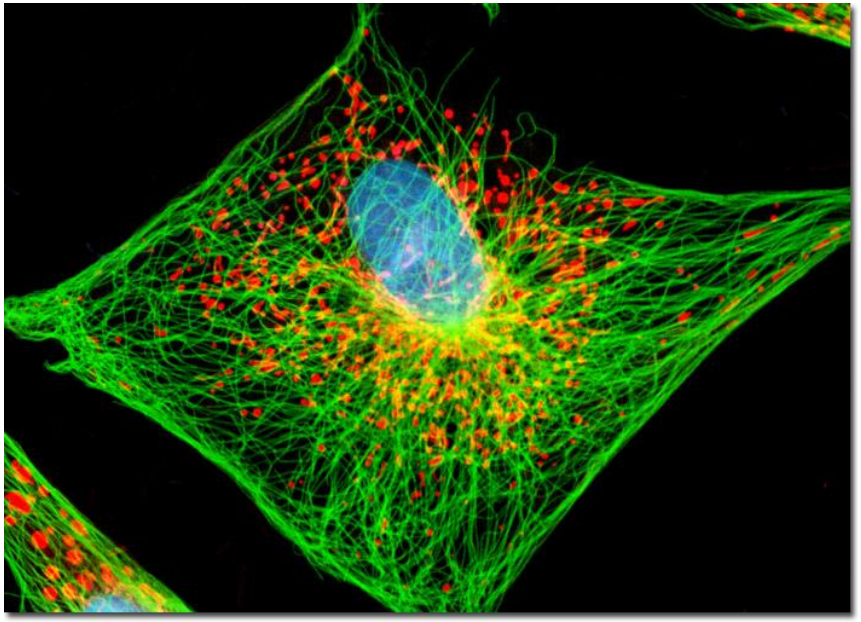


Millimeter= mm 1 mm=10^{-3}m
Mikrometer=µm 1 µm=10^{-6}m
Nanometer=nm 1 nm=10^{-9}m

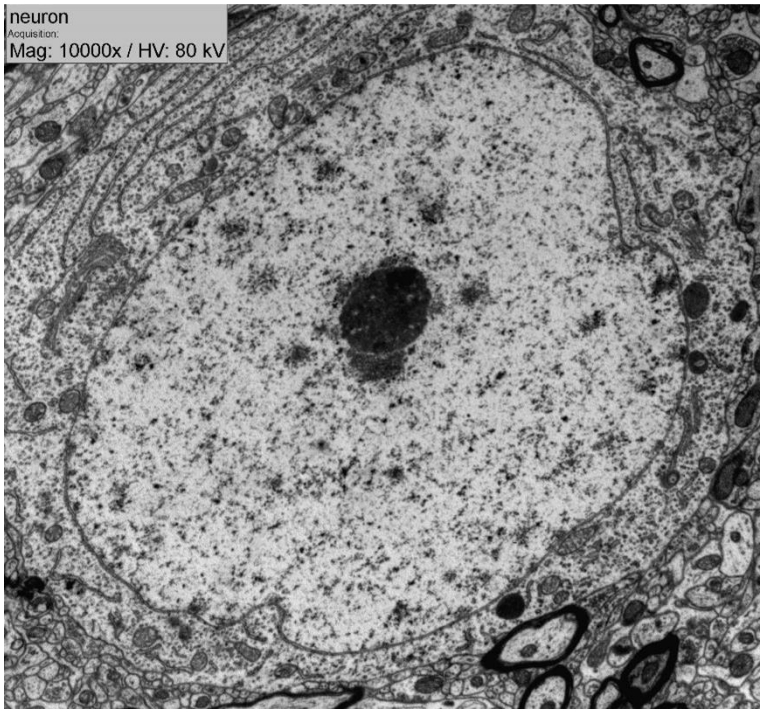
Centimeter=cm 1 cm=10^{-2}m
Kilometer=km 1 km=10^{3}m

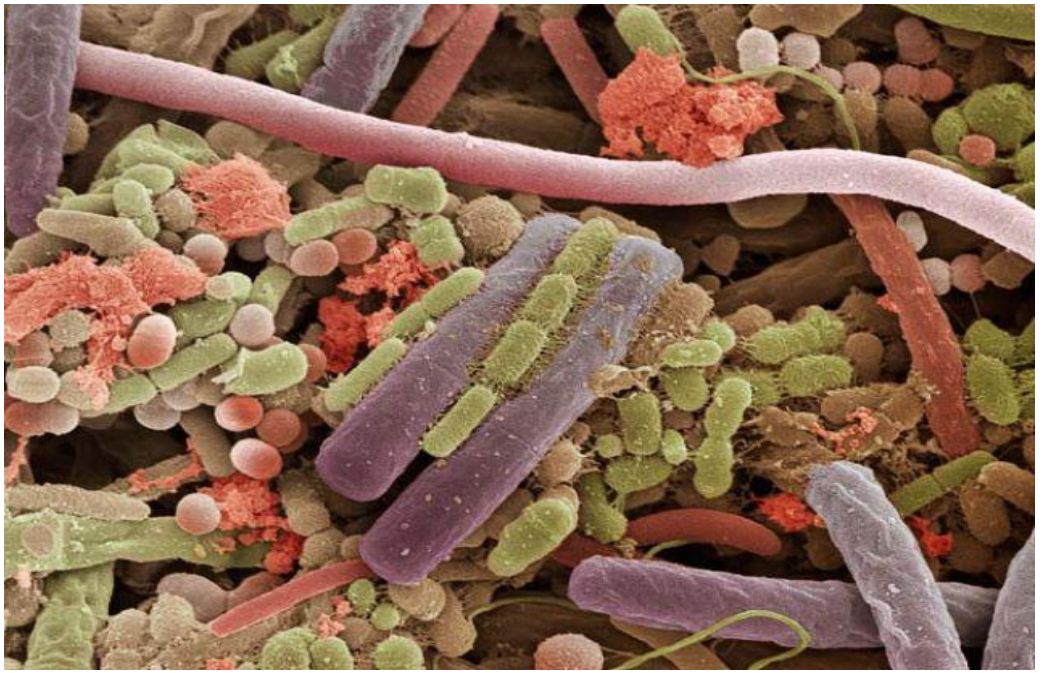
- Light microscopy





- Electron microscopy





Water I.
Chemistry

1) H-O-H (**„V" shape**)

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

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

H-bond:

-is a secondary bond,

between:

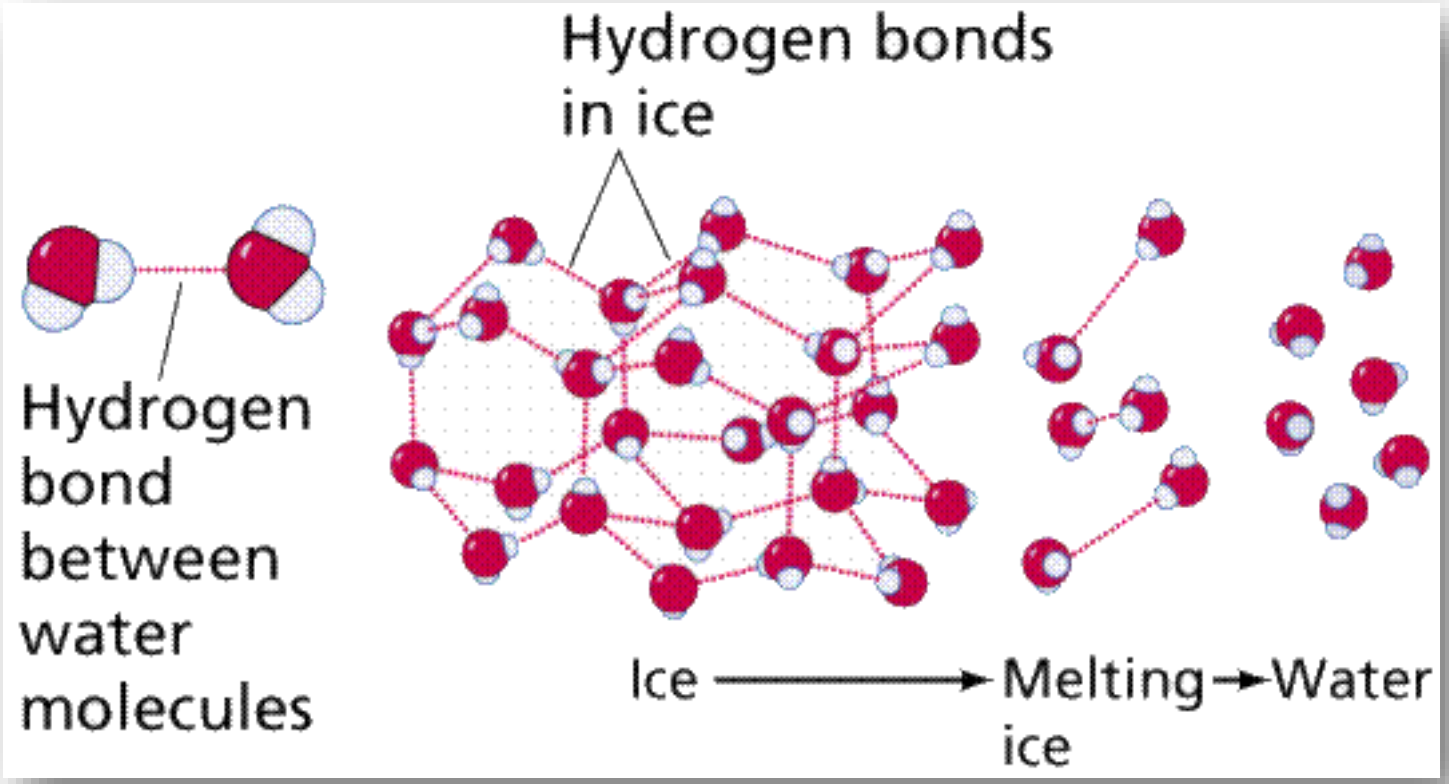
- a H atom covalently attached to an electronnegative atom (atom with a high affinity for electrons) e.g. O, N,

and

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

-weaker than covalent bonds

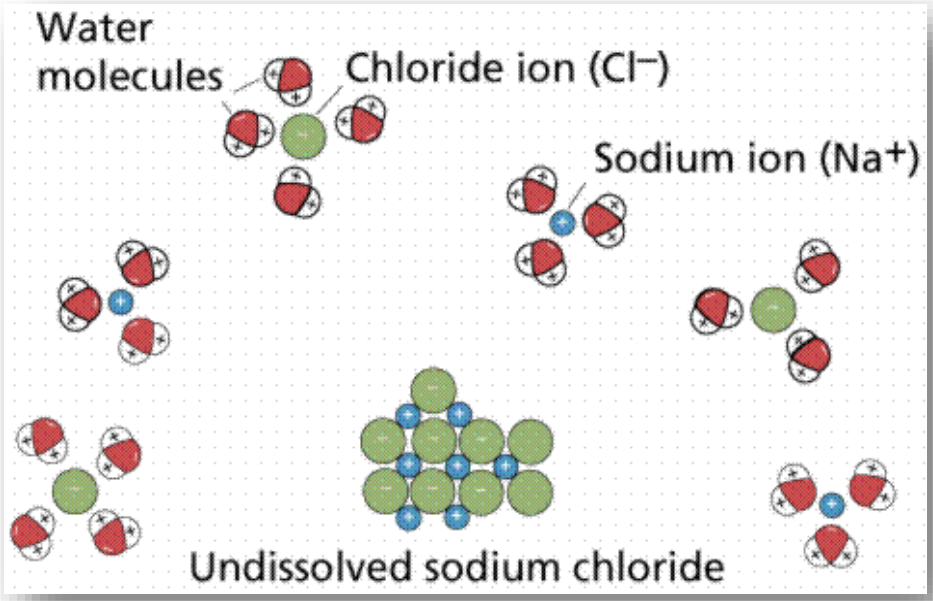
-e.g. between water molecules, inside protein molecules


Hydrogen bonds in ice
Hydrogen bond between water molecules
Ice
Melting ice
Water

4) **Solvent** of ions and polar substances (hydrohilic 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 (hydrohilic 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.

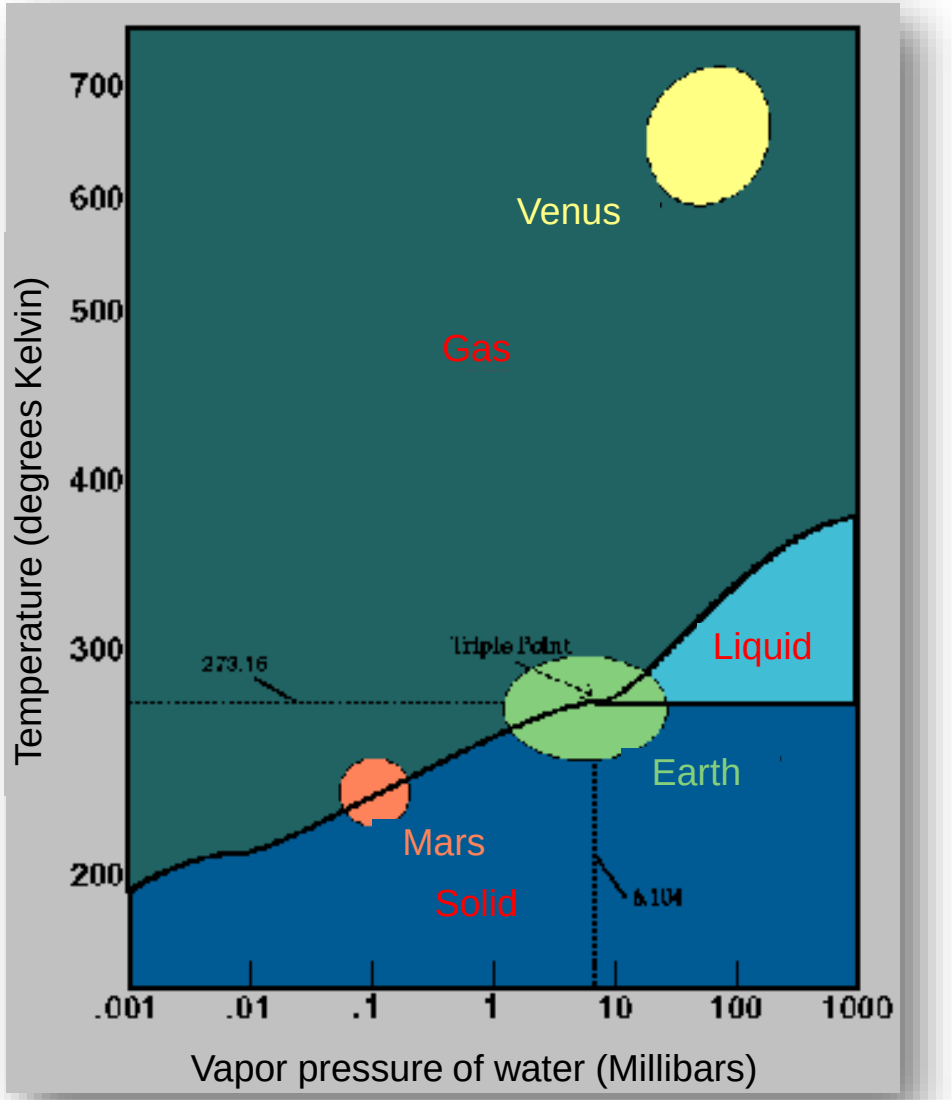
Water I.

Chemistry

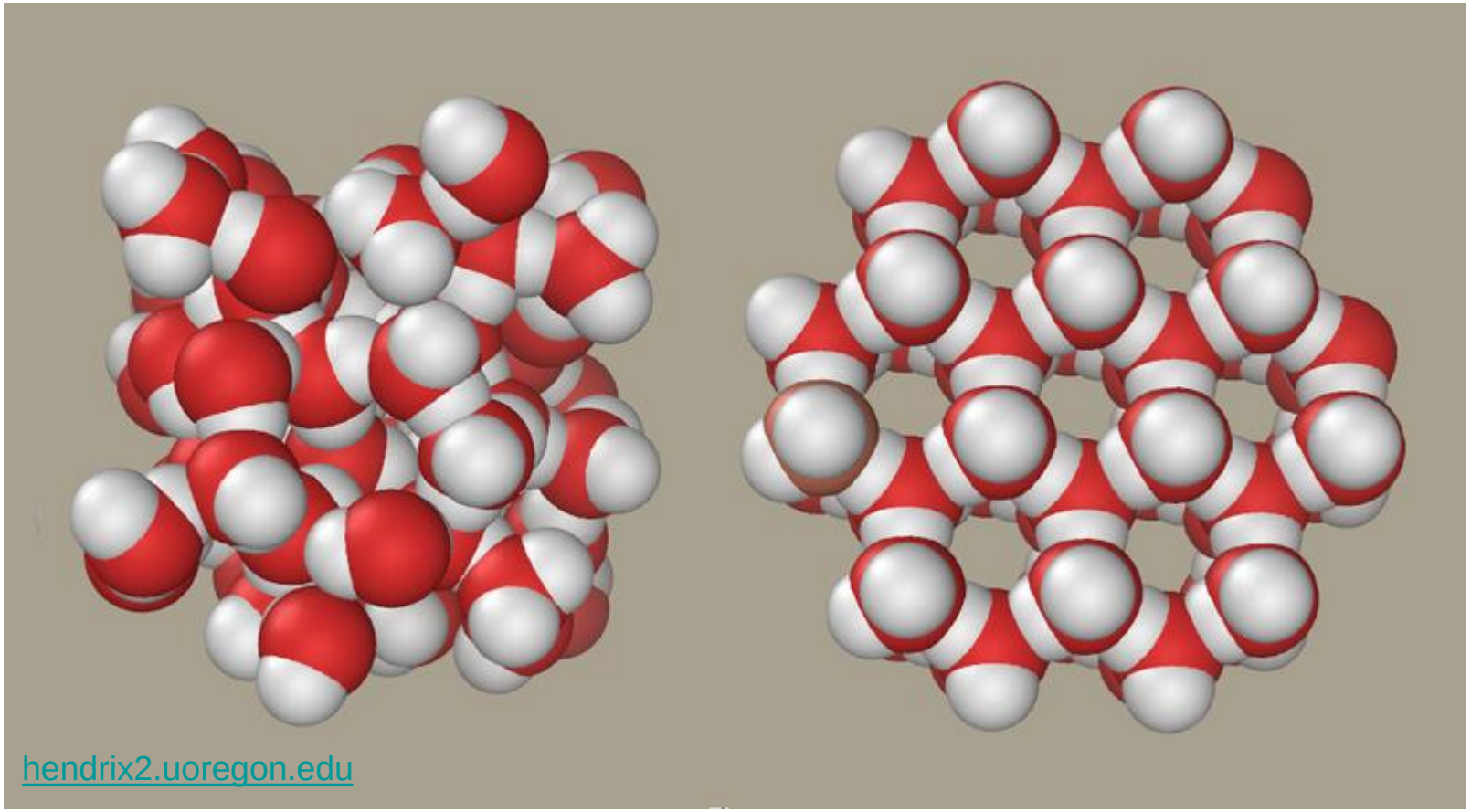
5) Tendency to dissociate into H^+ and OH^- in liquid state

acidic or alkalic nature of solutions

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



7) Expansion upon freezing leading to lower density



Water II.
Role in biology

1) enviroment for life
    a. cohesive behavior (H-bonds!)
    b. stabilisation of temperature
    c. expansion upon freezing
    d. dissolving capability
    e. weak viscosity (medium for transport, reactions)
    f. transparency

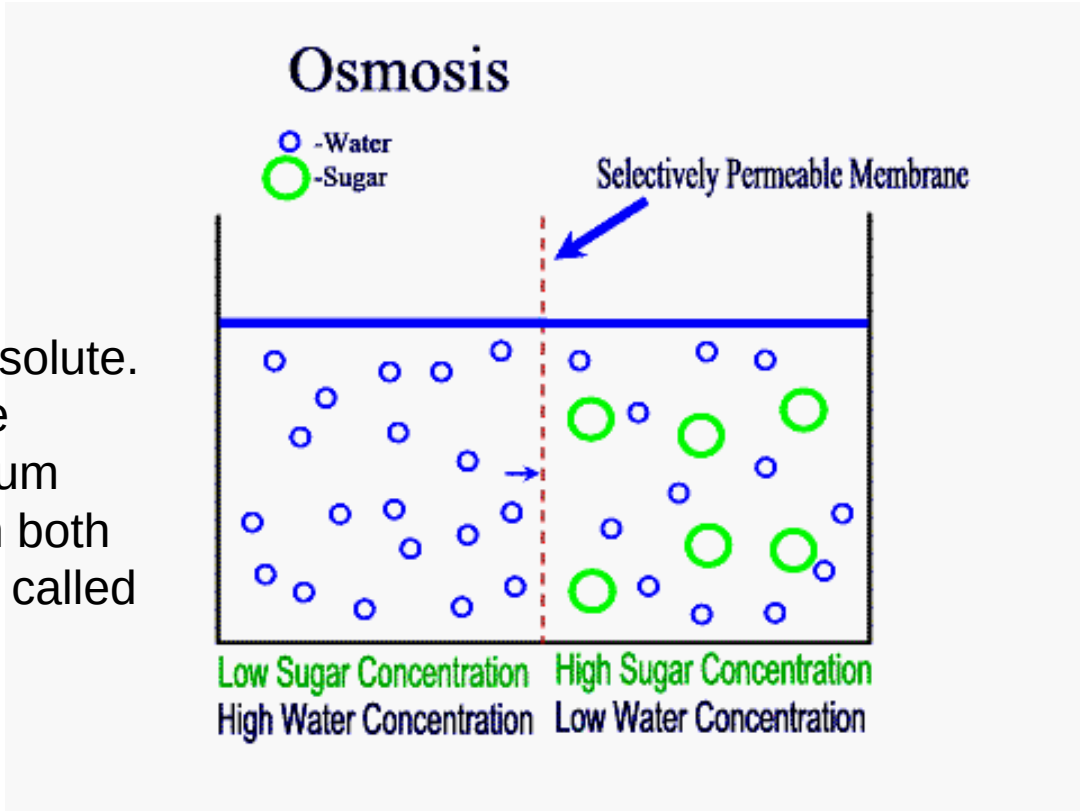
2) partner in biochemical reactions as either substrate or endproduct
    a) condensation (dehydration)
    b) hydrolysis (hydration)

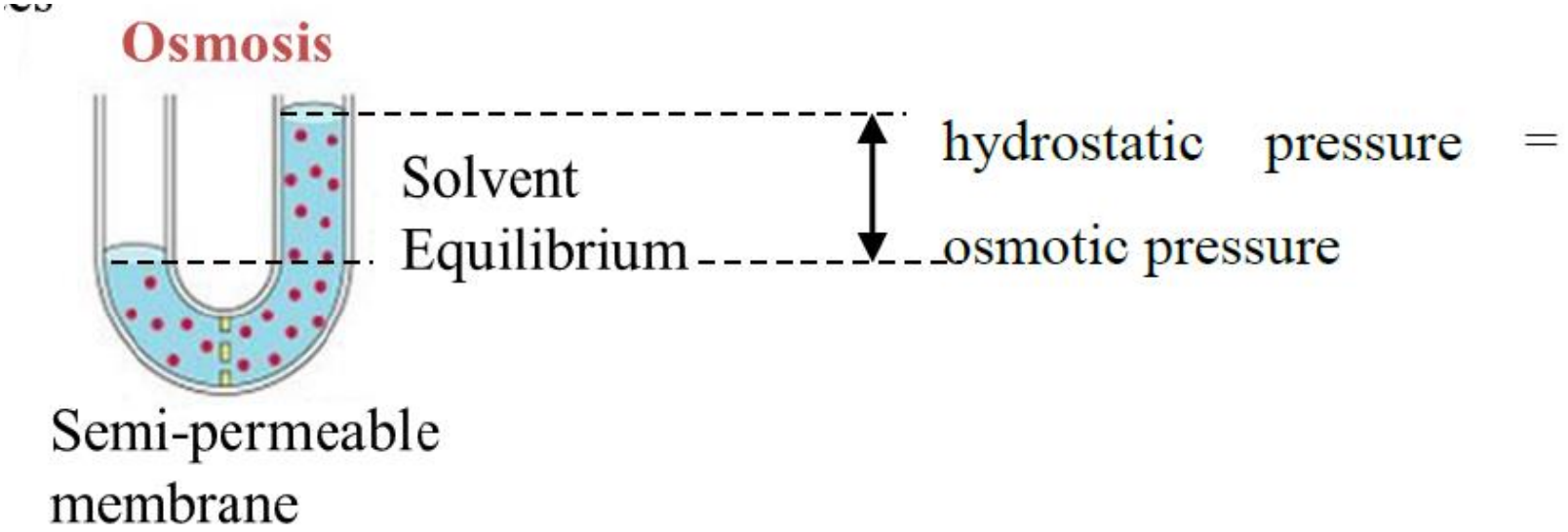
3) role in photosynthesis (photolysis of water)

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

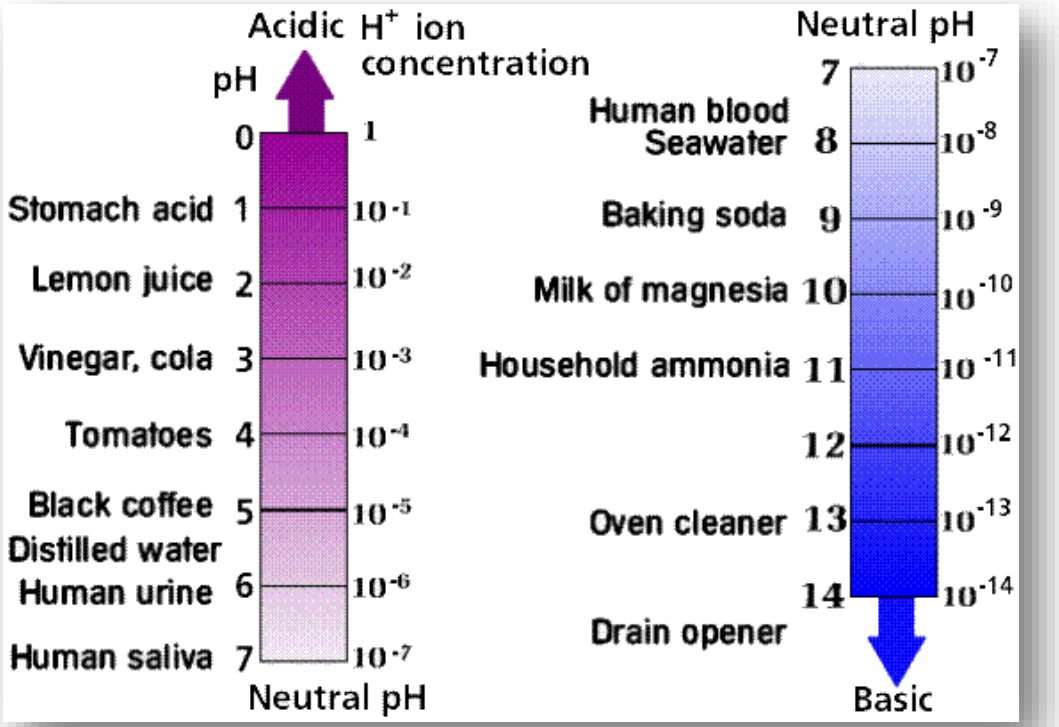
Osmosis: The solvent (water) is flowing through a semipermeable (selectively permeable) membrane, towards the higher concentration of solute. The pressure, which is needed to be exerted to reach a dynamic equilibrium state, where the solvent is flowing in both directions with tha same intensity, is called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





Water IV.

pH



$$\mathrm{pH} = -\log_{10}[\mathrm{H_3O^+}] = -\lg[\mathrm{H_3O^+}]$$

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