

Chapter 1 Biological molecules

1.1 Water

- Water is an inorganic compound consisting of the elements hydrogen and oxygen
- An individual human cell contains approximately 75% water
- The whole body is made up of 65% water

Free water (游离水) and bound water (结合水)

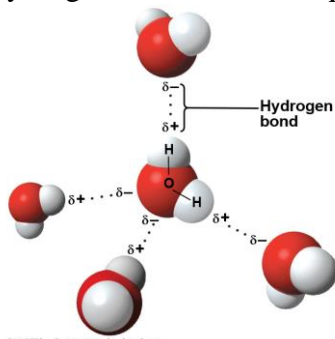
Free water	Bound water
Free water is surrounded only by other water molecules, free from any other constituent	Water that is an essential component of various materials (such as animal and plant cells or soils) from which it cannot be removed without changing their structure or composition and distinguishable from free water in such ways as by its inability to dissolve sugar or to form ice crystals

Covalent bond (共价键)

- Covalent bonds are formed when there is/are sharing of a pair/s of electrons to fill the outermost shell. e.g., H₂ (H - H) single bond, O₂ (O = O) double bonds
- Covalent bonds can be polar or nonpolar

Hydrogen bond (氢键)

- The attraction between a highly electronegative atom (e.g. O, N, F) and a hydrogen atom in another polar covalent bond



Polar molecule (极性分子) and nonpolar molecule (非极性分子)

Characteristics	Polar molecules	Nonpolar molecules
Definition	A polar molecule is a chemical substance in which the distribution of electrons between the atoms involved is uneven, resulting in a dipole moment	Nonpolar molecules are the molecules in which the electrons are equally shared among the involved atoms and have a zero-dipole moment
Examples	H ₂ O, NH ₃ , CHF ₃	CO ₂ , H ₂ , O ₂

Importance of water

- Water is a vital chemical constituent of living cells and environment for aquatic organisms

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- Water is a universal solvent (溶剂)
- Water is a good medium for transport and removal of substances and waste
- Water is the medium for biochemical reactions
- Water is a good temperature buffer
 - Water has a high specific heat capacity (比热容量)
- The density of water is highest at 4°C and therefore ice floats on top of water
- Water exhibits high surface tension (表面张力) and cohesion (内聚力)
 - Surface tension: small organisms like water striders, rely on surface tension to walk over water surfaces
 - Cohesion: translocation of water through the xylem tissue in plants by forming a continuous column of water
- Water can provide support in herbaceous plants (草本植物) through turgidity of cells
- Water can act as a lubricant