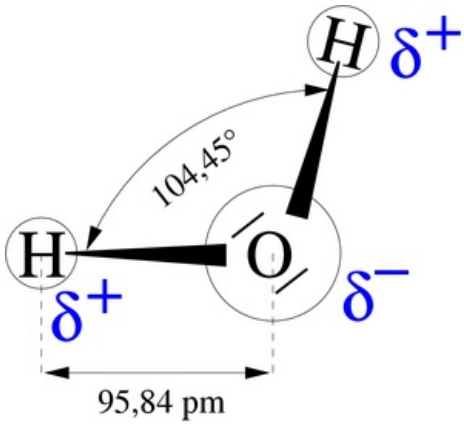
Water as solvent

Water is the most abundant component in living organisms, the most important solvent and is also, understandably, an essential part of the human body. Most of the important life processes take place in the aquatic environment.

Water molecule structure, properties

Two hydrogen atoms, each with one electron, and one oxygen atom with six electrons are bound in the molecule. Through the action of covalent bonds, the atoms achieve the ideal noble gas configuration. The water molecule is bent and its bonds make an angle of *104.45°* (we base it on the theory of hybridization and the presence of two free electron pairs that slightly change the bond angle).

The significant electronegativity difference between oxygen and hydrogen works by causing the oxygen to attract the electrons involved in the bond. Therefore, *partial charges* are created in the molecule (negative on oxygen, positive on conductors), which cause the electric dipole character.



Refracted structure of water molecule

Hydrogen bridges

So-called ***hydrogen bridges***, weak bonding interactions between the opposite charges of neighboring molecules, are created electrostatically between water molecules (hydrogen bond energy for water is 19 kJ•mol^{-1}) . Thanks to hydrogen bridges, a spatial network of connected molecules is formed. Water is therefore a good **polar solvent**.

Molecules organize themselves into tetrahedra and thus create the crystalline structure of ice (partially also of water). The **density of water**'is highest at *3.98 °C* and it is the so-called ***water anomaly***, because for other liquids the density increases with decreasing temperature.

Water as a solvent

Thanks to its asymmetry, water dissolves hydrophilic, polar substances in gaseous, liquid and solid phases, thus creating aqueous solutions. In the organism, they form a dispersion environment for macromolecules, molecules and ions in cells and thus help mutual interaction. When substances are dissolved in aqueous solutions in the form of ions, the solution is an *electrolyte* and conducts electricity (eg saline - 0.9% NaCl aqueous solution). Many organic substances (glycerol, ethanol, proteins) in aqueous solution do not conduct current, they are surrounded by water molecules, but are not split to ions.

Process of dissolution

The process of water dissolution can also be called electrolytic dissociation (dissociation due to the effect of a polar solvent). Electrolytic dissociations are divided into two types:

Dissociation of substances with an ionic lattice

Solvent molecules that surround the lattice orient themselves toward the surface of the lattice. Each molecule orients with the opposite charge to the ion in the lattice. Through the action of binding forces, the solvent molecule weakens the bonds in the lattice and tears off the ions, which are then released into the solution.

Dissociation of substances with a polar bond

As a result of the interaction between polar molecules (e.g. HCl, CH_3COOH) and polar solvent molecules, there is an *increase in polarization* of the covalent bond of polar solvent molecules. This causes the molecule to split completely. However, the released ions are still firmly surrounded by solvent molecules, creating a so-called ***solvation shell***. This process is also called *solvation*.

Water in the organism

Water in the body is divided into **free** water, which ensures the dissolution and transport of substances, and **bound** water, which is bound in hydration packages (eg hydrophilic colloids). Both components are in balance and their molecules are constantly exchanging with each other. Water is the final product of various biochemical reactions, one example being the course of oxidation. osmosis also plays an important role, thanks to which water in the body can move through *semipermeable membranes*. What will be the water content in individual body parts depends on

the content of osmotically active particles - osmolarity. (tooth enamel contains the least amount of water) Water is also important for thermoregulation and heat removal through sweating, due to its high value of vaporization heat (2.25 MJ•kg^{-1}) at 37 °C.

Links

Related Articles

Solutions

References

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