

1. The permanent dipole moment of the molecules
2. The density of dipole
3. How easily they can reorient in response to a field
4. How cooperative the reorientation is.

When consider the water it has a high dipole moment and due to its small size the density of dipole also high .due to its H-bonds it can easily reorient. The polarizability and flexibility of water give a small support for the dielectric constant. In addition to these factors; the temperature also affect on the dielectric constant of water. When the temperature is increased the dielectric constant is increased.

Ionization

In water the electron density around hydrogen is very low. Therefore the O-H bond is highly polarized. As a result of that the ionization is taken place as H^+ and OH^- . The spontaneous ionization of water can be expressed by the dissociation constant of water.

$$K_w = \frac{[H^+][OH^-]}{H_2O} = 1.82 \times 10^{-16} \text{ mol l}^{-1}$$

As 25°C the H^+ concentration in pure water is 1.0×10^{-7} and the pH is 7. The mobility of the H^+ ions in water is done by a hopping mechanism. The ionization constant of water is higher than of most organic solvents. The self ionization ability of water helps it to exchange the OH^- and H^+ with many of polar solutes. Water donate H^+ to

a base or accept H^+ from an acid. This acid-base reaction and the proton exchange reactions help to biological reactions in the organisms. Signal and energy transmission inside the biological systems can be done rapidly due to these reactions.

Hydrogen bonding

Water structure

Water has three states; vapour, liquid and ice. The liquid phase is important for living things. H-Bonding is the bond between the polar H and a strong electronegative atom such as C, N, O and S. In the water vapour the H-bond strength is 22.7 kJ mol^{-1} . But in solid state and liquid state the H-bond depends on geometry and the surrounding molecules. Coulombic interactions between H and the next atom can be used to explain the H-bond character. In ice-I the water molecules are arranged in a tetrahedral lattice. One water molecule is attached with four other water molecules. 2 H atoms in water make H-bonds with another 2 O atoms and O atom makes two H-bonds with another two water molecules. This is 2-2 H-bonding symmetry.

Effect of solutes

The radial distribution function of water is dominated by the size and packing of the water. Angular structure of water also affect on solutes. Apolar solutes and groups do not make strong electrostatic interactions with water. But they make vander waals interactions. The effect of the