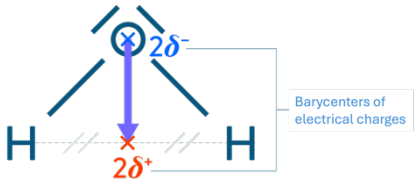
Water, a blessing for life

Water, H_2O, is a polar molecule. It is slightly negative (-δ) at the Oxygen end, and slightly positive (+δ) at the Hydrogen end.
This feature allows H_2O to interact electrically with other entities.



"The" universal solvent

The polar properties of water make it a good solvent for:

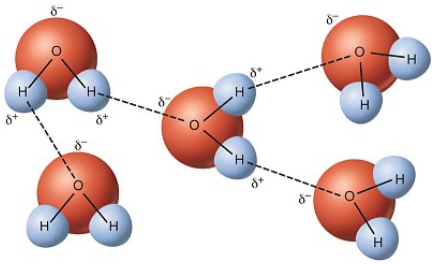
- Polar molecules, such as sugars and alcohols.
- Ionic compounds, such as salts, acids and bases, which will be dissociated into their component ions.

Ex: $NaCl_{(s)} \xrightarrow{water} Na^{+}{}_{(aq)} + Cl^{-}{}_{(aq)}$

This allows the transport of important molecules or ions inside the organism and through the cell membrane.

Cohesion

Due to their polarity, water molecules in liquid state interact with each other and form a lattice through interactions between "positive" hydrogen and "negative" oxygen atoms: hydrogen bonds.

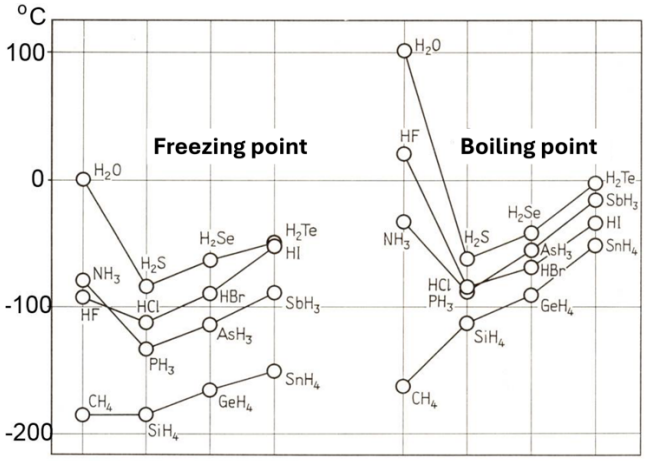


Although the arrangement of molecules in a sample of liquid water is constantly changing, at any given moment many of the molecules are linked by multiple hydrogen bonds. These linkages make water more structured than most other liquids. Collectively, the hydrogen bonds hold the substance together, a phenomenon called cohesion. Cohesion due to hydrogen bonding contributes to the transport of water and dissolved nutrients against gravity in plants (Figure 3.3). Water from the roots reaches the leaves through a network of very thin columns made of water-conducting cells: When water leaves a leaf due to transpiration, it "pulls" on the molecule below, which pulls on the molecule below, …

Note: *The lattice formed by the molecules of water is strong enough for some organisms to be supported. This is called surface tension.*

High heat capacity

The heat capacity of a substance is the energy involved in the change of the temperature of 1 kg of this substance by 1°C. The higher the heat capacity of a substance, the more energy is required to change its temperature.
When water is heated, energy is required to break the multitude of hydrogen bonds, resulting in a high heat capacity, thus abnormal high freezing and boiling points.



Water therefore is a thermally very stable environment, helping living organisms resist changes in their environment.

Note: As a lot of energy is required to change water from a liquid to a vapour, evaporation of water on the surface of a body cools it down significantly.