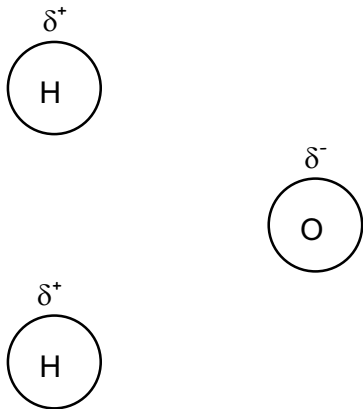


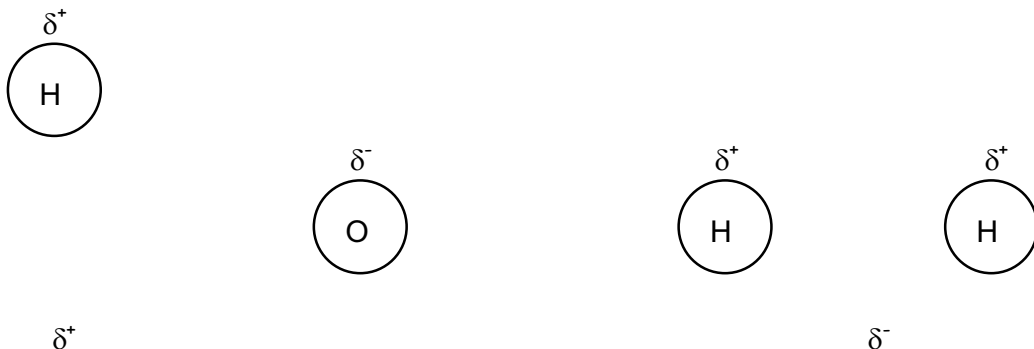
Discuss how the properties of water affect living organisms and why water might be considered essential to life on Earth

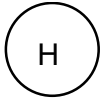
Water is the most abundant molecule in cells, whole organisms and on earth. It is necessary for life to exist on earth and this can be seen as it makes up between 60% and 95% of the mass of living organisms. Water makes up 75% of the Earth showing that it is needed for life as it is so readily available.

Water is a polar molecule this means that it has positively and negatively charged areas. Water is made up of two positively charged hydrogen atoms and one negatively charged oxygen atom.

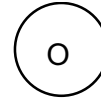


As a result of this polarity adjacent water molecules are attracted and form hydrogen bonds. These form when the slightly negative oxygen atoms bond with the slightly positive hydrogen bonds from another water molecule.





first water molecule



second water molecule

Individually the hydrogen bonds are weak but collectively they are strong and they give water a high specific heat capacity. This keeps a stable temperature in living organisms and in cells. This is especially important for metabolic reactions.

The polarity of water is very important for its properties as a solvent. Water allows other polar substances to dissolve into it easily. These are substances such as salts, simple alcohols and sugars. For example when sodium chloride is dissolved in water it splits forming ions of sodium and chlorine. The sodium cations are attracted to the negatively charged oxygen atoms and the chlorine anions are attracted to the positively charged hydrogen atoms. These polar substances are said to be hydrophilic. Any substances which are not polar do not dissolve in water. The use of water as a solvent is very important. All of the substances which are essential for cells and organisms to function are carried in solution. Also, all metabolic reactions occur in solution.

The hydrogen bonding between water molecules is important for its thermal properties. The high specific heat capacity of water is important for living organisms which need to keep particular temperatures in order to ensure optimum enzyme activity. The high water content of cells and tissues help to maintain a constant temperature. In this way water acts as a temperature buffer. Hydrogen bonding is also the reason that ice is less dense than water and so it floats. This allows the water below the ice to be insulated keeping a constant temperature in the water for all the organisms living in the water. Water can also be used for cooling. This is when evaporation occurs as a lot of heat energy is lost through evaporation. Therefore sweating is an efficient cooling mechanism in humans.

The combination of water's thermal stability and solvent properties make it a perfect environment for chemical reactions. Examples of reactions which take place in solution are photosynthesis, respiration and excretion.

Water is also important for transport. It is used by plants for the uptake of minerals from the soil across the root hairs. All transport fluids in animals are water-based. In plant cells, water is also necessary for turgidity. This maintains a large surface area, collecting more light allowing faster photosynthesis. In animals, turgid tissues also contribute to skeletal support and in aquatic organisms water gives support through buoyancy. Some organisms such as earthworms use water for movement

using their hydrostatic skeletons. Longitudinal and circular muscles contract against the watery fluid in the coelom causing movement. Water is also used in reproduction by organisms which employ sexual reproduction. Water is used to bring the gametes of the male and female together in fertilisation. In mammals the foetus then develops in a water filled sac providing physical and thermal stability.

In conclusion water is essential to life on Earth. We can see this because without water many metabolic and enzyme reactions would not be able to take place. These reactions are essential for the survival of all organisms. Further proof that water is essential to life on Earth is that without water, sexual reproduction cannot take place and the foetus of mammals would not be able to survive and therefore humans would not be alive. Water is also used by many organisms as a temperature controller. Therefore without water many organisms would either overheat or freeze. Without water, plants would also die as they need minerals from the soil and this is taken up in solution. They would also lose their turgidity, wilt, and die. These facts show that water is essential to life on Earth.