

The Importance of Water in Living Organisms

Water has importance inside cells and externally. This may be because it has interesting chemical and physical properties; it can be found naturally in all three of its states. However its molecules are bonded together by hydrogen bonds, this brings up its melting and boiling points, i.e. its boiling point would be -120°C rather than 100°C . Also because it contains slightly negatively charged oxygen atoms and slightly positively charged hydrogen atoms making it polar.

Water has been called a universal solvent because of its polarity. This means it can easily ionise substances, many compounds, whether ionic, polar or covalent will dissolve in it, therefore more reactions take place while in solution with water. Often in organisms substances must be in solution and water is the solvent. Plants can only obtain mineral salts in solution and human digestion will only dissolve soluble foods, meaning large starch molecules must be broken down into soluble sugars. Also many organisms living in water spend most of their time underwater, yet they require oxygen to respire, and as water is such a good solvent the required oxygen gas is dissolved in the water.

Water is the most abundant component in any organism, the lowest is 20% in seeds, while jellyfish are 99% (hence the transparency). It plays vital roles in the metabolism of all cells and in photosynthesis (providing raw materials) in plant cells. In all cells water is used for; hydrolysis, the breakdown of a substance by water, e.g. polysaccharides to monosaccharides, forming a glycosidic bond; a medium for chemical reactions, due to its properties as a solvent; the diffusion and osmosis of substances, e.g. gaseous exchange, which need to be moist as the exchange takes place in solution, therefore there is water in the lungs or in mesophyll cells in plants.

It is also used on a much larger scale for transport. Blood is mostly water, and is used to transport food, hormones, waste products (ammonia and urea) and oxygen, similarly in plants; sap is used to transport food and other substances. These substances all easily dissolve in water and then can be transported, whether it is oxygen to tissues, or hormones to various organs. Water is also used during fertilization when sperm must reach the ovum; the sperm is transported in semen, which is mostly water.

Due to water's viscosity it is a useful lubricant, as it reduces friction giving free and easy movement. For example the bodily fluid at joints, is mostly water. Water also surrounds many internal organs to give protection and lubrication like the pleural fluid around the lungs, the pericardial fluid around the heart and the brain contains cerebro-spinal fluid. The aqueous and vitreous humours of the eye help maintain its shape too. Amniotic fluid

protects and supports a foetus when it is growing and another lubricant, mucus is used in the gut to allow food to pass more easily through.

Water can also be used for support. As plant cells have cell walls as well as cell membranes, when the plant cell becomes full of water (due to osmosis) it will not burst but the cell wall exerts a force equal to the osmotic force (the cell is turgid) and this is important in the support of leaves and also in the stems of herbaceous plants. In animals like the earthworm support is often provided by the pressure of the fluid inside them, e.g. a hydrostatic skeleton.

Water can also be used to provide a habitat. Life originally evolved in an aqueous habitat and still provides an ideal habitat for a variety of life. This is for many reasons, a large mass of water around an organism can act as a protective shield, preventing the cells from drying out as they would on land; it provides support and buoyancy, so woody tissue and bones are not needed in such large amounts: due to its solvency and mobility nutrients can be easily supplied to an organism and waste products can be removed by diffusion (e.g. the gills of a fish): fertilization is much easier due to the surrounding water, and when offspring are produced they can more easily spread out, reducing the risk of competition; temperature remains constant (due to its high specific heat capacity) so few temperature control mechanisms are needed; finally water filters out harmful ultra-violet rays from the sun.

Water's unique role is due to its physical and chemical properties, they allow water to act as an excellent solvent because of its polarity, water is an excellent support mechanism because of its cohesive forces within molecules and being virtually incompressible, this also means water is a good protective fluid. Water is also important because of its abundance. Although, as all life evolved in water, but some organisms having moved onto land, they will all still rely on the conditions they found and used to their advantages in their original habitat