



## 16 - Water

### The Source of Life: Celebrating the Power of Water

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#### Video 16 - Transcript

Hi everyone. Welcome to video number 16. Today we're going to be looking at water. Now, we've met water before, and we've also gone through the hydrogen bonding that water exhibits. But today, we just want to delve a little bit more into the properties of water and what makes it so special. Water -  $H_2O$ , is commonly called the universal solvent. Water provides the aqueous media, which supports the chemical reactions of life. This here is the structure of water - one O atom bonded to two H atoms. Whilst the intramolecular forces in water are covalent, the intermolecular forces are hydrogen bonds. Now, we looked at hydrogen bonds in detail in video number 11, as well as the anomalous or strange behavior of water. We normally use water to exemplify hydrogen bonding, since water is so vitally important to life. One of the most important properties of water is its ability to be a solvent. Hydrogen bonding facilitates this ability. The term "like dissolves like" is one of the simplest ways to describe the solution properties of solute-solvent interactions. When a solid or a solute comes into contact with the liquid or the solvent, various intermolecular bonds or forces must be severed in the liquid, and therefore create spaces or holes for which the solid can now form new intermolecular bonds. These are usually ion-dipole forces of attraction, and hence solute becomes solvated. This is the basic process of forming a solution. A solid will only go into solution if the correct number and magnitude of intermolecular forces - correct number and magnitude of intramolecular forces are formed upon contact between the solute and the solvent. The overall enthalpy change must be negative for a favorable exothermic process. The ability of a solvent to, for example, hydrogen bond, will be critical in assessing its solvating properties. Now, water has a great ability to do just that. That makes it an ideal solvent for polar molecules. Of course, non polar solvents will be able to solubilize non polar solutes and the intermolecular attractions at play in those systems would be Van der Waals forces. We have listed here eight distinct properties of water that makes it so very important and special to biology. First, water has a small size. It just comprises of three atoms. It has a bent shape, as we always draw water in this form, bent or V-shaped, It is a highly polar substance, which comprises of highly polar covalent bonds and possesses overall polarity. My oxygen has a slightly negative charge, and my hydrogens have a slightly positive charge. Water also exhibits cohesion, and adhesion. Cohesion is the ability of water to stick to itself, whilst adhesion is the ability of water to stick to the system that it is contained in. Adhesion, for example, is responsible for the formation of a meniscus as well as capillary action. We mentioned before that water is denser in its liquid form than in its solid form. This is anomalous. Lastly, water has a very high specific heat capacity, which means that it takes a relatively large amount of heat energy to increase the temperature

of water by 1 degree. All of these properties of water makes it extremely important in sustaining life on Earth.