Features of Water

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**Introduction**

Water is well known to be inorganic denoted as H2O and covers the largest space of Earth’s hydrosphere including approximately 60% solvent of human body. Water has so many features that give it its special properties as a liquid. Liquid water acts as a major solvent to dissolve majority of polar solutes due to the presence of the electronegative oxygen atoms and electropositive hydrogen atoms. Water molecules have the ability to attract itself and other molucules, a feature called cohesiveness and adhesiveness. Also, it has high heat capacity and high vaporization heat which is a necessary feature for cooling and regulating temperatures respectively. Such features of water form the basis for this paper (L*esson Summary: Water and Life (Article) | Khan Academy*, 2024).

The first feature of water is its polar nature. This means that the hydrogens and oxygen atoms have partial positive and negative charges respectively characterized with a chemically bent structure. According to Helmenstine (2021), the oxygen has a high tendency to attract electrons since it is highly electronegative and hence, each hydrogen atom gives an electron in order to fill the oxygen valence shell. Initially oxygen’s valence structure is 1s2 2s2 2p4 and after the donation it becomes 1s2 2s2 2p6 and hence, the four electrons in the 2p outer shell are not involved in the chemical bonding. The electrons contain equal amounts of negative electrical charges and therefore they repel each other. This repulsion energy is enhanced by the hydrogen atoms repelling each other since they are positively charged and also the bond between the hydrogen atoms and oxygen atom. There is a balance act as the forces interact with each other leading to tetrahedral kind of structure but due to the invisible nature of the electron pairs what is observed is a bent molecular structure.

Water has an excellent solvency feature since it is capable to dissolve both polar and ionic components. In living things, as water travels through the body systems during various chemical processes it carries important nutrients along to various cells and parts needed in the body (*Lesson Summary: Water and Life (Article) | Khan Academy*, 2024). Due to the charge distribution in water as a polar molecule, approximately 20% of the water molecules are available to interact with external chemical substances added to the water as solutes. This interaction is called dissolving and gives water the nature of an universal solvent (A. M. Helmenstine PhD, 2022). For example, if salt is added to water and stirred, the crystals of salt dissociate to form Na and Cl ions. The Na ions are positively charged attracting the partially negative charges from water while the Cl ions attract the partially positive charges from water molecules. The oxygen attracts the Na ions while the hydrogen atoms are attracts the Cl ions. As the interactions continues, hydration shells are formed around all the Na and Cl ions and the initial table salt crystals are dissolved to form a solution (*Solvent Properties of Water (Article) | Khan Academy*, n.d.). Besides being a good solvent, it does not dissolve nonpolar molecules and this explains why fluids such as oil do not dissolve in water. The nonpolar molecules lack regions containing partial positive and negative charges making them electrostatically repellant to water molecules and form droplets when added to water.

Another key feature of water is that it has a high heat capacity which is described as the ability of the water molecule to take in heat energy. In order to raise temperatures of a given amount of water by a degree, it will consume a lot of energy. According to Libretexts (2022), it requires 1 Calorie of energy in order to raise temperature of 1 gram of water by 1o Celsius. Therefore, it takes much time and energy to heat water and a considerable amount of time to cool water. The resistance nature to sudden rise in temperature gives organisms an advantage to thrive and survive through regulated body temperatures. Mechanically, the high heat capacity nature of water is an advantage to machine cooling systems such as cars. Water has five times more specific heat capacity than that of sand and that is the main reason why the land has a less cooling time than the sea.

Due to the high heat capacity feature of liquid water, heat of vaporization is also very high. This means that amount of heat energy required to convert 1 gram of water into a gas or vapor is considerably very high. The existence of the strong hydrogen bonds requires around 540 Cal/g at 1000C, which is a high amount of heat energy for the water to be converted into gaseous state (*Specific Heat, Heat of Vaporization, and Density of Water (Article) | Khan Academy*, n.d.). The process of evaporation involves water molecules gaining kinetic energy and leaving the water surface causing a cooling effect at the surface they have left. In human body, the heat of evaporation is an advantage. During evaporation of sweat due to rise in temperatures, the sweat carries off heat from the body to the atmosphere and there is a reverse cooling effect on the body which is necessary to cool the body and maintain a steady body temperature.

Lastly, water has both cohesive and adhesive features. Cohesive feature allows hydrogen bonding among water molecules. Adhesive feature is the ability of the water molecules to stick and interact with other substances. The hydrogen bonds allow a needle to float on the water if placed carefully without breaking the surface tension and also water to form droplets on a dry ground surface. It is this property that also allows water to form a dome shape when above the glass rim. The adhesive feature allows water to rise in glasses such as capillary tubes since the glass molecules have a higher polarity than water molecules. These two forces allows movement of water up the trees, movement of tears from tear duct to the eyes corner and even allowing insects to float on water surfaces through surface tensions (Libretexts, 2022b).

**Conclusion**

In conclusion, liquid water as an organic compound covers a large extent in human existence and has many features that make it a unique liquid. As discussed above, it has a polar nature that gives it a bent geometric structure, high solvency feature since it is capable to dissolve both polar and ionic components, high heat capacity making it a better cooling agent, high vaporization heat and the cohesive and adhesive features that aid liquid water to rise up in objects.

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