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Chem 2310

H_2O

When I was interviewing for my current job, my employer knew that I am a student of chemistry so he asked me several questions related to water. He asked how much I knew about it, its shape, composition, and other pH related questions. I passed his quiz with flying colors and he told me that he was impressed because most people that he has interviewed over the years were not able to answer his questions, despite them having much more formal education than me. This experience sparked in me an interest in water and its importance in the universe.

Water is a very intriguing molecule to me. It is necessary for so much including the possibility of life itself. It's used not only as a solvent in many chemical reactions, but also for many everyday activities such as cooking, cleaning, and gardening. It has unique properties that allow it to be found naturally in all three phases of matter. Since our bodies contain so much of it, it is important for health. It also helps keep the earth at a relatively stable and livable temperature. I am constantly affected by the presence of water in my home life, at school, and at work, and without it, life, if at all possible, would be different.

Water is a bent molecule, meaning it has a V shape like if you were to bend a straw in the middle. Each molecule consists of one Oxygen atom covalently bonded to two Hydrogen atoms with a bond angle of 104.5°. The shape of the molecule, caused by the lone pairs of electrons on the Oxygen atom, causes it to be polar.

Apart from the general importance of water, water is a special molecule for me because one of my hobbies is cooking. Recently I was cooking spaghetti using a family recipe for the tomato sauce but while the sauce was simmering, I realized that it was going to be too thick. Luckily, I was able to add some to my sauce to make it thinner. I also recently used it to bake a loaf of bread along with many other dishes where water is an important ingredient. Water is such an important ingredient in cooking simply because it is odorless and tasteless, so it can be added to many dishes without fear of altering the desired taste of the final product. Obviously, many meals can be prepared without the direct use of water in the food preparation, but it would not be possible to have the food to cook in the first place without water.

Plants, along with animals, require water to grow and reproduce. During photosynthesis, water and carbon dioxide are absorbed by the plants and undergo a redox reaction to produce oxygen and glucose (National Geographic Society). Gardening is another developing interest of mine and it fascinates me that the health of different plants is often directly related to the amount or quality of water used. Water, in a pure solution, does not contain anything that is harmful to plants (or animals) but it is interesting to me that something so pure and seemingly harmless can be a carrier of impurities.

A few years ago, I was living in Peru in a town called Pucallpa. This town is very impoverished and as a result clean water was hard to come by. I was instructed not to eat certain fruits because they were grown with untreated sewage water and these particular fruits had high water content. I am uncertain as to the veracity of the claim that the crops were dangerous to my health because the water was dangerous, but it is true that water is a very common solvent for both harmful and helpful compounds. Vitamin C, for example, is a water-soluble vitamin that is used to improve overall health. I often drink a glass of water mixed with vitamin C to attempt to prevent myself from

getting sick or help myself heal faster if I do get sick. Water dissolves the vitamin, and once in the body, transports it along with other necessary vitamins to different parts of the body.

Along with being an important solvent for regular bodily function, it is also an important lab-based solvent. I work in a molecular biology lab where we experiment with Polymerase Chain Reaction (PCR). PCR is a technique to amplify or multiply a sample of DNA. This involves adding specific amounts of different components such as a DNA or RNA template, fluorescent dye, short ssDNA called primers, and a variety of enzymes. We often have a DNA template at a stock concentration of several orders of magnitude higher than what we need to add to the reaction. This turns out not to be a problem because most of the time we can simply use water to dilute the solution to the proper dilution.

Water is necessary for life to exist on this planet both in an individual and a general sense. About sixty percent of the adult human body is water (The water in You: Water and the human body). Water has many functions within the body such as digestion, joint lubrication, vitamin transportation, etc. While hydration is important for the individual, the water on earth and within its atmosphere is equally important for life. One reason for this is that water has an exceptionally high specific heat. The specific heat is $4.186\ \frac{Joule}{gram\,°C}$ which means that it takes over four joules to heat one gram of water one degree centigrade. Due to this specific heat capacity, the water on earth and in its atmosphere (specifically the oceans) act as a heat sink so the overall temperature on the surface of the planet is low enough and stable enough to be habitable.

Another property of water that I find particularly fascinating is its ability to form hydrogen bonds with itself. The hydrogen bonding causes it to have a high surface tension which allows it to do what is known as “capillary action”. This capillary action is how water can move around in the body and plants. The high surface tension causes the water to be “sticky” so it can move up a tube or porous material by sticking to itself and the walls of the tube and climb up against the force of gravity which would push it down. This movement is another reason why water is so important for individual health because the water will not only carry different nutrients, it can carry it in all directions in the body.

Along with its importance in relation to chemical and biological advances, it also has a different kind of importance to me since it is also used for recreational activities that I enjoy. A short list includes boating, fishing, kayaking, swimming, and water balloon fights. The fact that it can be found in more than just liquid form means that I can enjoy winter sports such as snowboarding, snowshoeing, and snowman building.

In my opinion, water is the most important molecule because without it, we would not even be alive and any other molecule would not have any importance. At first glance, it seems like a very basic molecule and relatively unimportant, or at least that’s what I thought when I first started learning chemistry. I always saw it as an introductory level molecule that teachers would present in order to teach concepts like hydrogen bonding, or molecular shapes, or pH, but the more reactions I learn about, the more I realize that water is presented early on not because it is basic, but because it is involved in so much.

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Works Cited

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