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Water

BC Biology 12 p. 29-30

1. Polarity within a water molecule causes the positive hydrogen atoms in one molecule to be attracted to the negative oxygen atoms in other water molecules. This attraction is called a hydrogen bond. Because hydrogen bonds can be easily broken, they are often represented by dotted lines.

2. Organisms are composed of 70 - 90% water.

3. Water is a polar molecule meaning it has charged atoms. There is a weak positive charge on the hydrogen atoms and a weak negative charge on the oxygen atom.

4. Draw and label a water molecule:

5. Water has a high heat capacity, keeping the body from heating up. The many hydrogen bonds that link water molecules help absorb a great deal of heat without a great change in temperature. Because the temperature of water rises and falls slowly, organisms are better able to maintain their normal internal temperatures and are protected from rapid temperature changes.

6. Without hydrogen bonding between molecules, water would melt at -100 °C and boil at -91 °C. Because of hydrogen bonding, water is a liquid at temperatures above 0 °C and below 100 °C.

7. Water has a high heat of vaporization. This is because hydrogen bonds must be broken before water boils and is changed to a vaporized state. When an animal sweats, or gets splashed, body heat is used to vaporize the water, thus cooling the animal. This is why temperatures along the coasts are moderate due to water's high heat capacity and high heat of vaporization. During the summer the ocean absorbs and stores solar heat, and during the winter, the ocean slowly releases it.

8. Water is the universal solvent and facilities chemical reactions inside and outside of living organisms. A solution contains dissolved substances called solutes. The negative ends of the water molecules are attracted to the positive sodium ions, and the positive ends of the water molecules are attracted to the chloride ions.

9. Molecules that can attract water are said to be hydrophilic. Molecules that cannot attract water are said to be hydrophobic.

10. Water molecules are cohesive and adhesive. Water molecules cling together because of hydrogen bonding. Water exhibits adhesion because its positive and negative poles allow it to adhere to polar surfaces. Cohesion and adhesion contribute to water's role as a lubricant. These properties also contribute to the transport of water in plants. The roots of the plants absorb water while the leaves lose water through evaporation.

11. Water has a high surface tension. The stronger the force between molecules in a liquid, the greater the surface tension. Hydrogen bonding causes water to have a high surface tension. This allows humans to skip rocks on water. It also allows the water strider to walk on top of a pond without breaking the surface.

12. Frozen water is less dense than liquid water so that ice floats on water. As liquid water cools, the molecules come closer together. When water is frozen it forms a regular crystal lattice that is rigid and has more open space between the water molecules. For this reason water expands when it freezes.

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Water

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1. What is a calorie?

- the amount of heat energy needed to raise the temp. of 1g of H_2O by 1°C.

2. What is organic chemistry?

- the study of compounds containing carbon.

3. Why is water not considered an organic molecule?

Water does not contain carbon

4. Why is water considered polar? Oxygen has slight negative charge, H $\delta+$ the sharing of the electrons b/w hydrogen + oxygen is not equal

5. What causes polarity in water molecules?

the electrons spend more time around O than H

6. What can form between adjacent water molecules?

Hydrogen bonds

7. Explain the following major characteristics of water:

a. It maintains a relatively constant temperature:

the many hydrogen bonds that link water molecules help water absorb heat without a great change in temp

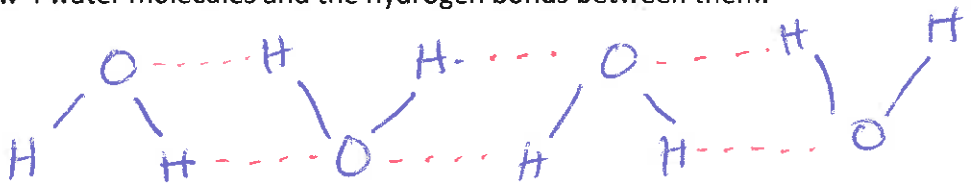
b. It is cohesive:

- water molecules cling together due to H-bonding

c. It is an excellent solvent:

- due to its polarity, water facilitates chemical rxns inside and outside the body, water dissolves all polar molecules.

8. Draw 4 water molecules and the hydrogen bonds between them:



9. Fats have no charge and thus do not dissolve in water. Water molecules only dissolve charged substances. Look at the diagram below, why are the water molecules facing a different way when water dissolves Cl^-, compared to Na^+?

Opposite charges attract eachother.

Cl^- is attracted to H ($\delta+$)

Na^+ is attracted to O ($\delta-$)