Name:_____

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Water is AWESOME!

In the space below write down the important information presented to you by Hank Green in the Crash Course Biology Lesson "Water- Liquid Awesome": (link for this video is provided)

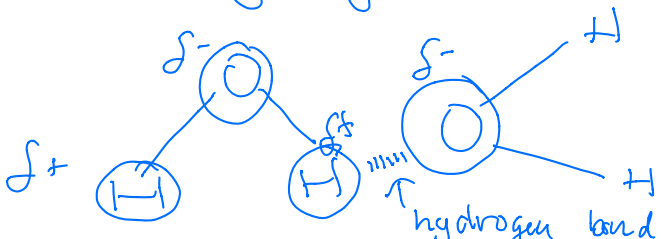
1. Water's unique molecular structure and H-bonds
2. Cohesion and surface tension
3. Adhesion and capillary action
4. Water is "polar" and often called the universal solvent.
5. hydrophilic substances "like" water
6. hydrophobic substances "avoid" water
7. Ice has a lower density than liquid water due to "H-bonds"
8. water has a high heat capacity

You were informed in the above video that water is a "POLAR" molecule ….so what is the difference between polar and non-polar Molecules? Let's investigate:

When we learn about MATTER in junior science we are taught that it can be divided into two branches:

3. pure substances – elements and compounds
4. mixtures - solutions, suspensions and mechanical mixtures

Water is an example of a pure substance (a compound). But a glass of water is not just one water molecule, it is many water molecules that function as a single entity due to an inter-molecular force known as the Hydrogen bond.



There are two types of Bonding Categories:

I. Intra-molecular Bonding
II. Inter-molecular Bonding

Intra-molecular bonding is the junior science bonding which you used to classify a compound as being either ionic or covalent. Well, as you may know it is not that simple….some substances, like water, are somewhat ionic and somewhat covalent….we call these molecules "polar covalent". As we already learned in the chemical reactions unit; when determining if a compound is held together by what is called true covalent, polar covalent or ionic bonds we use the electronegativity and the formula:

$$\Delta EN = EN(larger) - EN(smaller)$$

If the ΔEN is between 0.0 and 0.5 it has "true" covalent ← 100% sharing

If the ΔEN is between 0.6 and 1.6 it has "polar" covalent ← unequal

If the ΔEN is between 1.7 and 3.3 it has ionic ← no sharing

WHAT IS A DIPOLE?

A dipole translates to mean two poles. Much like the earth with the north and south pole. One pole is designated as being negative while the other is positive. In polar covalent and ionic compounds there is a permanent dipole and the appropriate regions are designated with a δ^+ or a δ^-.

However, we know that all atoms are made up of a densely packed positive nucleus surrounded by loosely held negative electrons that are circulating the nucleus in what are called orbitals. When these electrons are on one side of the atom that side is temporarily negative (making the other side temp. positive). This means that even covalent compounds can (even if short lived) possess a dipole.

INTER-MOLECULAR BONDING (also known as Van der Waal forces in honour of Dutch scientist Johannes Diderik van der Waals) is the bonding that holds two adjacent molecules together. There are three types of inter-molecular bonding forces: Dipole-Dipole force, Hydrogen Bond and London Forces. It is because of these forces that we can pour water.

Read the Summary of Molecular Polarity and Polar and Non-Polar Solvents on page 207 and then use your own words to describe them in the space below:

London Forces:
only force that holds non-polar molecules together due to temporary dipoles created by the movement of electrons

Dipole-Dipole Force:
force that holds POLAR molecules together due to the existance of permanent dipoles

Hydrogen Bonding:
a specialized dipole-dipole force that hold together polar molecules that contain H and at least one of either N, O or F.

Now read pages 205-206 and explain the process of **SOLVATION: (AKA LIKE DISSOLVES LIKE:)**

Polar solutes are soluble in Polar solvents
non-polar solutes are soluble in non-polar solvents
Polar solutes are INSOLUBLE in non-polar solvents
However: non-polar solutes are only somewhat insoluble in polar solvents

The weak London forces that hold together non-polar solutes can be overcome by the stronger dipole-dipole forces that hold polar solvents together

Ex: 23 pg 208 (all)