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Unit 3: THE HYDROSPHERE

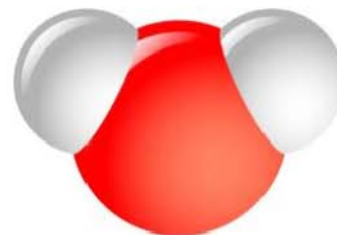
NOTES: 3.02

FOCUS: The Structure of the Hydrosphere

ESSENTIAL QUESTION: How are the properties of water unique compared to other liquid substances on Earth? What does it mean that water is a "universal solvent" and how does that affect water quality as it moves through the water cycle?

What do we already know?

- Water is matter, and all matter is made of atoms.
- Water's chemical formula is H₂O, which means it's made of 2 atoms of Hydrogen (H) and 1 atom of Oxygen (O).
- The water on Earth continually flows throughout the hydrosphere because of the water cycle.



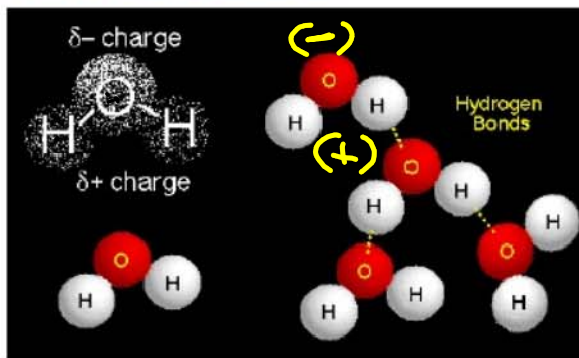
Water's Unique Properties

- Water is the most unique liquid substance on Earth because its physical & chemical properties are very different from other liquids.

has poles (top-bottom) + -
 • All of water's unique properties are caused by the polarity of water molecules.

- H₂O is bonded together by covalent bonds.
- Covalent bonds cause the electrons in the molecule to be shared unequally, giving the Oxygen atom a slightly negative charge and the Hydrogen atom a slightly positive charge.

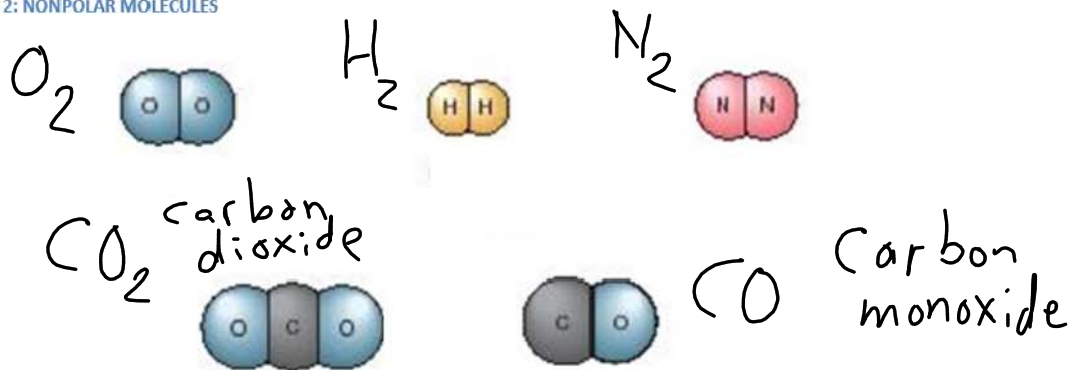
Figure 1: The Polarity of Water Molecules



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- This unique bond relationship makes all water molecules polar by giving them a negative pole (the Oxygen) and a positive pole (the Hydrogens).
- Molecules that are nonpolar have a neutral charge throughout the molecule.

Figure 2: NONPOLAR MOLECULES



- Water's polarity gives it several unique properties, including:
 - Cohesion & Adhesion
 - Capillary Action
 - Surface tension
 - Universal Solvency
 - High Specific heat

Cohesion & Adhesion

• Cohesion: The sticking together of molecules of the same substance

- Water molecules are called "sticky molecules" because they attach to other each easily and are difficult to separate.



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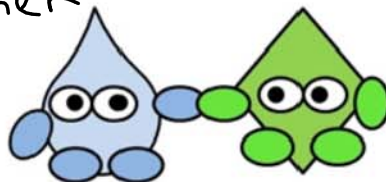
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- The (+) hydrogen ends attract the (-) Oxygen ends of nearby water molecules, making them stick together like magnets.
- Allows the formation of raindrops.

adhesive tape →

Adhesion: The sticking together of molecules of different

- Water molecules adhere to other substances, surfaces, or materials.



Capillary Action



- Capillary Action: The ability to climb the inside of a tube or paper/cloth
- Why?

- Water molecules are attracted to other materials (adhesion) and pull other water molecules up with them as they climb (cohesion).

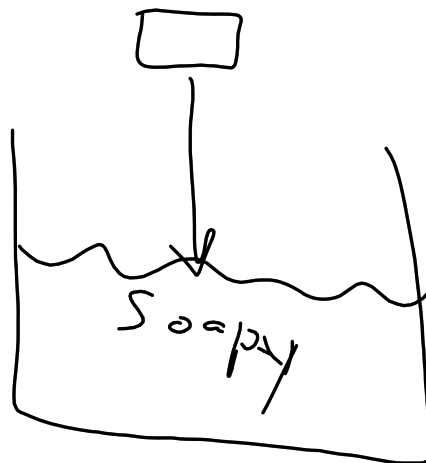
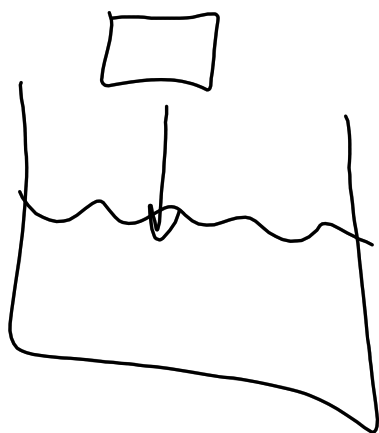
Surface Tension

- Surface Tension: tightness across the surface of a liquid

• Why?

- Polar molecules are so strongly attracted to each other (cohesion), that they pull the surface of water into a tight curved sheet.
- Gives water striders the ability to "walk on water".
- Allows water to bead up on surfaces.
- ~~Makes water to jump into from high heights.~~





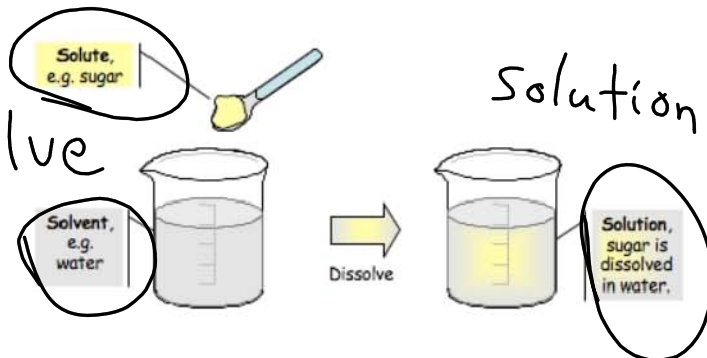
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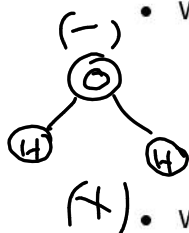
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"Universal" Solvency

• "Universal" Solvency: The ability to dissolve many (but not all) other substances



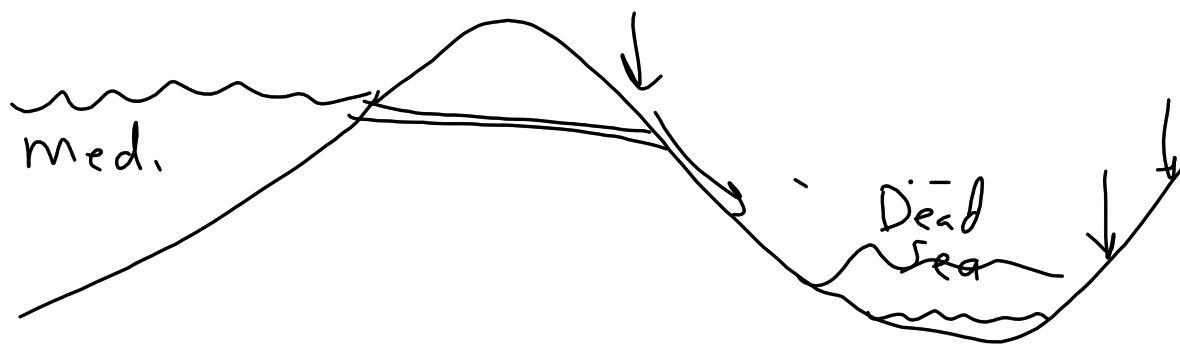
- Solvent: A substance that dissolves other substances
- solute: A substance that is being dissolved
- Solution: A mixture made when one substance dissolves into another
- Solvency is the reason behind our salty ocean! Salts are dissolved by water throughout its journey to the ocean and deposited when it arrives.



- Why is water such a great solvent?
 - The charged ends of the polar water molecules attract the charged ends of other polar solutes.
- When is solvency a good thing?
 - In your body: Water in your blood carries important materials throughout your body (vitamins, minerals, nutrients)
- When is solvency a bad thing?
 - When there are pollutants in the Water Cycle: Pollutants in air, soil, and water will be dissolved and carried with the water.

High Specific Heat

- High Specific Heat: It requires a lot of energy to increase water's temperature



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• Water...

- Heats up slowly
- Cools down slowly

<u>Low Specific Heat Examples</u>	<u>High Specific Heat Examples</u>
metals (silver, Sand aluminum) Pavement	Water apples potatoes

