



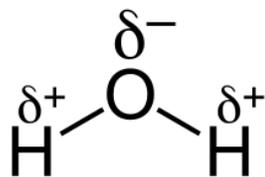
## Properties of Water (H<sub>2</sub>O)

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## Learning Intentions:

- Demonstrate critical thinking skills by generating a prediction for each demonstration based on previous knowledge.
- Be able to record accurate observations during demonstrations.
- Understand and recognize the properties of water molecules including hydrogen bonding, surface tension and solubility.

## Demonstration: Polar Molecule



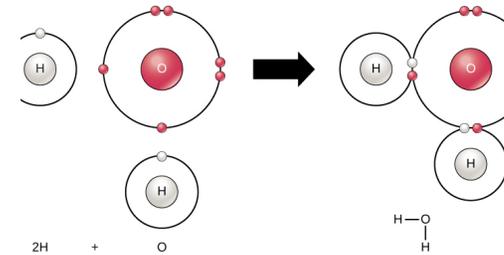
## Solubility Demonstration:



## Demonstration: Surface Tension



## Properties of H<sub>2</sub>O:



- H<sub>2</sub>O molecules are made up of **covalent bonds**.

- **Covalent Bonds**: involve the sharing of electrons between atoms in a way that results in having a filled valence shell.

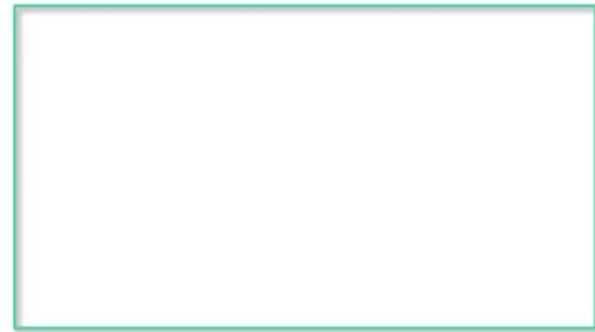
## Properties of H<sub>2</sub>O:

- H<sub>2</sub>O have **Polar Covalent Bonds**

- A covalent bond between atoms that differ in **electronegativity** is called a polar covalent bond.

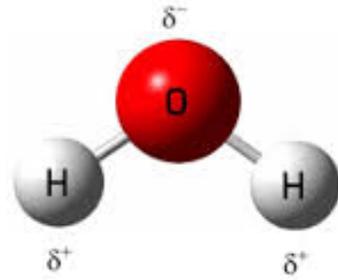
## Video: Electronegativity

<https://www.youtube.com/watch?v=09Vx5VHiMHA>



## Properties of H<sub>2</sub>O:

Since oxygen is more **electronegative** than hydrogen the electrons spend more time **orbiting** the oxygen creating a partial negative charge on the oxygen molecule and a partial positive charge on each hydrogen molecule.



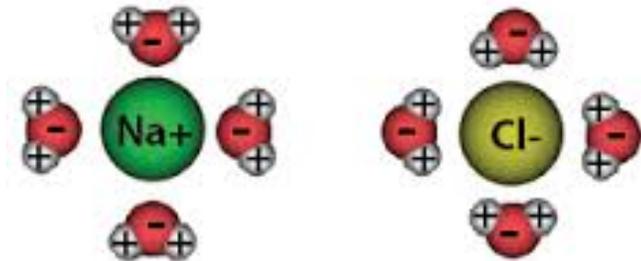
Check Point: Now that we understand partial charges...

Do our results from demonstration 1 make sense?

## Properties of H<sub>2</sub>O: Solubility

- Water is a **solvent**
- H<sub>2</sub>O dissolves a great number of substances.
- A solution contains dissolved substances called **solutes**.

## Properties of H<sub>2</sub>O: Solubility

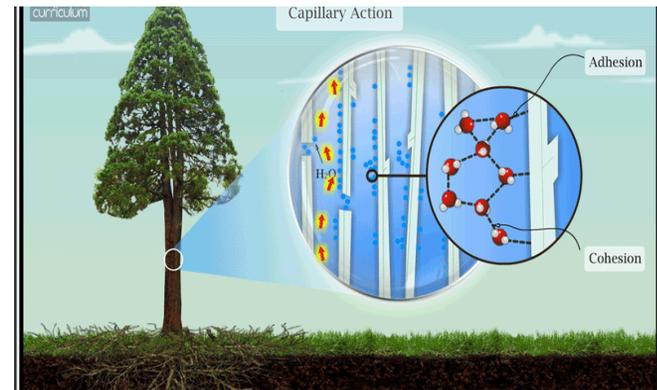


Salt dissolved in water

## Properties of H<sub>2</sub>O: Solubility

- Molecules that can attract water are **Hydrophilic**.
- Molecules that are non-polar and do not attract water are **Hydrophobic**. An example of a hydrophobic molecule is oil.
- Water molecules are **adhesive**.
- Water is adhesive because its positive and negative poles allow it to adhere to polar surface.

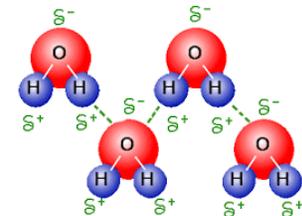
## Adhesion:



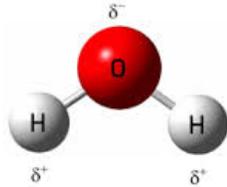
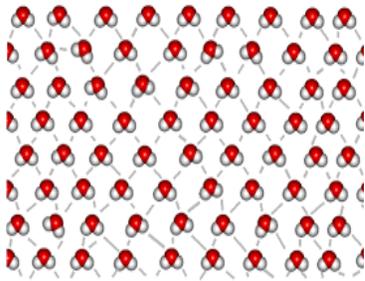
## Check Point: Solubility

## Properties of H<sub>2</sub>O

- Polarity within a water molecule causes the **hydrogen atoms** in one molecule to be attracted to the **oxygen atoms** in the other water molecules.



## Surface Tension:



## Hydrogen Bonding

- Water Molecules are **cohesive**. Water flows freely but water molecules do not separate. This is due to the hydrogen bonding.
- Water has a **high heat capacity**.
- Water has a **high heat of vaporization**.

## Check Point: Hydrogen Bonding

## Discussion Question:

Why is it important to understand the properties of H<sub>2</sub>O when learning about living systems? How do these properties impact living systems?

## H<sub>2</sub>O and living systems:

- The polarity of water makes it a good solvent. These properties effect how molecules are transported in living things.
- Hydrogen Bonding: Allows ice to be less dense then liquid water.
- Hydrogen Bonding: Stabilizes DNA
- Hydrogen Bonding: Helps organisms maintain homeostasis
- Surface Tension: Surfactant in lungs allows for oxygen and CO<sub>2</sub> to dissolve and diffuse between tissues.