

- The Water Molecule
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The Water Molecule

- 2 Hydrogens and 1 Oxygen
- How many Protons in the nucleus of H?
- How many Protons in the nucleus of O?
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- Which one has a stronger attraction of electrons?
 - Oxygen
- So what does this all mean?
 - There is a difference in charge at each end of a water molecule







• Polar Molecule: an uneven distribution of electrons.

• <u>Negative Pole</u> is near the O because the electrons (-) spend more time around the Oxygen end Water Molecule

• **Positive Pole** is near the H







- The partial (+) and (-) charges cause molecules of water to attract each other.
- Not as strong as covalent or ionic bonds, but they are the strongest bonds that form between molecules.









- <u>Cohesion:</u> attraction between molecules of the same substance...Water.
- <u>Adhesion:</u> attraction between molecules of different substances...Water and glass.



Cohesion

- HzO stick to other HzO molecules →via H bonds

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Tronspiration of Water

HzO

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H2D



- Water Sticks to non water molecules -> via H bonds

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cohesion



- Water is abundant on Earth and frequently appears as a gas, liquid, and solid.
- It is one of the few substances on Earth that is frequently found in all three phases of matter and it can readily cycle through the globe
- Water is unique is because of its melting point and boiling point.
 - Under normal atmospheric conditions, water freezes at $0^{\circ}C$ (32°F) & boils at 100°C (212°F).







3 States of Water

- Because of our Earth's position in the solar system, Earth's temperature varies from far below the melting point of water to well above that melting point.
 - Even though water does not boil at normal temperatures, it often becomes gaseous water vapor by evaporating.



Heat Capacity of Water

- Water has a high specific heat index it absorbs a lot of heat before it begins to get hot.
- The high specific heat capacity of water has a great deal to do with regulating extremes in the environment.
 - It helps regulate the rate at which air changes temperature, which is why the temperature change between seasons is gradual rather than sudden, especially near the oceans.
 - Water surrounding or near cities take longer to heat up and longer to cool down than do land masses, so cities near the oceans will tend to have less change and less extreme temperatures than inland cities.



Density of Water

- Density: A measure of the amount of matter contained by a given volume.
- The orientation of hydrogen bonds as water changes states dictates the properties of water in its gaseous, liquid, and solid forms.
- As water is boiled, kinetic energy causes the hydrogen bonds to break completely and allows water molecules to escape into the air as gas (steam or water vapor).
- When water freezes, water molecules form a crystalline structure maintained by hydrogen bonding.



- Solid water, or ice, is less dense than liquid water.
- Ice is less dense than water because the orientation of hydrogen bonds causes molecules to push farther apart, which lowers the density.
- Because ice is less dense than water, it is able to float at the surface of water.

Solutions and Suspensions

- <u>Mixture:</u>
 - a material composed of two or more elements or compounds that are PHYSICALLY mixed together but not CHEMICALLY combined.
- <u>Solution</u>:
 - Salt Water
 - Salt = Solute
 - Water = Solvent
- <u>Suspension</u>:
 - Dirty Water
 - Dirt is suspended in the water but not dissolved.



Water & Earth Materials

- As streams move over the ground, they transport weathered materials.
- Streams continually erode material away from their banks and some of these materials are carried in solution.
- Many minerals are ionic compounds that dissolve easily in water, so water moves these elements to the ocean as part of the **dissolved load** that the stream carries.
- As groundwater leaches through layers of soil and rock, minerals dissolve and are carried away.
- Once an element has completely dissolved, it will likely be carried to the ocean
- In some circumstances, the stream water could become saturated with dissolved materials, in which case elements of those minerals might precipitate out of the water before they reach the ocean.
- Another way that rivers and streams move weathered materials is as the **suspended load**. These are pieces of rock that are carried as solids as the river flows. The size of the particle that can be carried as suspended load is determined by the velocity of the stream. As a stream flows faster, it can carry larger and larger particles. Sand, silt and clay size particles generally make up the suspended load for a stream.



Water & Chemical Weatehring

- Chemical weathering changes the materials that make up rocks and soil.
- Carbon dioxide from the air or soil can combine with water producing a weak acid, called carbonic acid, that can dissolve rock.



 Carbonic acid is very effective at dissolving limestone. When the carbonic acid seeps through limestone underground, it can open up huge cracks or hollow out vast networks of caves.



Weathering and People

- Weathering is a natural process, but human activities can speed it up.
- Certain kinds of air pollution increase the rate of weathering.
 - Burning coal, natural gas, and oil releases chemicals such as <u>nitrogen oxide</u> and <u>sulfur</u> <u>dioxide</u> into the atmosphere.
 - When these chemicals combine with sunlight and WATER, they change into acids. They then fall back to Earth as acid rain.

Crash Course Video - Water

• <u>https://youtu.be/HVT3Y3_gHGg</u> (11:16)

