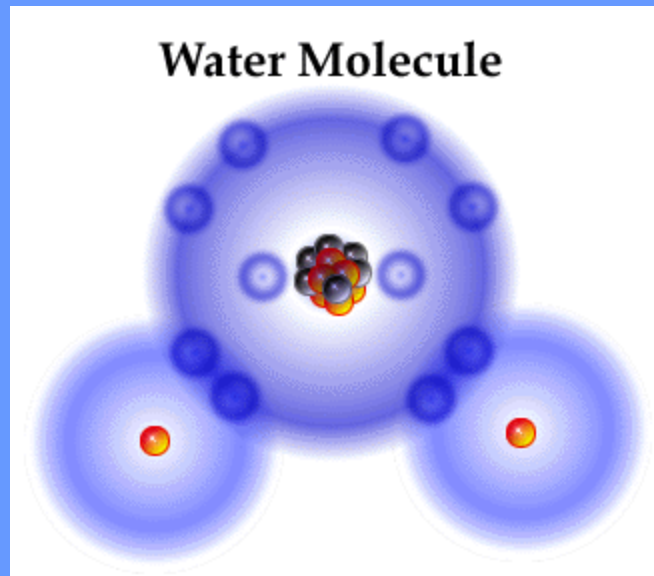


The Extraordinary Properties of Water



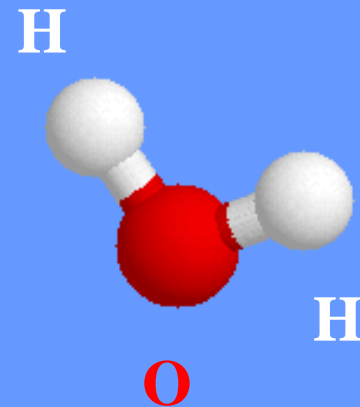
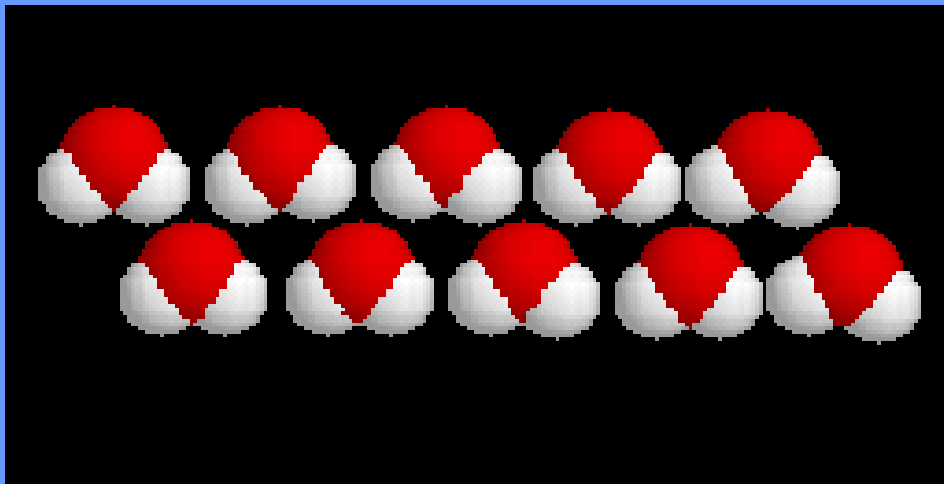
BrainPOP- Water

<http://www.brainpop.com/science/earthsystem/water/preview.weml>



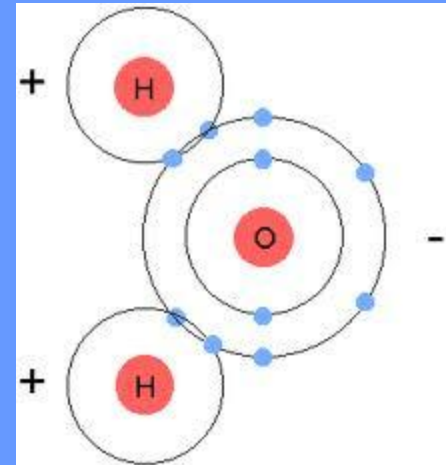
Water

- A water molecule (H_2O), is made up of three atoms --- one oxygen and two hydrogen.



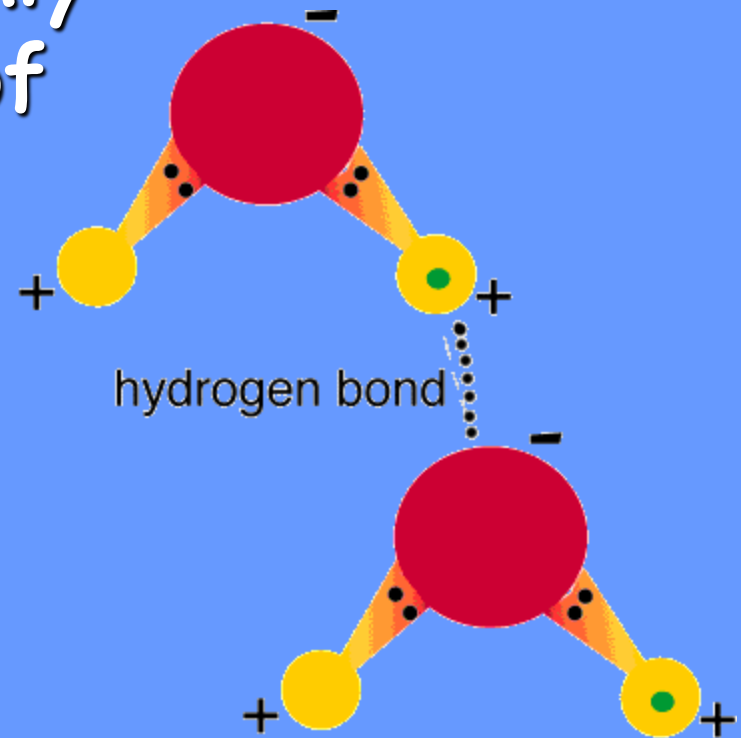
Water is Polar

- In each water molecule, the oxygen atom **attracts** more than its "fair share" of electrons
- The oxygen end "acts" **negative**
- The hydrogen end "acts" **positive**
- Causes the water to be **POLAR**
- However, Water is neutral (equal number of e^- and p^+) --- **Zero Net Charge**



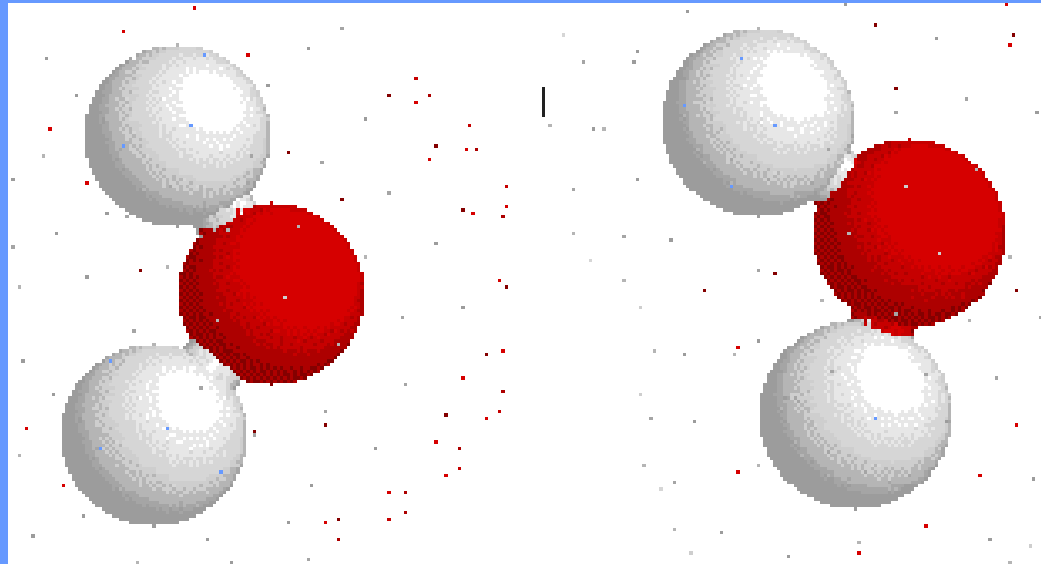
Hydrogen Bonds Exist Between Water Molecules

- Formed between a highly **Electronegative atom** of a polar molecule and a **Hydrogen**
- One hydrogen bond is **weak** , but many hydrogen bonds are **strong**

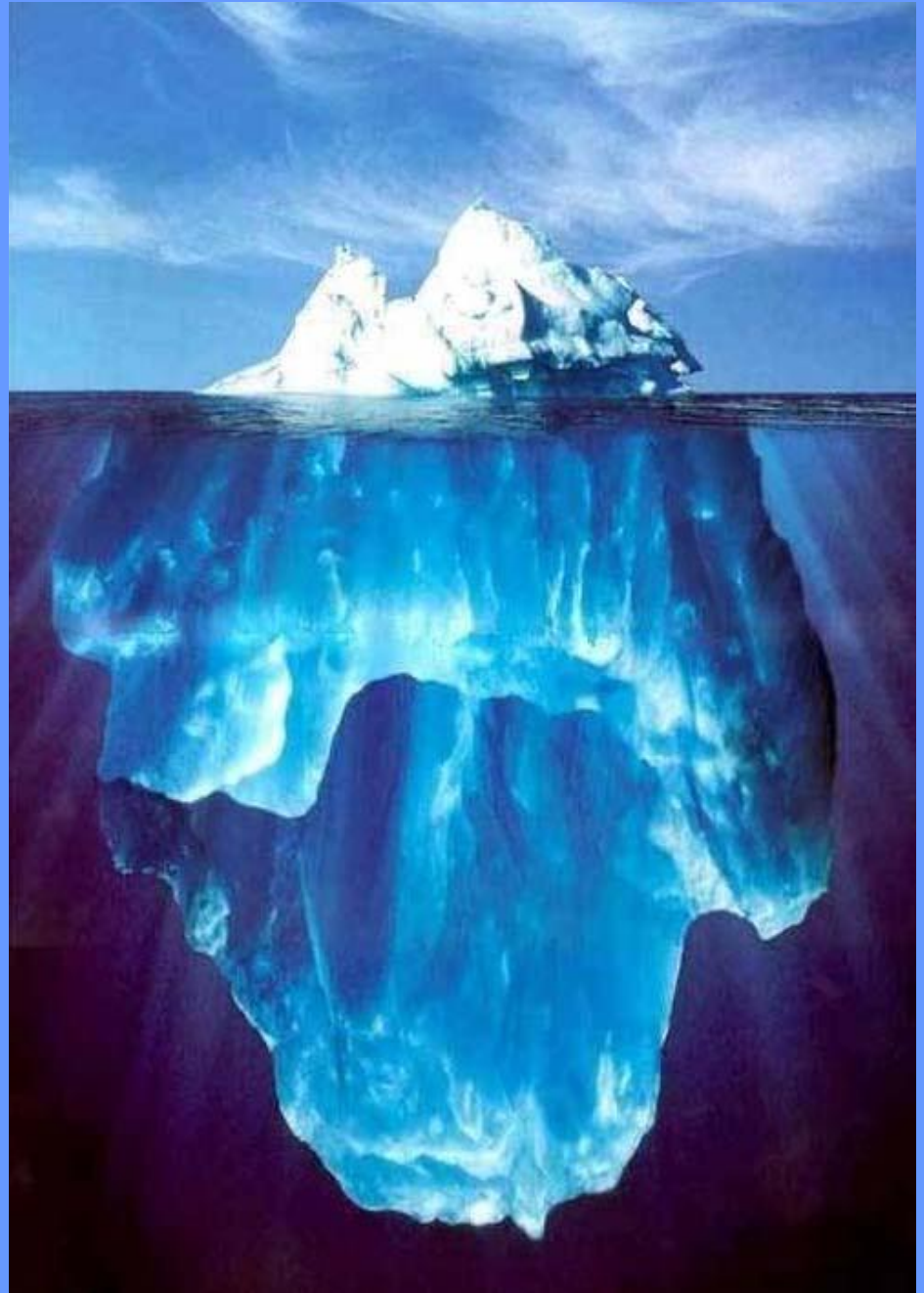


Interaction Between Water Molecules

Negative Oxygen end of one water molecule is attracted to the Positive Hydrogen end of another water molecule to form a **HYDROGEN BOND**

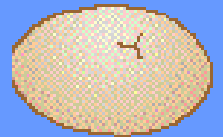


What are
the
Properties
of Water?



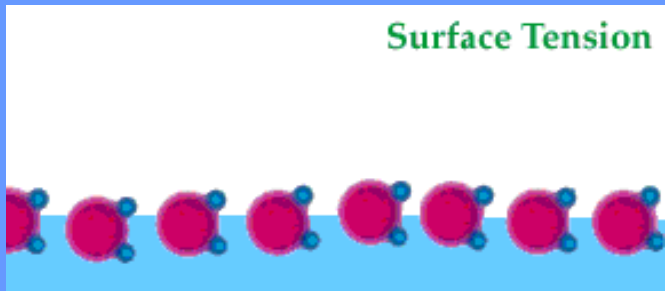
Properties of Water

- At sea level, pure water boils at **100 °C** and freezes at **0 °C**.
- The boiling temperature of water decreases at **higher** elevations (lower atmospheric pressure).
- For this reason, an egg will take longer to boil at higher altitudes



Cohesion

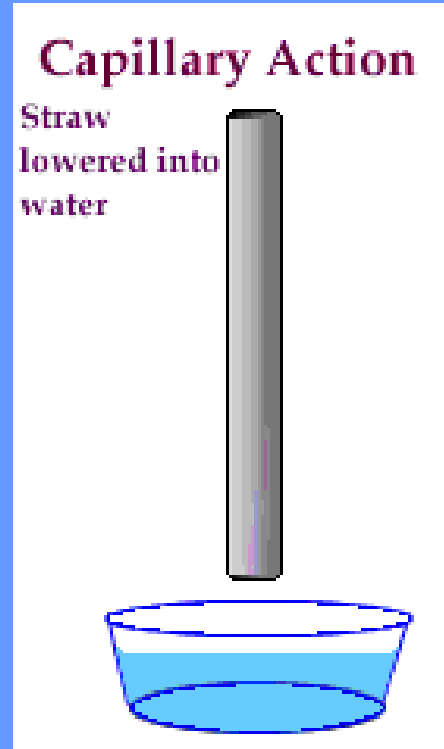
- **Attraction** between particles of the **same** substance (why water is attracted to itself)
- Results in **Surface tension** (a measure of the strength of water's surface)
- Produces a **surface film** on water that allows insects to walk on the surface of water



Helps insects walk across water

Adhesion

- **Attraction** between two **different** substances.
- Water will make hydrogen bonds with other surfaces such as glass, soil, plant tissues, and cotton.
- **Capillary action**-water molecules will "tow" each other along when in a thin glass tube.
- Example: **transpiration** process which plants and trees remove water from the soil, and paper towels soak up water.



Which gives water the ability to "climb" structures

Adhesion Also Causes Water to ...



Form spheres &
hold onto plant
leaves



Attach to a
silken spider
web

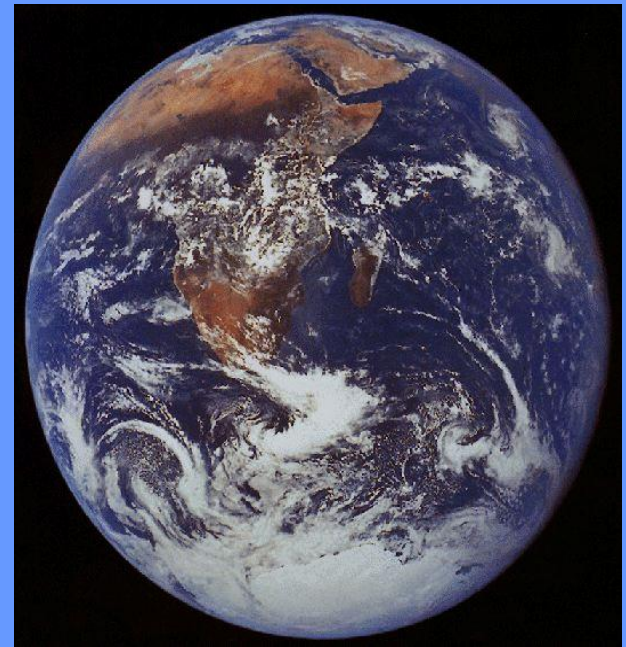
High Specific Heat

- **Amount of heat** needed to raise or lower **1g** of a substance **1° C**.
- **Water resists temperature change**, both for heating and cooling.
- **Water can absorb or release large amounts of heat energy** with little change in actual temperature.

High Heat of Vaporization

- Amount of energy to convert 1g of a substance from a **liquid to a gas**
- In order for water to evaporate, **hydrogen bonds must be broken.**
- As water **evaporates**, it removes a lot of heat with it.

- Water vapor forms a kind of global "blanket" which helps to keep the **Earth warm**.
- Heat radiated from the sun warmed surface of the earth is absorbed and held by the vapor.

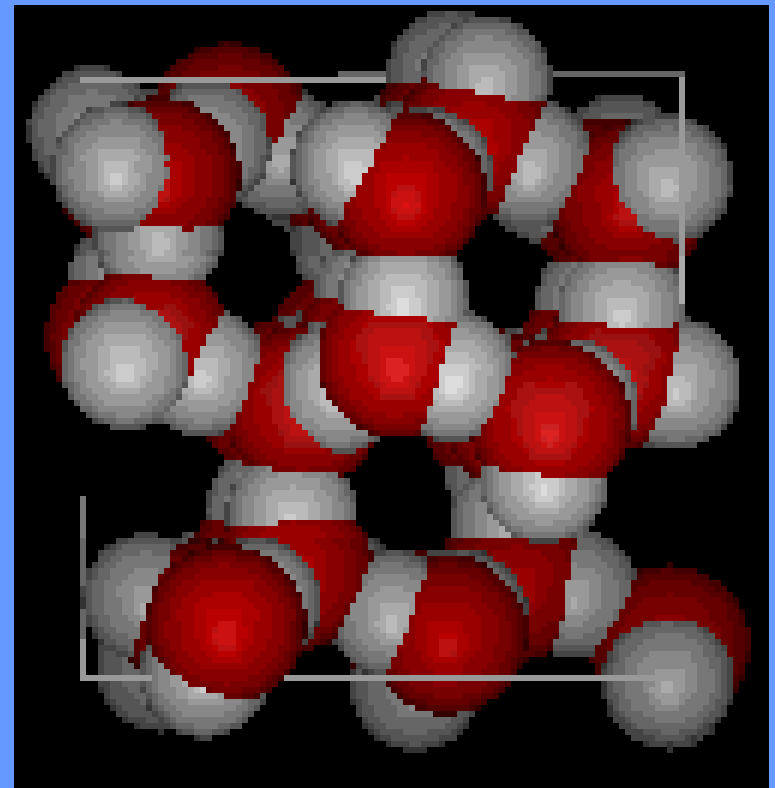
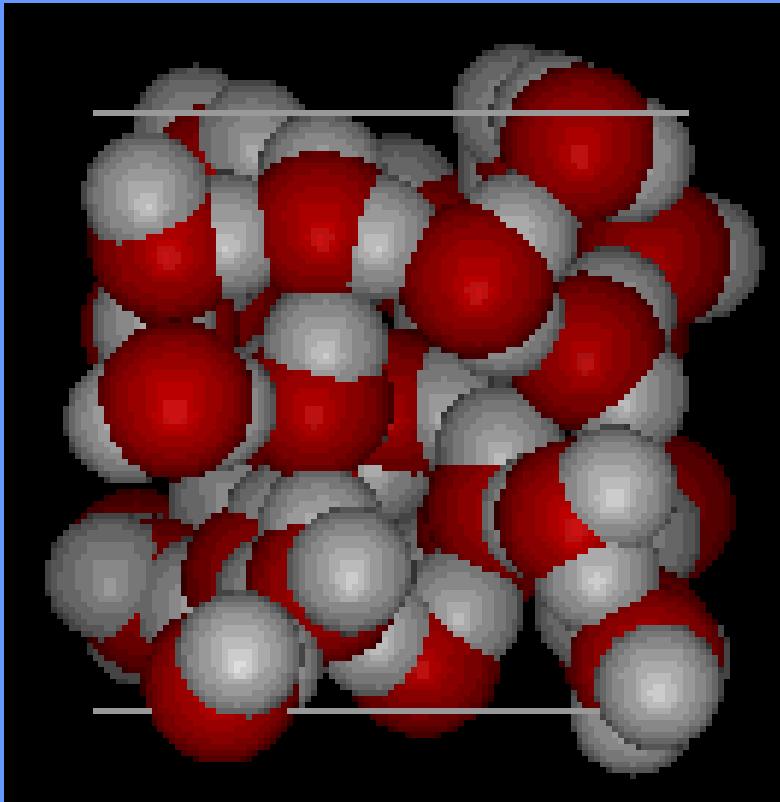


Water is Less Dense as a Solid

- **Ice is less dense** as a solid than as a liquid (ice floats)
- Liquid water has hydrogen bonds that are constantly being broken and reformed.
- **Frozen water forms a crystal-like lattice** whereby molecules are set at fixed distances.

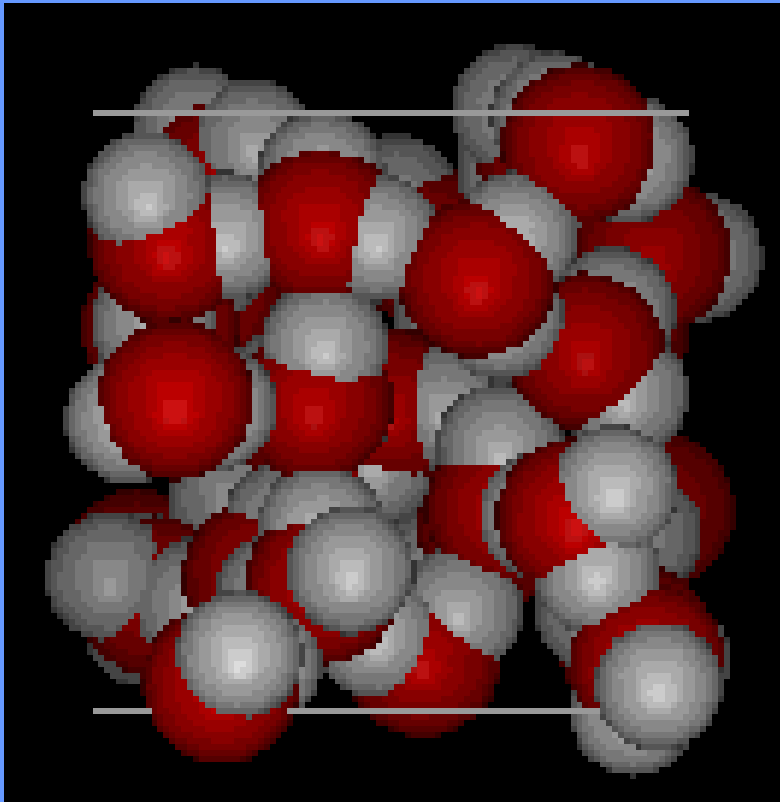
Water is Less Dense as a Solid

- Which is ice and which is water?

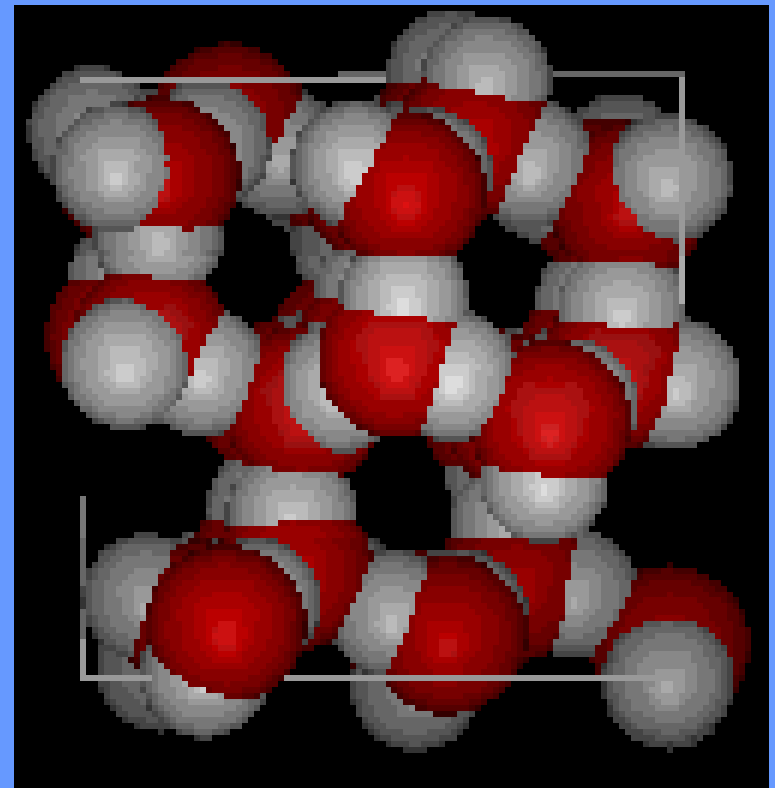


Water is Less Dense as a Solid

Water



Ice



Universal Solvent

- Water is usually part of a **mixture**.
- Water keeps the pieces suspended so they don't settle out.
- **SOLUTE**
 - Substance that is being dissolved
- **SOLVENT**
 - Substance into which the solute dissolves



Homeostasis

- Ability to maintain a **steady state** despite changing conditions
- Water is important to this process because:
 - a. Makes a **good insulator**
 - b. Resists temperature change
 - c. **Universal solvent**
 - d. Coolant
 - e. Ice protects against temperature extremes (**insulates** frozen lakes)

Water Vocab Cartoons

Polar	Hydrogen Bonds
Cohesion	Surface Tension
Adhesion	Capillary Action
Specific Heat	Heat of Vaporization
Density	Universal Solvent