The Extraordinary Properties of Water
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Page Number(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Periodic Table</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scientific Method</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>SI Units</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Density of Pennies Lab</td>
<td>4-5</td>
</tr>
<tr>
<td></td>
<td>Chemistry Diagnostic Mastery Tracker</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Glassware Information</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Properties of Water Lesson</td>
<td>8-11</td>
</tr>
</tbody>
</table>
What happens if I run out of space?

Simply take a half sheet of copy paper and staple it in on top of the current page we are using to take notes.
Bell Ringer (Top of page 8)
2- 5 min

Make a list of 5 – 10 things that you know or think you know about water. These things can include any unique characteristics or properties. Having trouble…think about what you learned in BIOLOGY
Properties of Water Video
Water

• A water molecule (H$_2$O), 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.
Properties of Water

• Cohesion
Properties of Water

- Cohesion
- Adhesion
Properties of Water

• Cohesion
• Adhesion
• High Specific Heat
Properties of Water

• Cohesion
• Adhesion
• High Specific Heat
• Universal Solvent
Properties of Water

- Cohesion
- Adhesion
- High Specific Heat
- Universal Solvent
- Less Dense as a Solid
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
Cohesion ...

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.
Adhesion Causes Capillary Action

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.
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
Water is a Universal Solvent

- Water is capable of dissolving a variety of different substances.
- It is called the "universal solvent" because it dissolves more substances than any other liquid.
- This property is important to every living thing on earth.
The pH Scale

- Indicates the concentration of H\(^+\) ions
- Ranges from 0 - 14
- pH of 7 is neutral
- pH 0 up to 7 is acid ... H\(^+\)
- pH above 7 - 14 is basic... OH\(^-\)
- Each pH unit represents a factor of 10X change in concentration
- pH 3 is 10 x 10 x 10 (1000) stronger than a pH of 6
Acids

- Strong Acids have a pH of 1-3
- Produce lots of H\(^+\) ions
Bases

- **Strong Bases** have a pH of 11 to 14
- Contain lots of OH⁻ ions and fewer H⁺ ions
Creating your Foldable

Create Your Foldable:

• Take a sheet of copy paper, hold it with the long edge on top, and fold each side into the center like window shutters.
• Keeping it folded, fold it downward in half twice to create 8 boxes.
• Cut the top layer along the folded lines to make 8 flaps. (You should make 6 cuts)
• Glue or tape the entire foldable in the notebook.
Label Your Foldable with the following terms:

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion</td>
<td>Temp: Heat/Cold</td>
</tr>
<tr>
<td>Adhesion</td>
<td>Hydrogen Bonding</td>
</tr>
<tr>
<td>Surface Tension</td>
<td>Density</td>
</tr>
<tr>
<td>Capillary Action</td>
<td>pH</td>
</tr>
</tbody>
</table>
What should it look like?

<table>
<thead>
<tr>
<th>Outside</th>
<th>Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion</td>
<td>Definition of cohesion</td>
</tr>
<tr>
<td>- Surface Tension</td>
<td>Example of cohesion</td>
</tr>
<tr>
<td>- Hydrogen Bonding</td>
<td>Example of adhesion</td>
</tr>
<tr>
<td>- Density</td>
<td>Definition of adhesion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside</th>
<th>Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion</td>
<td>Example of cohesion</td>
</tr>
<tr>
<td>- Capillary Action</td>
<td>Example of adhesion</td>
</tr>
<tr>
<td>- Temp: Cold</td>
<td>Definition of adhesion</td>
</tr>
<tr>
<td>- pH</td>
<td></td>
</tr>
</tbody>
</table>