

UNIT 2 TOPIC 2: WATER

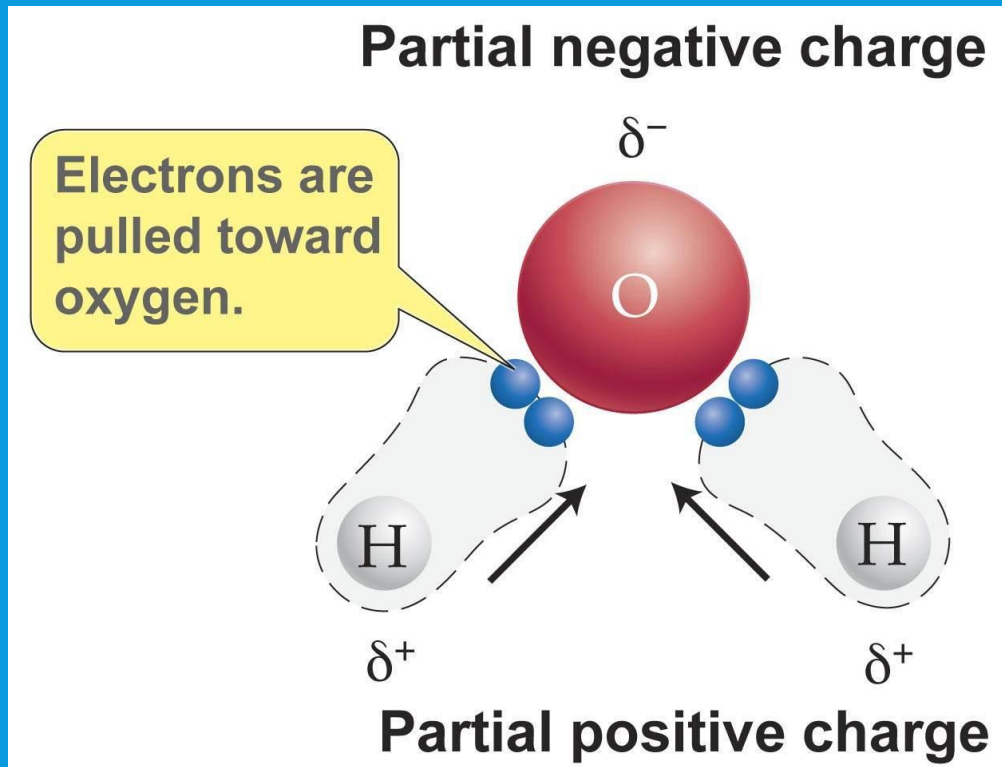
- By the end of this topic, I will be able to:
 1. Explain what “water is polar” means
 2. Explain the importance of hydrogen bonds in water
 3. List the properties of water
 4. Discuss the pH scale and identify substances as acids, bases, or neutral

PROPERTIES OF WATER

- Water is not alive, but understanding water is essential
 - ~2/3 the mass of a cell is water
 - Most life-sustaining reactions take place in water solutions
- Water, H_2O , is a molecule made of two hydrogen atoms covalently bonded to one oxygen atom



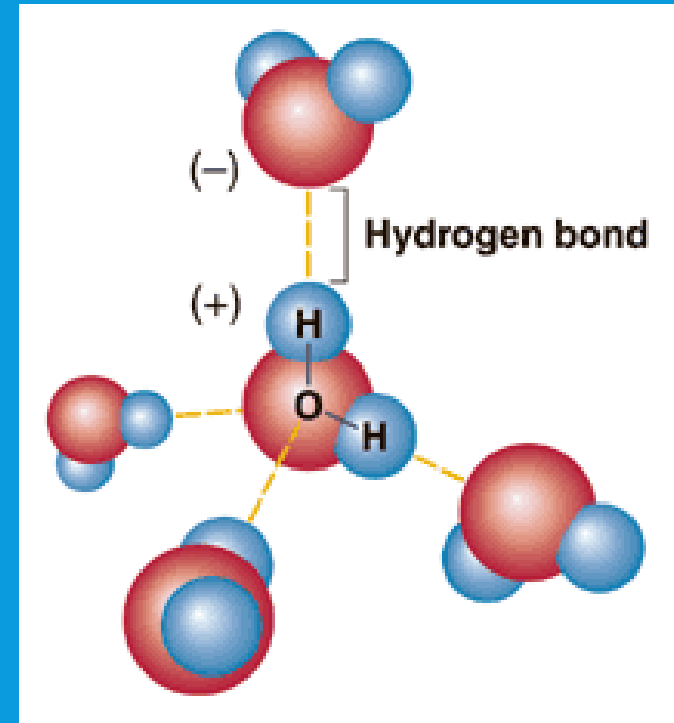
POLARITY OF WATER



- Electrons are unevenly distributed in a molecule of water
 - Leads to positive end and negative end
- The atom with more protons, oxygen (8), pulls electrons closer to its nucleus
 - This makes oxygen slightly negative and hydrogen slightly positive

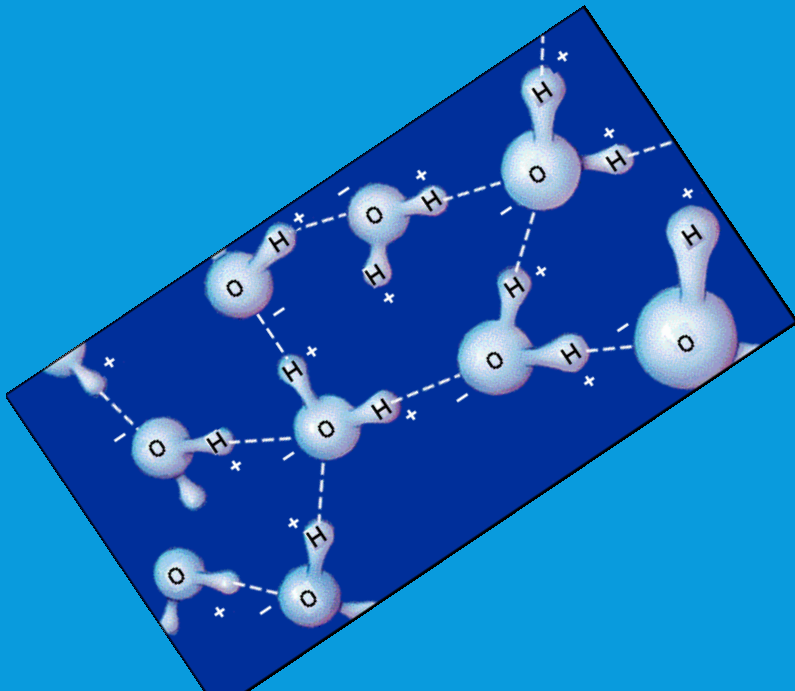
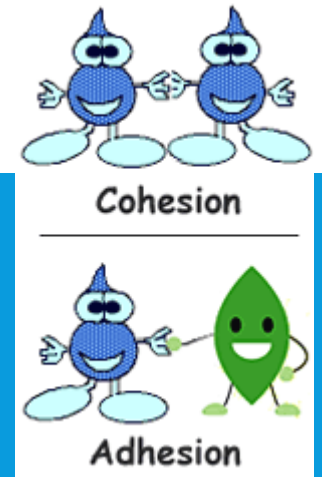
WATER MOLECULES

- Molecules of water are attracted to one another and form hydrogen bonds
 - Opposites attract
- Each molecule of water can make up to four hydrogen bonds
- Hydrogen bonds are VERY weak



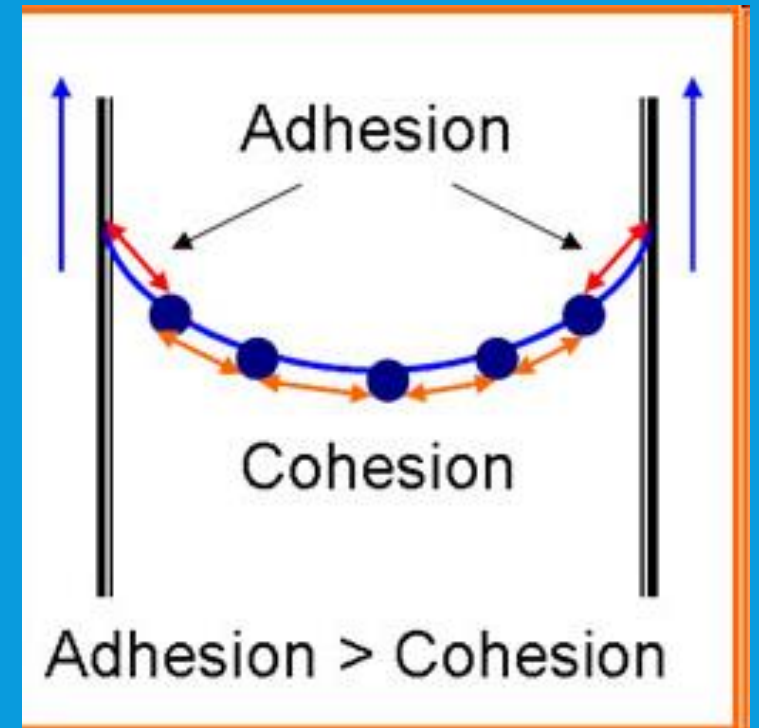
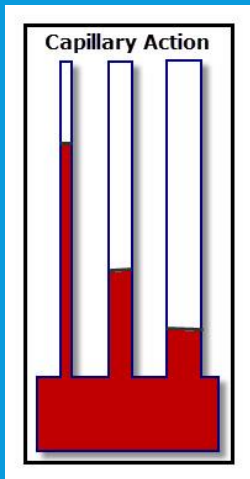
PROPERTIES OF WATER

- **Adhesion:** attraction between *unlike* molecules (water to a paper towel)
- **Cohesion:** attraction between *like* molecules (water to water)
 - Results in **surface tension** (measure of the strength of the surface of water)
 - Produces a surface film, allowing insects to walk on water



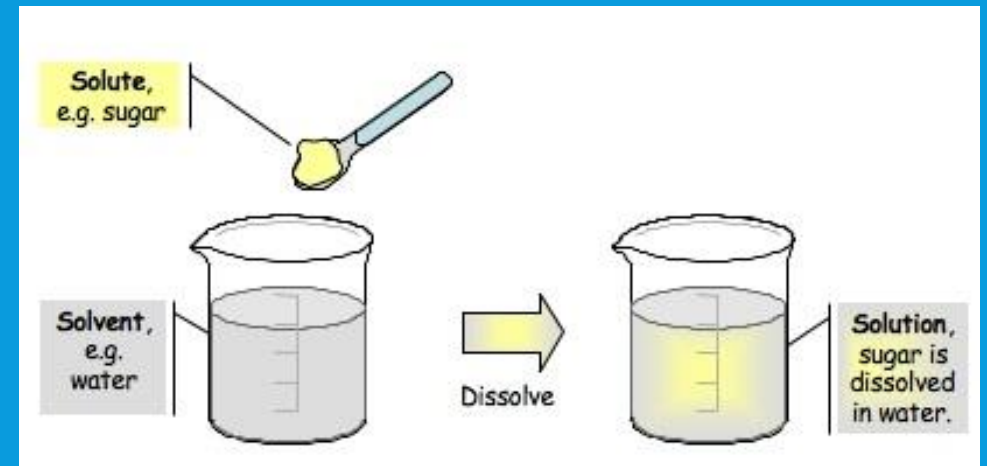
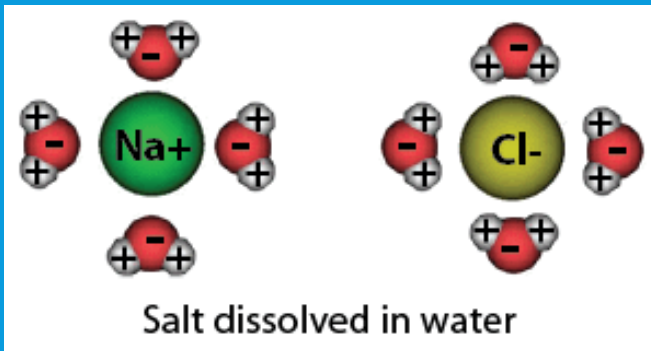
CAPILLARY ACTION

- Cohesion (water sticking to water) and adhesion (water sticking to other substances) work together to form **capillary action**
 - Water rises in a tube against gravity
 - Real life example: water is absorbed by the roots of plants and travels upward!



PROPERTIES OF WATER

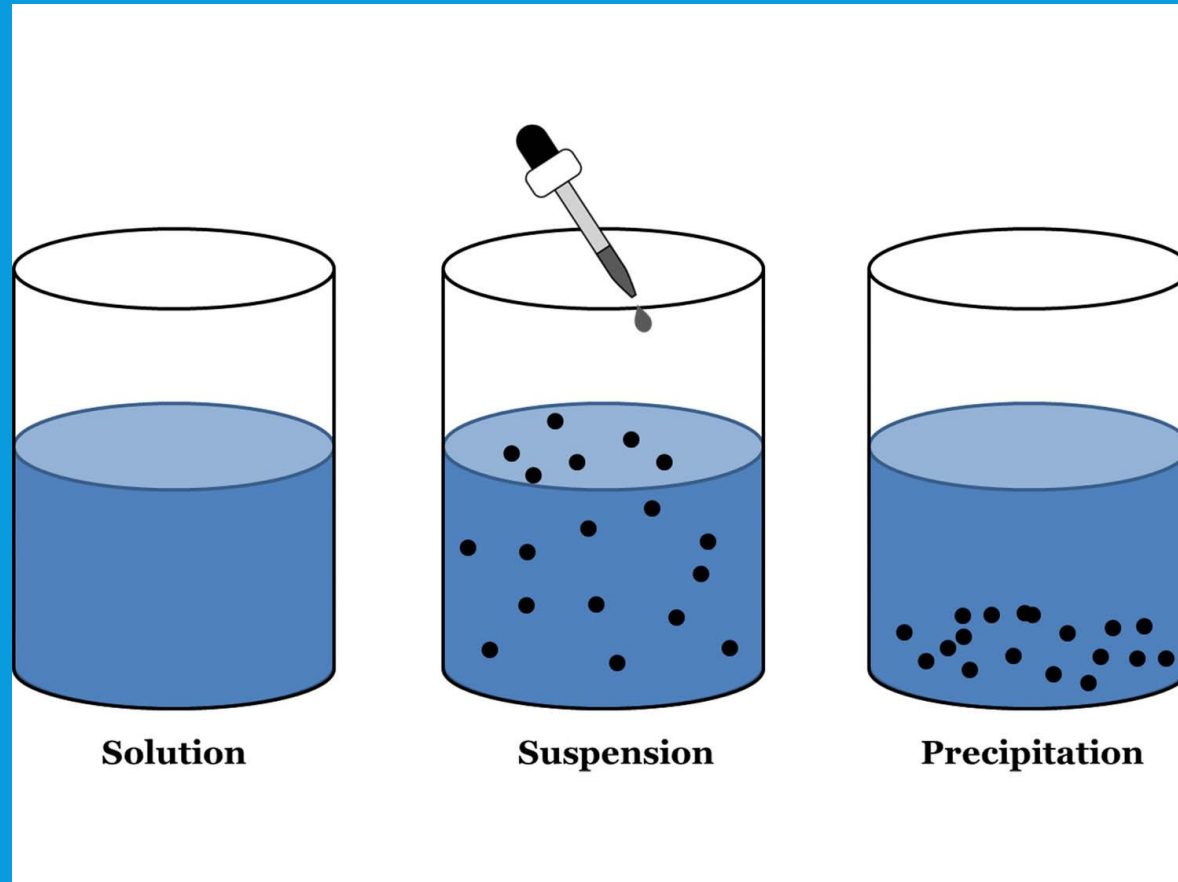
- **Universal solvent:** water dissolves more substances than any other liquid
 - Again, because water is polar and has hydrogen with positive ends and oxygen with negative ends, water attracts many other substances and is able to dissolve these substances it attracts
 - General rule: “like dissolves like,” so being polar, water dissolves other polar substances
 - It cannot dissolve nonpolar substances, like oils!



VOCAB RELATING TO SOLUTIONS

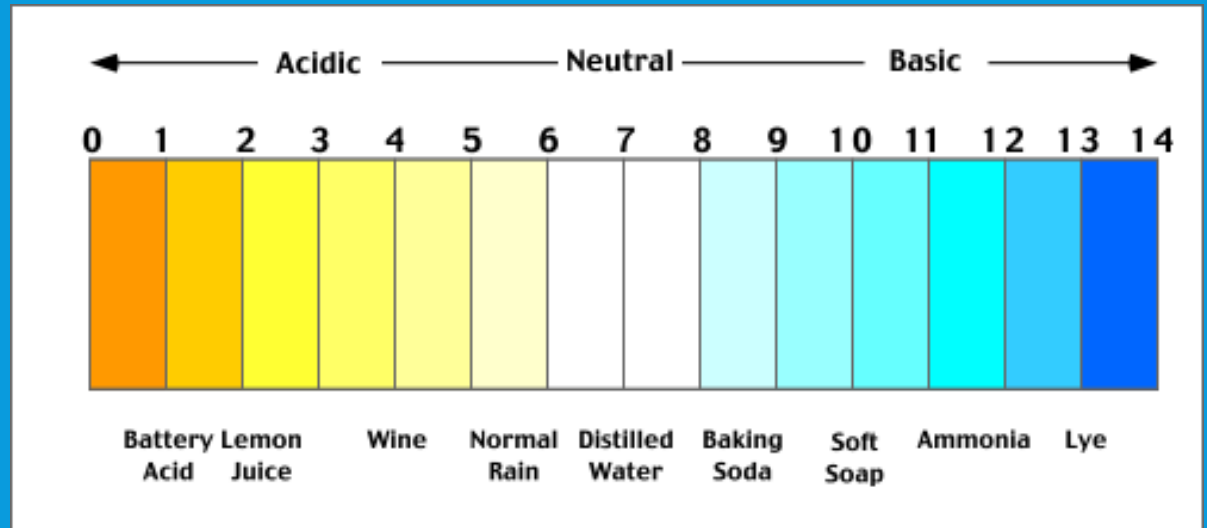
- Solute: substance that is dissolved (sugar)
- Solvent: substance that does the dissolving (water)
- Mixture: combination of substances in which individual substances retain their own properties (sand + sugar)
- Solution: mixture of 2+ substances in which the molecules of these substances are evenly distributed (sugar water)
- Suspension: no dissolving occurs, but one substance separates into small pieces and remains suspended

SOLUTION/SUSPENSION



PH OF WATER

- **Pure water has a pH of 7**
 - pH: measure of how acidic or basic a solution is
 - Scale ranges from 0 to 14
 - Acid: H^+ (hydrogen ions) form in water; pH is **less than 7**
 - Base: OH^- (hydroxide ions) form in water; pH is **greater than 7**
 - Neutral: pH is equal to 7

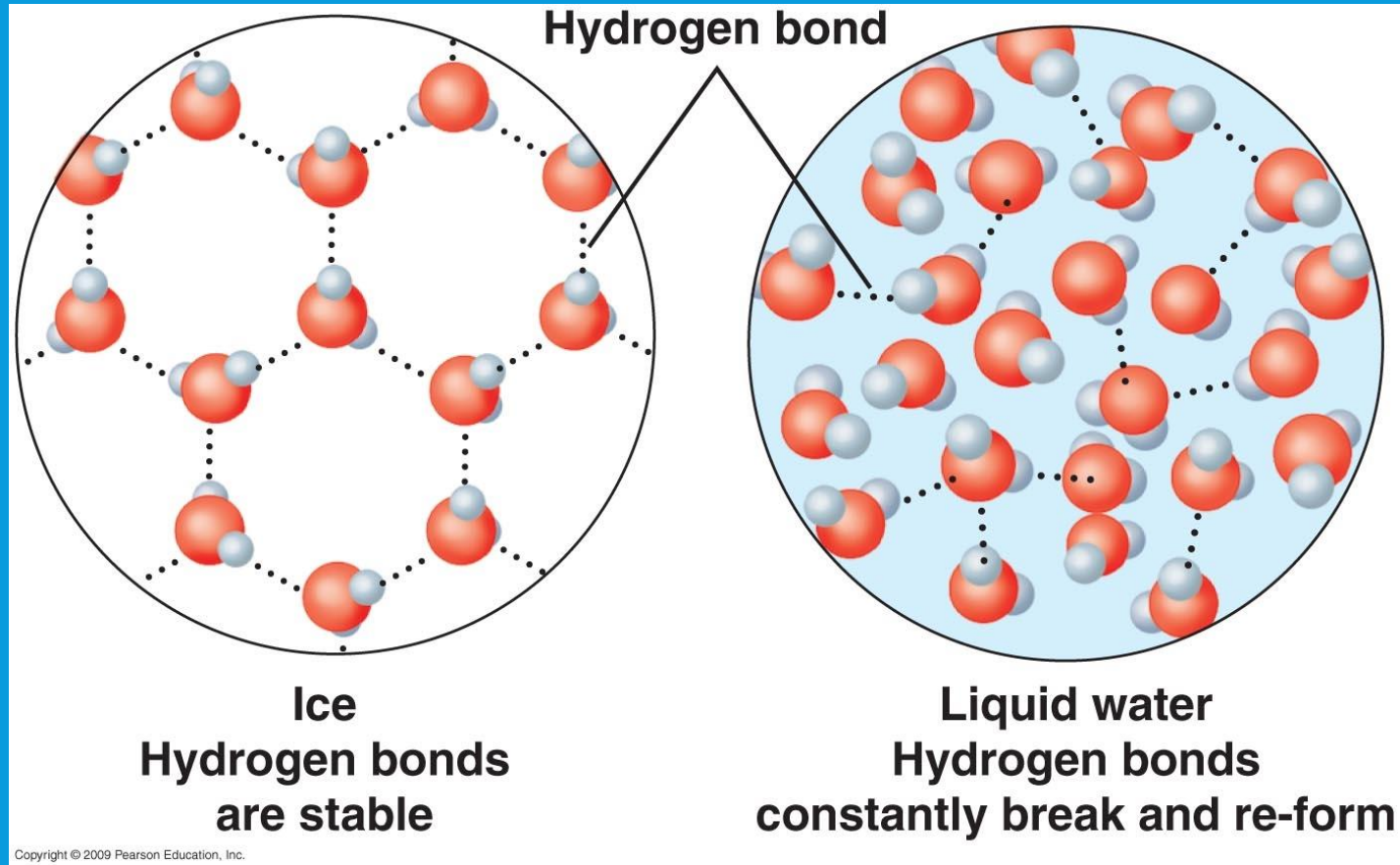


The lower the pH (when under 7), the stronger the acid
The higher the pH (when above 7), the stronger the base

WATER DENSITY

- **Water is less dense in its solid form (ice) than its liquid form**
 - The orientation of hydrogen bonds pushes the molecules to push further apart, lowering the density
 - Because ice is less dense, it floats on liquid water
 - If water was most dense at the freezing point, then in winter the very cold water at the surface of lakes would sink, the lake could freeze from the bottom up, and all life in them would be killed. And, with water being such a good insulator (due to its heat capacity), some frozen lakes might not totally thaw in summer.

DENSITY



HEAT CAPACITY

- Water absorbs a lot of heat from the air without having a large temperature change
- Lakes and oceans often stabilize air temperatures
- Water absorbs heat when it cools, which is why sweating helps us cool down
- It takes a lot of heat to change the temperature of water because the hydrogen bonds between the water need to be broken!

1. COLOR CODE BUILDING MACROMOLECULES
2. U2T3 Notes (fill in language targets as working through it)
3. Building macromolecules activity throughout notes

In your building macromolecules activity, the last item you need to make is a molecule of ATP. We have not talked about this (yet), BUT you are told everything you need to do. *ATP is similar to DNA but it has two extra _____.* Look at the pieces that you have left. Are they all part of a nucleotide? Yes. BUT, there are 3 _____ instead of 2.