

Chapter 3 – Biochemistry, Nutrition, and Water

Section 1: Organic/Inorganic and Water

Activity: Biochemistry Wordle (posted on google classroom)

Activity Link: Salt and Sugar: What's the Difference? (Sugar = Sucrose ($C_{12}H_{22}O_{11}$); Salt = Sodium Chloride (NaCl))

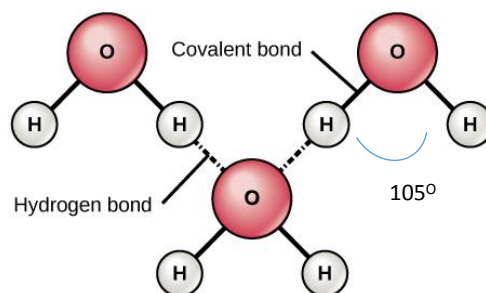
	Sugar	Salt
Common Name	Table sugar	Table salt
Chemical Name	Sucrose	Sodium Chloride
Chemical Formula	$C_{12}H_{22}O_{11}$	NaCl
Chemical Make-Up	Disaccharide made up of glucose and fructose; molecules with molecular bonds	Sodium and chloride ions held together by hydrogen bonds; a salt with a lattice structure
Organic or Inorganic	Organic	Inorganic

Organic Vs. Inorganic

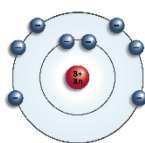
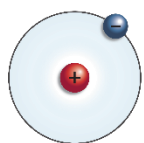
Organic	Inorganic
Contain carbon (element 6 on periodic table)	Contain a metal ion
Living or from living	Non-living
Large molecules	Small molecules
Covalent bonds	Ionic bonds
Slow reactions	Fast reactions
Not soluble	Soluble
Does not conduct electricity	Conducts electricity when dissolved in water

Water: the most important **INORGANIC** compound to living things

- ✓ Remember: water is inorganic because it contains no carbon
- ✓ Made up of two elements: hydrogen and oxygen
- ✓ Formula is H_2O (2 hydrogen atoms with 1 oxygen atom)
- ✓ Water has a slightly (+) and slightly (-) region
- ✓ Polar covalent bonds link Hydrogen and Oxygen
- ✓ 1 gram of water = $1\text{cm}^3 = 1.00\text{g/cm}^3$



Structure and Bonding



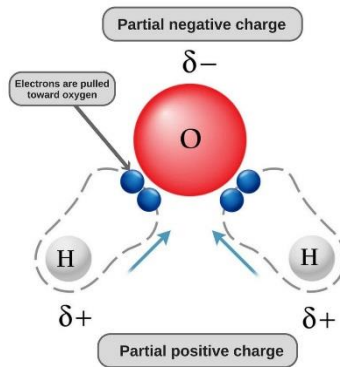
Oxygen: 8 protons (#8 on the periodic table), 8 total electrons

Hydrogen: 1 proton, 1 total electron

Need 2 hydrogens to every 1 oxygen to get a total of 8 valence electrons

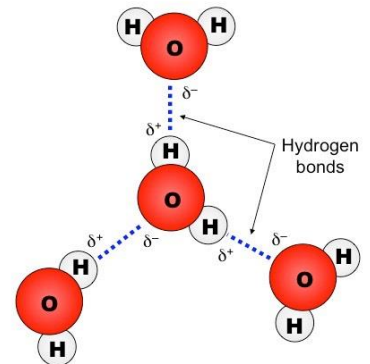
Polarity

- ✓ Water is a polar molecule
- ✓ Methane is nonpolar



Hydrogen Bonding

- ✓ **Not really a bond, it is an interaction**
- ✓ A weak interaction between the slightly positive hydrogen of one molecule and the negative atom of another. **HOWEVER**, when they act together, they form a powerful attraction between water molecules.
- ✓ **Example:** Velcro is weak when alone. When placed together, the many loops and hooks are very strong.
- ✓ Water is a rule breaker: it is an inorganic compound but it forms covalent bonds



Water Models

Molecular Formula	Structural Formula	Molecular Model: Space Filling	Molecular Model: Ball-and-stick
H ₂ O	H-O-H		95.7 pm 104.5°

Importance of Water

- ✓ Acts as a catalyst
- ✓ Helps organs to function
- ✓ Energizes the cell
- ✓ Hydrates the body



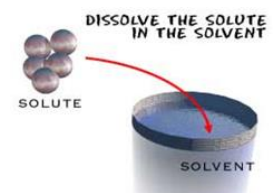
(Link in Purple Packet – Water Olympics)

Properties of Water

- Water has its properties due to its **polarity**.

1. Universal Solvent

- ✓ Water dissolves most ionic substances and polar substances
- ✓ Solvent = water (breaks down, dissolves the item); Solute = item being dissolved (salt)



2. Adhesion

- ✓ Water sticks to different substances but not itself



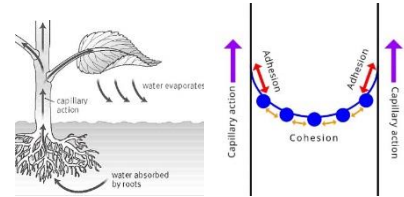
3. Cohesion

- ✓ Water sticks to water
 - Example: Gortex



4. Capillarity (Capillary Action)

- ✓ Ability to move up a small tube or vessel
- ✓ Water moves up small vesicles against gravity if tube is narrow enough
- ✓ Requires both adhesion and cohesion



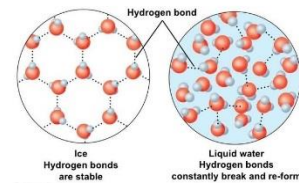
5. Ability to resist changes in temperature and state (Specific Heat)

- ✓ Water resists changes in temperature and state
- ✓ Water takes longer to absorb heat...when really hot, hydrogen bonds break and molecules move faster
- ✓ High specific heat and high heat of vaporization
- ✓ Helps us maintain homeostasis



6. Density of water and ice (freezing point)

- ✓ Solid form of water is ice. Ice is less dense than water
- ✓ Water is most dense at 39.2°F / 4°C
- ✓ When you freeze a bottle of water, there is more space between the bonds (hydrogen bonds are expanding) that are between the water molecules which causes the ice to expand – The volume is expanding



7. Surface Tension

- ✓ Resistance of a fluid to increase in surface area
 - Example: skipping stones, water bugs
- ✓ Creates a "film" on top of water due to cohesion



Link in Purple Packet – Properties of Water Concept Map



How does water make it possible for life to exist on this planet?

Answer. The chemical properties of water make it indispensable for living creatures. Not only can water dissolve nearly anything, but it is also one of only a few materials that can exist as solid, liquid and gas within a relatively narrow range of temperatures.