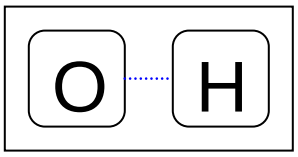
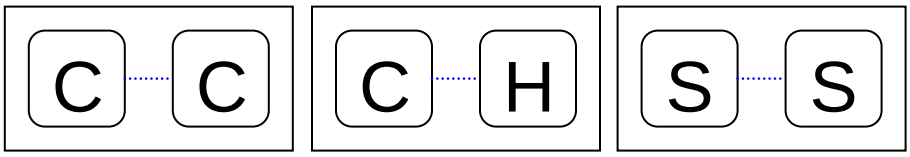
# The Chemistry of Life (7%)

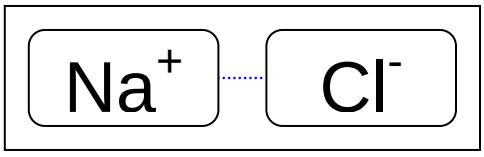
I. **Bonds**
   a. **Covalent**
      i. Polar
         1. Between atoms that are conversely electronegative



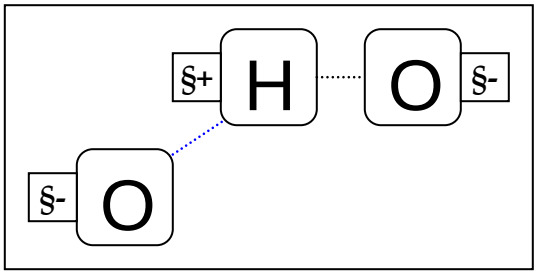

      ii. Non Polar
         1. Between atoms that have electro-negativities that are either about the same or the same




   b. **Ionic**
      1. Between atoms that have a full charge

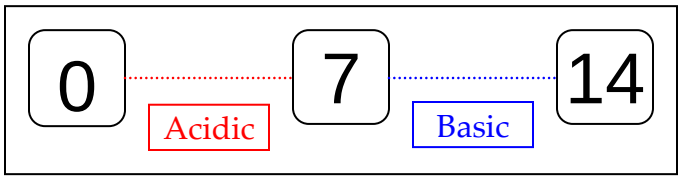



   c. **Hydrogen**
      1. Hydrogen attached to an electronegative element (N, O) (Polar Covalent bond)
      2. Causes partial positive and partial negative charge
      3. Bond between second electronegative atom and H is the Hydrogen bond
      4. Found mainly between nucleic acid strands



## II. pH

### a. Scale




### b. Acidic

i. More H+

### c. Basic

i. More $OH^-$

### d. Increments

**i.** 10x

1. i.e. pH 3 is 10x more acidic than pH 4

## III. Biomolecules

### a. Lipids

i. Mostly C-C and C-H bonds

ii. Fats

1. Glycerol Backbone + Fatty Acid Tails
2. Saturated: Solid at room temperature
   a. i.e. butter
3. Unsaturated: Liquid at room temperature
   a. i.e. oil

iii. Steroids

1. Carbon Rings + OH groups

### b. Nucleic Acids

i. Nucleotides

1. Phosphate Group + Carbon Ring (Sugar) + Base
2. Bases attracted by Hydrogen Bonds
   a. A-T (2 H bonds)
   b. C-G (3 H bonds)
   c. A-U (2 H bonds)

### c. Carbohydrates

i. C-H-O Ratio is 1:2:1

ii. Monosaccharides

1. Glucose
2. Galactose
3. Fructose

iii. Disaccharides

1. Lactose → Glucose + Galactose (Hydrolysis)

2. Sucrose → Glucose + Fructose (Hydrolysis)
3. Maltose → Glucose + Glucose (Hydrolysis)

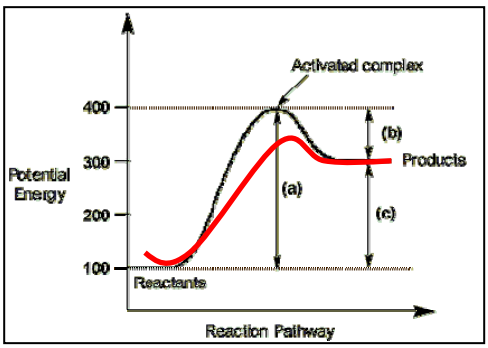
iv. Polysaccharides
1. Starch: Plant storage form
2. Glycogen: Animal storage form
3. Chitin: Exoskeleton of insects; fungal cell walls
4. Cellulose: Plant cell wall

**d. Proteins**

i. Amino Acids
1. R group + Central Carbon + Amino Group → Amino Acid
2. Amino Acid + Amino Acid → Dipeptide (Condensation)
3. Combinations
a. 1: Primary: Sequence of Amino Acids
b. 2: Secondary: Hydrogen Bonds
i. Alpha Helices
ii. Beta Sheets
c. 3: Tertiary: Interactions between R groups (3D)
i. Ionic Bonds
ii. Covalent Bonds
1. Disulfide Bonds
iii. Hydrogen Bonds
iv. Hydrophobic Interactions
d. 4: Quantanary: Interactions between polypeptide chains

ii. Enzymes

1. Accelerate rates of reactions (rxn)
2. Not destroyed in the reactions
3. Don't change overall energetics (ΔG)
4. Lower activation energy



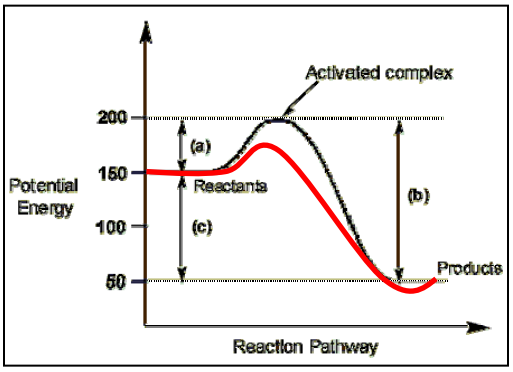

Endothermic

**Endothermic:** Heat energy taken in from surroundings → turned into potential energy in the products

**Enthalpy:** Products > Reactants

**(a):** The activation energy **(Ea)** for the forward reaction

**(b):** The activation energy **(Ea)** for the reverse reaction




Exothermic

**Exothermic:** Reactant's potential energy or enthalpy is released into the surroundings, usually in the form of heat

**Enthalpy:** Products < Reactants

**(a):** The activation energy **(Ea)** for the forward reaction

**(b):** The activation energy **(Ea)** for the reverse reaction

5. Effects and Alterations
    a. pH
        i. Affect hydrogen bonding between R groups
            1. Change structure
    b. Temperature
        i. Cold:
            1. Enzymes not as flexible
            2. Active site not able to mold around substrate
        ii. Hot:
            1. Cause hydrogen bonds to break between R groups
            2. Denaturing
            3. *More collisions → not necessarily going to accelerate reaction