

### Properties of Water

**Polarity:**  
 - allows cohesion, adhesion, surface tension

**High Specific Heat:**  
 - resists temp change  
 - high heat of vaporization  
 - allows evaporative cooling (high energy particles vaporize)

**Universal Solvent:**  
 - dissolves hydrophilic/repels hydrophobic

### Properties of Carbon

**tetravalence** 4 bonds->complex molecules

**hydrocarbons** C and H, release energy

**structural isomer** differs in covalent arrangement of atoms

**geometric isomer** differs in spacial arrangements around double bonds

**enantiomer** mirror image of 4 molecules attached to asymmetric carbon

### Functional Groups

-OH	hydroxyl	polar/hydrophilic
-CH <sub>3</sub>	methyl	nonpolar/hydrophobic
-COOH	carboxyl	polar/hydrophilic
-COH	carbonyl	polar/hydrophilic
-NH <sub>2</sub>	amino	polar/hydrophilic
-SH	sulfhydryl	nonpolar/hydrophobic
-PO <sub>4</sub>	phosphate	polar/hydrophilic

### Acids and Bases

**Acid** increases H<sup>+</sup> in solution

**Base** reduces H<sup>+</sup> in solution (accepts H<sup>+</sup> or donates OH<sup>-</sup>)

**pH** = -log[H<sup>+</sup>]

**Buffer** accepts/donates H<sup>+</sup> to stabilize pH

### Metabolism

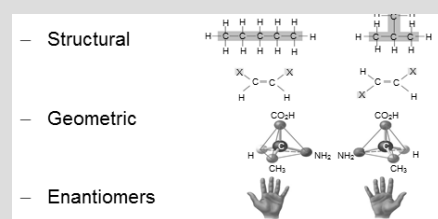
**metabolic pathway** a specific molecule that is altered in defined steps catalyzed by enzymes that result in a certain product

**catabolic pathway** releases energy by breaking down complex molecules

**anabolic pathway** consumes energy to build more complex molecules

**energy** the capacity to cause change or rearrange matter

### Isomers



### Laws of Thermodynamics

**1st Law of Thermodynamics**  
 energy can be transferred and transformed but not created or destroyed

**2nd Law of Thermodynamics**  
 every energy transfer/transformation increases the entropy of the universe; a process must increase entropy to be spontaneous

### Free Energy

**Gibbs free energy-  $\Delta G = \Delta H - T\Delta S$**   
 energy in a temp/pressure constant system that can perform work

**exergonic**  
 has a net release of free energy (- $\Delta G$ )

**endergonic**  
 absorbs free energy (+ $\Delta G$ )

### ATP

ribose, adenine, 3 phosphate groups  
 hydrolyzed to ADP+P<sub>i</sub>  
 phosphorylated molecules=more reactive

### Large Biomolecules

**Carbohydrates**  
 -monosaccharides held by glycosidic linkages  
 -energy storage, structure, protection

**Lipids**  
 -fatty acids held by ester linkages  
 -hydrophobic, saturated/unsaturated, hormones

**Nucleic Acids**  
 -nucleotides held by phosphodiester H-bonds  
 -enable reproduction, controls protein synthesis

**Proteins**  
 -amino acids held by peptide bonds  
 -follow varied instructions from DNA

### Enzymes

**Enzymes**  
 these macromolecules act as catalysts that lower activation energy barriers by forming an induced fit w/substrate in the active site

**Enzyme Activation**  
 -gene regulation= enzymes produced when needed  
 -activators=cofactors (inorganic) and coenzymes (organic) make up and help enzymes function

**Enzyme Inhibition**  
 -competitive=inhibitor molecule binds to active site to block substrate  
 -allosteric=inhibitor molecule binds to allosteric site to cover or change shape of the active site

**Optimal Conditions**  
 -enzymes have optimal temp+pH  
 -cofactors+coenzymes bind to enzyme or substrate