

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 |
| -CH3 | methyl | nonpolar/hydrophobic |
| -COOH | carboxyl | polar/hydrophilic |
| -COH | carbonyl | polar/hydrophilic |
| -NH2 | amino | polar/hydrophilic |
| -SH | sulfhydryl | nonpolar/hydrophobic |
| -PO4 | phosphate | polar/hydrophilic |

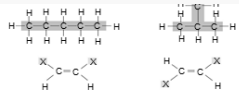
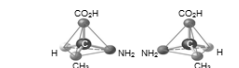

Acids and Bases

| | |
|--------|---|
| Acid | increases H ⁺ in solution |
| Base | reduces H ⁺ in solution (accepts H ⁺ or donates OH ⁻) |
| pH | =-log[H ⁺] |
| Buffer | accepts/donates H ⁺ 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

- **Structural** 
- **Geometric** 
- **Enantiomers** 

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 (- ΔG)

endergonic
 absorbs free energy (+ ΔG)

ATP
 ribose, adenine, 3 phosphate groups hydrolyzed to ADP+P_i
 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

Enzymes (cont)

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

C

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