

Expected Prior Knowledge before you begin Biochemistry I & II

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The following terms and concepts are those with which you should be familiar BEFORE you begin biochemistry training. Other than the first exam and the Molecular Biology Quiz (see below), you will not be tested on these topics *per se*, however; their use and understanding will be expected. In many cases, these topics will be reviewed in the context of biological molecules and structures. For example, while you may have heard about a hydrogen bond, it will be extensively expanded on and put in the context of macromolecules in these courses. This is not an exhaustive list, but just meant to summarize the many key terms and skills you will need to build on.

Should you need a refresher on any of these terms, there are many online resources that are available to you. For chemistry, you can access [libre chemistry](#). Likewise for biology, you can access [libre biology](#).

Molecular Biology Quiz: Available on the lab Blackboard site will be links to a lecture that reviews the essential concepts of molecular biology and the so-called Central Dogma. Also there will be a link to a 30 min quiz on this material. This quiz will count towards your grade (1-2%) and must be completed by September 15.

Basic Chemistry:

Atomic Number
Dalton/Atomic Mass Unit
Electronegativity
Ionization
Formal charge
Mass Number
Metal, Transition metals
Nonmetal
Oxidation State
Periodic Table
Avogadro's number

Introductory Biology

Endocytosis
Exocytosis
Cytoskeleton
Cell nucleus
Endoplasmic reticulum, rough and smooth
Endosomes, vesicles
Enzymes
Eukaryotic
Prokaryotic
Golgi
Apparatus
Lumen
Lysosomes

Introductory Biology (continued)

Mitochondria
Matrix, Intermembrane space
Inner membrane
Outer membrane
Chloroplasts;
Chlorophyll
Thylakoid
Stroma
Organelles
Photosynthesis
Plasma membrane
Prokaryotic
Ribosome
Secretory granules
Transport
Osmosis

Replication
Transcription
Translation

} See Molecular Biology Quiz

Chemical Bonding:

Anion
Cation

Chemical Bonding (continued):

- Covalent Bond (single, double, triple)
 - Pi-Bond
 - Sigma Bond
- Covalent bond
 - Coordinate
 - Polar
- Dipole moment
- Hybrid orbitals (sp^3 , sp^2 , sp)
- Hydrogen bond
- Ionic bond, Polar bonds
- Ionic interaction
 - Coulomb's law
- Lewis structure
- London Dispersion Forces
- Lone Pair electrons
- Electronic and Molecular Geometries
 - Linear, Tetrahedral, Trigonal planar, Trigonal pyramidal, Bent
- Valence electrons

Chemical Reaction Principles:

- Balanced Chemical reaction
- Enthalpy
- Entropy
- Free energy
- Equilibrium constant (K_{eq})
 - Concentration:** Mole, Molarity
 - Le Chatelier's principle
 - Mass action
- Endothermic
- Exothermic
- Joule (J, kJ)
- Calorie (cal, kcal, Cal)
- Catalyst
- Reaction rate
 - Reaction order (0, 1st, 2nd)
 - Rate constants (k_1 , k_{-1} , etc.)

Organic Chemistry:

- Acyl group
- Aliphatic Alkenes
- Alkyl group
- Alkynes
- Aromatic Carbocation, carbonium ion
- Carbo-anion, carbanion
- Functional group
 - Alcohol (primary, secondary, tertiary)
 - Aldehyde

Organic Chemistry (continued):

- Amide
- Amine
- Carbonyl group
- Carboxylic acid/Carboxylate
- Disulfide
- Ester
- Ether
- Hemiacetal/Hemiketal
- Ketone
- Sulfhydryl (thiol)
- Hydrocarbons
 - saturated (aka alkanes)
 - substituted
 - unsaturated
 - aromatic
 - cyclic
 - conjugated
- Hydrophilic
- Hydrophobic
- Hydration reaction
- Hydrogenation reaction
- Isomers (geometric, positional, stereo)
- Tautomer
- Leaving groups
- Electrophile
- Nucleophile
- Nucleophilic Attack
- Resonance hybrid
- R and S configurations
- SN1 and SN2 reactions

Chemical Reactions:

Acid-base reaction
Displacement reaction
Elimination reaction
Oxidation and Reduction reaction
Oxidation and Reduction half-reactions Oxidation potentials
Oxidizing and Reducing agents REDOX reaction
Standard reduction potential Substitution (Displacement) reaction

pH

Aqueous Buffers
Brønsted-Lowry acids and bases Conjugate acid or base
Acid Dissociation constant (K_a) Henderson Hasselbalch equation Lewis acids and bases
Strong acid or base Weak acid or base

Describe the organic chemistry mechanisms of:

Amide/ester condensation from amine/alcohol and carboxylic acid
Amide/ester hydrolysis into amine/alcohol and carboxylic acid
Hemiacetal (hemiketal) isomerization from an aldehyde (ketone) and alcohol
Acetal (ketal) condensation from a hemiacetal (hemiketal) and alcohol

Chemistry Skills You Must Have

(We will briefly review over most of them, though)

- Conversions between standard measurements:
mega, M - 10^6 kilo, k - 10^3 milli, m - 10^{-3} micro, μ - 10^{-6}
nano, n - 10^{-9} pico, p - 10^{-12} femto, f - 10^{-15}
- Calculate pH from $[H^+]$ or $[OH^-]$
- Use Henderson-Hasselbalch equation to calculate pH, pK_a or the concentrations of acid and conjugate base
- Given three of temperature, enthalpy, entropy or free energy, calculate the fourth term. Balance chemical equations
- Set up the equilibrium equation for a reaction
- Given the initial concentrations of reactants and the equilibrium constant, calculate the concentrations of reactants and products at equilibrium.
- Calculate the equilibrium constant when given the concentrations of reactants and products at equilibrium.
- Interconvert between standard free energy and equilibrium constants
Calculate reduction potentials and free energies of REDOX reactions
Determine oxidation numbers for atoms in a molecule
- Assign R and S configurations to chiral carbons
- Describe the effect of oxidizing and reducing agents on organic molecules, and the relationships between alkanes, alkenes, alcohols, aldehydes, ketones, and carboxylic acids