

Study Guide for Exam #1 (Review, Ch. 1-2)

Chem21, Introduction to Organic and Biochemistry

MEMORIZE

- $[\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14}$, $\text{pH} = -\log([\text{H}_3\text{O}^+])$, $[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$
- Carbon prefixes (meth-, eth-, prop-, but-, pent-, hex-, hept-, oct-, non-, dec-)
- Common name substituents (isopropyl, isobutyl, *sec*-butyl, *tert*-butyl)
- Number prefixes (di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, nona-, deca-)
- Class suffixes (alkane \rightarrow “-ane”, alkene \rightarrow “-ene”)
- Halogenation, hydrogenation, hydrohalogenation, acid-catalyzed hydration

General Chemistry Review

I. Chemical Reactions: Know how to calculate molecular weights for molecules. Know how to balance chemical reactions with stoichiometric coefficients.

II. Lewis Structures: Know how to draw correct Lewis structures for organic molecules, using the “organic shortcuts”. From the structures, know how to determine the VSEPR geometries, whether they are overall polar or nonpolar, and what intermolecular forces are present.

III. Acids and Bases: Given an equation, know how to identify the acid, base, conjugate acid, and conjugate base. Be able to calculate the $[\text{H}_3\text{O}^+]$, $[\text{OH}^-]$, or pH given one of the three and use them to classify whether the solution is acidic, neutral, or basic. Given the structure of a weak acid or base and their conjugate, be able to determine which side/structure would predominate in acidic/low pH or basic/high pH conditions.

Chapter One: Saturated Hydrocarbons

I. Structures (1.1-3, 5-6): Know how to identify inorganic and organic molecules. Know how to use $\text{C}_n\text{H}_{2n+2}$ to identify saturated hydrocarbons. Know how to draw the correct Lewis, structural, and condensed/line angle structures for a given formula, including finding all possible constitutional isomers. Know how to identify and/or draw eclipsed or staggered conformational isomers.

Ex., Ch. 1: 1.5, 1.18-22, 1.27-30

II. Nomenclature (1.7): Know how to derive the correct IUPAC name for alkanes both normal and branched, including common-name substituents (i.e., isopropyl, isobutyl, etc.). Or, given the IUPAC name, be able to draw the correct line-angle formula for the structure.

Ex., Ch. 1: 1.33-42

III. Cycloalkanes (1.8-9): Know how to derive the correct IUPAC name for cycloalkanes, including cis/trans if applicable. Or, given the IUPAC name, know how to draw the correct line-angle formula for the structure.

Ex., Ch. 1: 1.43-49, 1.52-55

IV. Properties of Alkanes (11.10-11): Given a series of alkanes, know how to arrange them by increasing/decreasing intermolecular forces and boiling point. Given a solvent, know how to determine whether alkanes will be soluble or insoluble in it given its polarity. Given the formula or name of the alkane, know how to write balanced equations for their combustion.

Ex., Ch. 1: 1.56-58, 1.60-62, 1.65

Chapter Two: Unsaturated Hydrocarbons

I. Nomenclature (2.1-2): Know how to identify an alkene by structure. Know how to derive correct IUPAC names for alkenes, given the structure including cis/trans where applicable. Or, given the IUPAC name, know how to draw the correct line-angle structure.

Ex., Ch. 2: 2.3-12, 2.18-21

II. Alkene Properties (2.3): Given a series of alkenes, know how to arrange them by increasing/decreasing intermolecular forces and boiling point. Given a solvent, know how to determine whether alkenes will be soluble or insoluble in it given its polarity. Given the alkene structure and reagents, know how to predict the products from the four addition reactions, including using Markovnikov's Rule: (1) halogenation, (2) hydrogenation, (3) hydrohalogenation and (4) acid-catalyzed hydration.

Ex., Ch. 2: 2.25-31

III. Haloalkanes (2.3): Know how to derive the correct IUPAC names for haloalkanes. Or, given the IUPAC name, know how to draw the correct line-angle formula for the structure.

III. Alkynes (2.5): Given the structure, know how to derive the correct IUPAC names for alkynes. Or, given the IUPAC name, know how to draw the correct line-angle formula for the structure. Given the alkyne structure and reagents, know how to predict the products from the four addition reactions, including if only one or two equivalents are used, including using Markovnikov's Rule: (1) halogenation, (2) hydrogenation, (3) hydrohalogenation, and (4) acid-catalyzed hydration.

Ex., Ch. 2: 2.41, 44