Study Guide for Exam #2 (Ch. 2-4)

Chem21, Introduction to Organic and Biochemistry

MEMORIZE

- Class suffixes (alkene → "-ene", alkyne → "-yne", alcohol → "-ol", ether → "ether", aldehyde → "-al", ketone → "-one")
- Halogenation, hydrogenation, hydrohalogenation, acid-catalyzed hydration of alkenes AND alkynes
- Four common-name benzene derivatives (aniline, toluene, benzoic acid, phenol)
- Dehydration (low AND high temperatures) and oxidation of alcohols
- Oxidation and reduction of aldehydes and ketones
- Hemiacetal, acetal, hemiketal, and ketal functional groups
- Acid-base neutralizations with carboxylic acids

Chapter Two: Unsaturated Hydrocarbons

I. 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

II. 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

Chapter Three: Alcohols, Phenols, and Ethers

I. Nomenclature of Alcohols (3.1-2): Know how to identify primary, secondary, and tertiary alcohols Know how to derive the correct IUPAC names for alcohols. Or, given the IUPAC name, know how to draw the correct line-angle formula for the structure.
Ex., Ch. 3: 3.3-4, 6, 3-8, 14-16

II. Alcohol Properties (3.3): Know the intermolecular forces present in alcohols and how they affect relative boiling points. Given a series of compounds (hydrocarbons, ethers, and alcohols), be able to arrange them by increasing or decreasing boiling point.
Ex., Ch. 3: 3.17-20

III. Reactions of Alcohols (3.4): Know how to predict the products for (1) dehydration of alcohols (high AND low temperatures) including all possible products and major/minor products formed, if applicable, and (2) oxidation. Given the products of a reaction, know how to determine the reactant used. Be able to develop multistep syntheses to prepare given products from given reactants.
Ex., Ch. 3: 3.22-31

IV. Ethers (3.7-8): Know how to derive the correct common names for ethers. Or, given the common name, know how to draw the correct line-angle formulas for their structures. Know the intermolecular forces present in ethers and how they affect relative boiling points. Be able to identify hydrogen bond donors and hydrogen bond acceptors.
Ex., Ch. 3: 3.39-40, 43-44, 48-50

V. Thiols (3.9): Know how to identify thiol functional groups in a molecular structure. Be able to predict the products for the oxidation of thiols.
Ex., Ch. 3: 3.51-52, 58

Chapter 4: Aldehydes and Ketones

I. Nomenclature of Aldehydes and Ketones (4.1-2): Know how to derive the correct IUPAC names for aldehydes and ketones. Or, given the name, know how to draw the correct line-angle formulas for their structures. Know the intermolecular forces that are present in aldehydes and ketones and how they affect relative boiling points. Be able to identify hydrogen bond donors and hydrogen bond acceptors.
Ex., Ch. 4: 4.5-13, 15-20

II. Reactions of Aldehydes and Ketones (4.3): Know how to determine the products for the (1) oxidation of aldehydes and ketones with $KMnO_4$ or $K_2Cr_2O_7$ (2) hydrogenation/reduction, or (3) the addition of alcohols. Or, given the products, be able to determine the original aldehyde or ketone. Be able to identify hemiacetals, acetals, hemiketals, and ketals.
Ex., Ch. 4: 4.21-26, 42-43