General Instructional Objectives
Chapter 13. Unsaturated hydrocarbons

Materials That you should be familier by taking CHEM 120 or 100, 101 &102

- Be able to write Lewis symbols of elements and predict the number covalent bonds and ionic charge
- Be able to tell polarity (non-polar/polar/ionic) based on electronegativity of a covalent bond
- Be able to draw Lewis structures of organic molecules
- Be able to label the hybridization of carbon, oxygen and nitrogen in compounds
- Be able to identify functional groups and types of organic compounds

Chapter 12. Saturated Hydrocarbons.

12. 1 Organic and Inorganic Compounds.

- Know the difference between organic and inorganic compounds

12. 2 Bonding Characteristics of the Carbon Atom.

- Describe the bonding characteristics of the carbon atom

12. 3 Hydrocarbons and Hydrocarbon Derivatives.

- Describe and select hydrocarbons and hydrocarbon derivatives

12. 4 Alkanes: Acyclic Saturated Hydrocarbons.

- Know the types of alkanes: acyclic saturated hydrocarbons: normal and branched

12. 5 Structural Formulas.

- Draw and interpret the structural formula of alkanes: acyclic saturated hydrocarbons: normal and branched.
- Be able to determine molecular formula from, condensed, structural, a line-angle formula of alkanes.

12. 6 Alkane Isomerism.

- Describe the types of isomerism found in hydrocarbons, hydrocarbon derivatives and organic compounds: constitutional isomerism.
- Be able to draw constitutional isomers (Lewis structures or condensed formulas as specified) given the molecular formula.

12. 7 Conformations of Alkanes.

- Describe the types of conformation found in hydrocarbons, hydrocarbon derivatives and organic compounds: conformational stereoisomerism.
- Know what a Newman projection (staggered/ecliped) is and what it represents along with the most and least stable conformers

12. 8 IUPAC Nomenclature for Alkanes.

- Know IUPAC nomenclature for simple (unbranched) alkanes.
- Know the names of common alkyl groups found on branched alkanes
- Describe the ways alkanes are named using IUPAC rules.

12. 9 Line-Angle Structural Formulas for Alkanes.

- Draw and interpret the line anglel formula of alkanes: acyclic saturated hydrocarbons: normal and branched.

CHEMISTRY AT A GLANCE:
Structural Representations for Alkane Molecules.
12. 10 Classification of Carbon Atoms.

- Describe the ways carbon atoms are classified in alkanes: acyclic saturated hydrocarbons: normal and branched.
- Be able to identify primary, secondary and tertiary carbons on a organic compound

12. 11 Branched-Chain Alkyl Groups.

- Describe the ways alkyl groups are made by removing hydrogen from alkanes and use of alkyl group names in IUPAC nomenclature to name branched chain alkanes.
- Know IUPAC nomenclature for complex (branched) alkanes

12. 12 Cycloalkanes.

- Know the types of cycloalkanes: cyclic saturated hydrocarbons: cyclo-propane, -butane, -pentane and –hexane etc.
- Know the naming of simple and substituted cycloalknes.

12. 13 IUPAC Nomenclature for Cycloalkanes.

- Describe the ways cycloalkanes are named using IUPAC rules.

12. 14 Isomerism in Cycloalkanes.

- Describe the types of isomerism found in cycloalkanes, and their derivatives: Geometrical Isomerism-Cis- and Trans- Geometrical Isomerism.
- Know cis/trans geometric isomerism in cycloalakne compounds
- Know cyclepentane and cyclohexane conformations (most stable and least stable)

12. 15 Sources of Alkanes and Cycloalkanes.

12. 16 Physical Properties of Alkanes and Cycloalkanes.

- Know structure and physical property trends (you do not need to know the exact melting point or boiling point for a specific alkanes and cycloalkanes).

12. 17 Chemical Properties of Alkanes and Cycloalkanes.

- Know chemical properties of alkanes and cycloalkanes.
- Know combustion and substation reactions of alkanes and cycloalkanes.
- Know the substitution reactions of alkanes and cycloalkanes.

CHEMISTRY AT A GLANCE: Properties of Alkanes and Cycloalkanes.
12. 18 Nomenclature and Properties of Halogenated Alkanes.

- Know the substitution reactions of alkanes and cycloalkanes with halogens to produce CFCs.
- Know the effect of CFCs on the ozone depletion.

CHEMICAL CONNECTIONS:
The Occurrence of Methane; The Physiological Effects of Alkanes; Chlorofluorocarbons and the Ozone Layer.

13.1 Unsaturated Hydrocarbons

- Be familiar with important classes of unsaturated hydrocarbons and provide examples of each of these classes of compounds and discuss their uses.

13.2 Characteristics of Alkenes and Cycloalkenes

- Describe the bonding characteristics of the carbon atom forming double and triple bonds.
- Be able to determine the number of units of unsaturation in a compound.

13.3 Names for Alkenes and Cycloalkenes

- Know IUPAC nomenclature for alkenes.

13.4 Line-Angle Formulas for Alkenes

- Draw and interpret the line anglel formula of alkenes: acyclic saturated hydrocarbons: normal and branched.

13.5 Isomerism in Alkenes

- Be able to determine different types of isomerism: constitutional, conformational and stereo isomers.
- Write structures and name simple geometric isomers of alkenes.
- Know cis/trans geometric isomerism (stereo ismoers) in alkenes
- Be able to determine the number of units of unsaturation in a compound

13.6 Naturally Occurring Alkenes

- Be able to identify Terpenes.
- Be able to identify isoprene units in terpenes.

13.7 Physical Properties of Alkenes

- Know structure and physical property trends (you do not need to know the exact melting point or boiling point for a specific alkenes and cycloalkanes.

13.8 Chemical Reactions of Alkenes

- Write equations predicting the products of the simple addition reactions of alkenes: hydrogenation, halogenation, hydration, and drohalogenation.
- Discuss the addition mechanism for alkenes particularly as it pertains to the hydration reaction.

13.9 Polymerization of Alkenes: Addition Polymers

- Write equations predicting the products of polymerization reactions of alkenes: ethylene, propylene, vinyl chloride, and styrene.

13.10 Alkynes

- Know IUPAC nomenclature for alkynes.

Chemistry at a Glance: Chemical Reactions of Alkenes

Chemistry at a Glance: IUPAC Nomenclature for Alkanes, Alkenes, and Alkynes

13.11 Aromatic Hydrocarbons

- Be familiar with important classes of aromatic hydrocarbons and provide examples of each of these classes of compounds and discuss their uses.

13.12 Names for Aromatic Hydrocarbons

- Know nomenclature for simple aromatic compounds

13.13 Aromatic Hydrocarbons: Physical Properties and Sources

- Know structure, physical property trends and source of aromatic hydrocarbons.

13.14 Chemical Reactions of Aromatic Hydrocarbons

- Write equations for substitution reactions involving benzene.

Chapter 14. Alcohols, Phenols, and Ethers

14.1 Bonding Characteristics of Oxygen Atoms in Organic Compounds

- Describe the bonding characteristics of the carbon atom in alcohols, and ethers.

14.2 Structural Characteristics of Alcohols

- Describe the bonding characteristics of the carbon atom forming alcohols and ethers.
- Be able to classify alcohols as 1^{ry}, 2^{ry} or 3^{ry} alcohols depending on the carbone atom attached to –OH.

14.3 Nomenclature for Alcohols

- Know the names of common alkyl groups found on alcohols and give common names of alcohols.
- Know IUPAC nomenclature for simple alcohols.
- Describe the ways Alcohols are named using IUPAC rules.

14.4 Isomerism for Alcohols

- Describe the types of isomerism found in alcohols: constitutional isomerism (skeletal and positional)
- Be able to draw constitutional isomers (Lewis structures or condensed formulas as specified) given alcohol formula.

14.6 Physical Properties of Alcohols

- Describe the physical properties of commonly used alcohols.

14.7 Preparation of Alcohols

- Know preparations of alcohols by dehydration of alkenes including knowing the reagents necessary to carry out these reactions.

14.8 Classification of Alcohols

14.9 Chemical Reactions of Alcohols

- Classify reactions as substitution, rearrangement, addition or elimination.
- Know reactions of alcohols by intramolecular dehydration of alkenes, intermolecular dehydration to produce ethers, oxidation of alcohols, halogenations of alcohols including knowing the reagents necessary to carry out these reactions.
- Be able to apply opposite of Markovnikov's rule- Zaitisev's Rule.

14.11 Structural Characteristics of Phenols

- Describe the bonding characteristics of the phenols.

14.12 Nomenclature for Phenols

14.13 Physical and Chemical Properties of Phenols

14.15 Structural Characteristics of Ethers

14.16 Nomenclature for Ethers

14.18 Physical and Chemical Properties of Ethers

14.20 Sulfur Analogs and Alcohols

14.21 Sulfur Analogs of Ethers

Menthol: A Useful Naturally Occurring Terpene Alcohol; Ethers as General Anesthetics; Marijuana: The Most Commonly Used Illicit Drug; Garlic and Onions: Odiferous Medicinal Plants