

TOPIC LIST FOUR

Select Topics in Ch 07-09

The following is a list of important topics and objectives for students taking Chemistry 10. Exams and assignments will focus on helping students achieve these objectives. Additional topics may be added during the semester and not all will be tested for on any given exam or assignment. Students are encouraged to use this outline as a baseline for reviewing chapters, preparing for exams, and determining if Chemistry 10 meets the student's personal objectives in studying chemistry.

Organic Compounds

- Differentiate between organic and inorganic substances by composition, bond type, bond polarity, mp, bp, flammability and solubility in water.
- Understand the significance of the Urea synthesis, conducted by Wöhler.

Alkanes

- Write the IUPAC name and formula of alkane chains of up to ten carbons.
- Draw the structure of alkanes in expanded, condensed and skeletal form.
- Understand how single bond rotation produces different conformations of the same molecule.
- Name and draw cycloalkanes with three to ten carbons.
- Identify pairs of structural isomers.
- Draw the structure, formula of substituted alkanes given their name.

Properties of Alkanes

- Know that alkanes are insoluble in water, but soluble in many non-polar solvents.
- Know that alkanes have densities less than water.
- Be able to write the combustion reaction for a given alkane.

Alkenes & Alkynes

- Understand that alkenes and alkynes are hydrocarbons with double and triple bonds, respectively.
- Understand why alkenes and alkynes are called unsaturated hydrocarbons.
- Know alkanes are saturated hydrocarbons and contain the maximum number of hydrogen atoms.
- Understand why unsaturated hydrocarbons burn hotter even though alkanes release more heat.
- Write the IUPAC name of alkenes and alkynes and draw their structures, including cyclic and substituted structures.

Cis-Trans Isomerism & Aromatics

- Understand how a double bond can lead to either of two geometric isomers (stereo isomers).
- Understand how stereo isomerism is different than conformation or structural isomerism.
- Name and draw the structure of substances which may be cis or trans stereoisomers.
- Know the conditions and be able to predict the product of hydrogenation (H_2 addition), hydration (H_2O addition), bromination, and permanganate oxidation reactions of alkenes.
- Be able to draw and name single ring aromatic compounds.

Alcohols, Phenols, Thiols & Ethers

- Know what a functional group is and how it can be used to define a family of organic compounds.
- Draw structures for, and use IUPAC to name, alcohols.
- Recognize and provide the common names of simple alcohols.
- Name and draw the structure of substituted phenols.
- Know how the thiol functional group (-SH) defines the thiol family of compounds.
- Draw structures and use IUPAC to name thiols.
- Understand ethers are substances that contain an ether group (-O-) between two carbons.
- Draw and provide the common name of simple ethers.

Properties

- Be able to identify and give examples of primary, secondary, and tertiary alcohols and thiols.
- Understand how the hydroxyl group allows alcohols to participate in hydrogen bonding (-OH).
- Understand how the presence of hydroxyl groups effect relative solubility, boiling & melting points.
- Know the thiol group does not participate in hydrogen bonding.

- Predict which compounds may have harsh or pleasant odor, sweet or bitter taste by the presence of thiol or phenol groups.

Oxidation

- Know oxidation is the loss of electrons or increase in an atoms oxidation number.
- Know reduction is the gaining of electrons or the decrease in an atoms oxidation number.
- Determine the oxidation number for an atom embedded in either a molecule or ion.
- Identify a single displacement reaction.
- Identify the half reactions in an oxidation-reduction reaction with single displacement kinetics.
- Know the relative activity of elements in the seven regions of the periodic table presented.
- Understand a red-ox reaction occurs if the metal reactant is more active than the ion it displaces.
- Predict whether a given red-ox reaction will occur, based on relative metal activities.

Aldehydes & Ketones

- Know aldehydes, ketones, & carboxylic acids are substances containing a carbonyl group (-CO-).
- Use IUPAC to name and draw aldehydes and ketones.

Reactions of Alcohols, Thiols, Aldehydes, & Ketones

- Recognize an organic molecule gaining O-C bonds or loosing H atoms is being oxidized.
- Recognize an organic molecule gaining H-C bonds or loosing O atoms is being reduced.
- Predict the product of oxidizing or reducing an alkane, alcohol, aldehyde, or carboxylic acid.
- Understand tertiary alcohols cannot be oxidized.
- Identify and write combustion reactions (an oxidation) of alcohols, using oxygen and heat.
- Identify and write dehydration reactions (a reduction) of alcohols, using acid and heat.
- Predict what stereo isomers or structural isomers may result from dehydration of an alcohol.
- Know NaBH_4 or H_2 + catalyst (Pt or Ni) is used to reduce aldehydes and ketones to alcohols.

Acids

- Know that acids taste sour, turn litmus red, conduct electricity, destroy bases and produce H_2 gas.
- Know bases taste bitter, turn litmus blue, conduct electricity, destroy acids, and feel soapy.
- Understand the Liebig model of acids (a substance that releases hydrogen with active metals).
- Understand the Arrhenius model of acids and bases (a source of hydrogen ions & hydroxy ions)
- Understand the Brønsted-Lowry model of acids (a proton donor and receiver).
- Name and write the formula of binary acids.
- Understand that binary acids are a mixture of a binary compound and water.
- Understand hydroxide compounds are an Arrhenius base.
- Name and write the formula of oxy-acids.
- Understand oxy-ions are a Brønsted-Lowry base.
- Understand neutral substances with loan pairs can also be Brønsted-Lowry bases.
- Identify acid-base reactions.
- Identify conjugate acid and base pairs in an acid base reaction.
- Know higher oxidation numbers produce stronger acids.
- Know cations are stronger acids than neutral compounds than anions.

Carboxylic Acids

- Understand the difference between a selective and specific chemical change.
- Draw and name carboxylic acids using the IUPAC system.
- Know the structure and common name of formic acid and acetic acid.
- Draw and name carboxylate ions and salts.
- Know that carboxylate salts are solid at room temperature, odorless, and soluble in water.
- Know properties and some common uses of carboxylic acids and their salts.
- Know why salicylic acid is more acidic than other carboxylic acids.

Esters

- Know how esterification combines carboxylic acids and alcohols to form esters.
- Name and draw esters using the IUPAC system.

Hydrolysis of Esters

- Understand how esters equilibrate in strong acid to hydrolyze.
- Understand how strong bases can be used irreversibly to hydrolyze esters.