

Note: This list is not necessarily exhaustive; ultimately, you are responsible for whatever came up in class!

You can ignore the items that are struck out.

Similarly, and items in the "practice quiz" and "practice questions" that deal with the struck out items can be ignored.

Bonding

Orbital diagrams, energy level diagrams & electron config. for row 1 & row 2 atoms

s, p orbitals (shape, orientation, phase, filling with electrons)

Hybridized orbitals: sp, sp², sp³ (shape, geometry) & remaining unhybridised orbitals

Hybridization for C, N, O atoms and associated angles between bonds (& nonbonding orbitals, if any)

MO Theory, describe details of bonding and antibonding for (s,s) σ and (p,p) π bonds

"bonding results from overlap of same phase orbitals being filled w/ electrons"

σ bonds, describe & recognize

(s,s ; s,sp ; s,sp² ; s,sp³ ; sp,sp ;sp²,sp³ ; sp³,sp³)

π bonds, describe & recognize

(sideways overlap of p orbitals)

Multiple bonds : 1 σ plus one or more π bonds

VSEPR Theory

predict molecular shape, bonding angles & hybridization of atoms based on "number of e⁻ clouds" (incl. those of high energy species)

Given a structural formula, locate non-bonding electrons & describe hybridization of any atom, bonding angles and overall geometry of the molecule

Electronegativity, know trends in PT, apply to differentiate ionic/ polar/ nonpolar bonds

recognize symbols re: polarity and apply to formulas derive molecular polarity from bond polarity for simple molecules

know "modified octet rule"

assess whether a given Lewis structure is feasible

Formal charges, determine & locate for given Lewis structures

Resonance,

define & determine whether structures are related by resonance

place correct curved arrows to derive one resonance structure from another

if curved arrow(s) are shown on one structure derive the alternative resonance structure

devise alternative resonance structures for simple cases

Formulas

differentiate between dash, condensed, bond-line, and molecular formulas

derive one from the other, as far as possible

apply the conventional method to show 3D structures

recognize constitutional isomers

Reaction Theory

define reactions at the macro and micro level

know the basic ideas of the collision theory for chem. rxns

understand the terms associated w/ reaction diagrams 4 classes of rxn: addn, elimin, substitn, rearr.

define, recognize and give examples

2 types of rxns:

homolytic and heterolytic, define & describe

know symbols for homo- and heterolytic e⁻ mvmt

know & apply rules of e⁻ mvmt

show e⁻ mvmt if reactants & products are given

Acids/Bases

B/L concept, define

"conjugate" acid/base, define and derive

K_a, pK_a, define & predict acid/base rxns

Lewis concept, define

associate Lewis acid w/ the terms electron acceptor, electron sink, low energy empty orbital, electrophile

associate Lewis base w/ the terms electron donor, electron source, lone pairs, nucleophile

Functional Groups & IR

correlate names & structure of 14 F.G.s

identify F.G.s in organic structures

give examples of cmpds w/ specified F.G.s

use IR correlation charts to identify F.G.s

physics of IR spectroscopy

Alkanes/ Cycloalkanes

describe relevant molecular features

name first 10 straight chain hydrocarbons

recognize simple alkyl and halogen substituents:

Me, Et, Pr, iPr, Bu, iBu, sBu, tBu, F, Cl, Br, I

know/ apply concepts of constitutional isomerism and isomeric substituents

recognize & give examples of primary, secondary, tertiary, quaternary C's, H's and F.G.s

name alkyl/ halo substituted alkanes/cycloalkanes

apply concept of cis/trans isomerism to substituted cycloalkanes

Reactions (know substrate, reagent(s), product(s)): combustion, halogenation, cracking