**Chemistry IB – Organic Chemistry Notes**

- Organic Chemistry

 - organic chemistry—the study of molecular compounds containing

 CARBON

 - most organic molecules also contain H, O, N, S, P or the halogens

 - organic molecules contain COVALENT BONDS (sharing electrons)

 - not all sharing of electrons is equal (which is determined by the

 ELECTRONEGATIVITY of the atoms sharing) and can produce POLAR

 BONDS

 - organic chemistry uses condensed structural formulas called LINE

 DRAWINGS (represents the basic structural formula but does NOT show C

 or H atoms)



 - in a LINE DRAWING, anywhere that LINES END or LINES CONNECT is a

 CARBON ATOM (unless some other atom is specifically drawn in)

 - also EACH CARBON MUST form FOUR BONDS, so since each line

 represents a bond, any missing lines would represent bonds to

 HYDROGEN

- Alkanes:

 - ALKANE—compounds that contain ONLY C—C and C—H bonds (ALL of

 which are SINGLE BONDS!!)

 - General Formula: **CnH2n+2**



- Naming Alkanes:

 - the alkane is named for the LONGEST continuous chain of Carbon atoms

 (PARENT CHAIN)

 - numbers are assigned to each carbon in the parent chain starting on the

 side that is the nearest to the first point of branching

 - substituent groups are named and numbered according to their position

 on the parent chain

 —CH3 (methyl) —CH2CH3 (ethyl) —CH2CH2CH3 (propyl)

 - substituent groups are named ALPHABETICALLY

 - the alkane always ends in “-ANE”

 - Cycloalkanes:

 - CYCLOALKANE—alkanes in which the carbons are connected in a RING

 structure

 - General Formula: CnH2n

 - 2 H atoms are ELIMINATED when the end C atoms join together

  

- Alkenes:

 - ALKENE—an organic molecule that contains at least ONE C=C (DOUBLE

 BOND!!)

 - General Formula: **CnH2n**

- names end in “-ENE”

- Alkynes:
 - ALKYNE—an organic molecule that contains at least ONE CΞC (TRIPLE

 BOND!!)

 - General Formula: **CnH2n-2**

- names end in “-YNE”

- Naming Alkenes & Alkynes:

 - PARENT CHAIN = the longest continuous C chain containing the C=C or

 CΞC

- number the chain starting at the end NEAREST the C=C or CΞC (if distance

 is the SAME, then start numbering at side nearest first branch point)

- list substituents ALPHABETICALLY with their numbers

- the C=C or CΞC is numbered using the carbon with the LOWEST number in

 the bond

 - if there is MORE THAN ONE C=C or CΞC, then the compound is referred to
 as –*diene* or –*triene* and so forth

- Functional Groups:

 - organic molecules are classified according to their FUNCTIONAL GROUPS

 (substituted atoms where the REACTIONS OCCUR)

 A. HALOALKANES (ALKYL HALIDES)

 - **R—X** (where X = F, Cl, Br, I)

 - F = fluoro- Cl = chloro- Br = bromo- I = iodo-

 - NAME: number carbon chain so X has lowest number / use prefix /

 name the alkane chain

 - can be synthesized by FREE RADICAL HALOGENATION

 or by HYDROHALOGENATION of an ALKENE



B. ALCOHOLS

 - **R—OH**

 - NAME: number carbon chain so C—OH has lowest possible

 number / root name of alkane chain + ending “-OL”

 - can be synthesized by NUCLEOPHILIC SUBSTITUTION of R—X



 - can also be formed by HYDRATION (adding water) of an alkene



C. ETHERS

 - **R—OR’**

 - NAME: find longest C chain / prefix + OR’ becomes “alkOXY-“

 where alk is the smaller chain prefix

 - COMMON NAME: name R and R’ alphabetically as alkyl groups +

 “ether”

 - synthesis of ethers can occur by SN2 of an ALKOXIDE ION (RO-) on

 an ALKYL HALIDE (RX)

 **RO- + R’—X 🡪 R’—O—R + X-**



 - synthesis of ether can also occur by DEHYDRATION of ALCOHOL



**R—O—H + R’—O—H 🡪 R—O—R’ + H—O—H**

 - Ethers are fairly unreactive which make them very good solvents

 for other reactions

 - Have a tendency to spontaneously form PEROXIDES (explosive!!)

D. Aromatic Hydrocarbons

 - AROMATIC—class of ring shaped molecules that have a structure

 based on BENZENE (C6H6)

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 - BENZENE has a resonance structure so the double bond electrons

 are DELOCALIZED

 - NAME: for monosubstituted “substituent”-BENZENE

 (bromobenzene, chlorobenzene, etc.)

 - for disubstituted, you can number the C in the benzene ring or use

 PREFIXES

 1) ortho- = 1,2

 2) meta- = 1,3

 3) para- = 1,4





E. AMINES

 - AMINE—an organic compound that is derived from ammonia (NH3)

 - **R—NH2**



 - amines are named just like alcohols but the “-ol” ending is replaced

 by “-AMINE”

 - another way of naming is to use the prefix “AMINO-” if there are

 other substituents that have to be named also

 - since the N has a LONE PAIR of electrons it can accept a proton

 from another molecule and act as a BRONSTED or LEWIS BASE

 - synthesis of amines happens by reducing other compounds



F. ALDEHYDES & KETONES

 - ALDEHYDYE: **R—CO—H**

 - KETONE: **R—CO—R’**

 - aldehydes and ketones have a CARBONYL CARBON (C=O) as a part

 of their functional group



 - naming aldehydes: “prefix of substituent (R) name-” + “-aldehyde”

 - naming ketones: “name of R and R’” (in order of increasing mass)

 as ALKYL GROUPS + “KETONE”

 - IUPAC names of aldehydes have the ROOT of the R chain with the

 ending “-al”

 - IUPAC names of ketones have the C=O numbered (lowest #) named

 for the longest continuous C chain and the ending “-one”

 - Ketones may be synthesized by oxidation of 2o ROH



 - Ketones may also be synthesized by DEHYDROGENATION

 (loss of H2) of a 2o ROH



G. CARBOXYLIC ACIDS

 - **R—COOH**

 - acts as an acid!!

 - RCOOH 🡪 H+ + RCOO-



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 - Names of Carboxylic acids 🡪 name the longest carbon chain as an

 ALKYL group prefix + “-OIC ACID”

H. ESTERS

 - **R—CO—O—R’**

 - NAME: Esters are named after the alcohol and carboxylic acids that

 they are derived from (SEE REACTION #1 above for reactions of

 Carboxylic acids!!!)

 - the ALKYL GROUP (R’) from the ALCOHOL is named first followed by

 the name of the CARBOXYLIC ACID (R—CO) ending in “-OATE” or

 just “-ATE”

