SCH4U Organic Chemistry Cheat Sheet Cheat Sheet

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Root Name/Branch Prefixes

Number of C atoms / branches	Root prefix	Multiplying prefix
1	meth-	mono-
2	eth-	di-
3	prop-	tri-
4	but-	tetra-
5	pent-	penta-
6	hex-	hexa-
7	hep-	hepta-
8	oct-	octa-
9	non-	nona-
10	dec-	deca-

Alkyl Groups

CH3	methyl
C2H5	ethyl
C3H7	propyk
C4H9	butyl
C5H11	pentyl
C6H13	hexyl
C7H15	heptyl
C8H17	octyle
C9H19	nonyl
C10H21	decyl

Alkanes

CH4	Methane
C2H6	Ethane
C3H8	Propane
C4H10	Butane
C5H12	Pentane
C6H14	Hexane
C7H16	Heptane
C8H18	Octane
C9H20	Nonane
C10H22	Decane

General Formula for an alkane is C(n)H(-2n+2)
Alkanes are non-polar (only C-H bonds)

Common Functional Groups

F	Flouro
Cl	Chloro
Br	bromo
I	iodo
NO2	nitro
NH2	amino

Alkenes

General formula for alkenes is C(n)H(2n)

Alkenes contain a carbon to carbon double bond

Non-polar

Suffix if highest precedence is -ene

Alkynes

Alkynes have carbon-carbon triple bonds

General formula for alkynes is C(n)H(2n-2)

Non polar

suffix is -yne if highest precedence

Cyclic Aliphatics

Cyclic compounds occur when carbon atoms are arranged to form rings

General formula for cyclic compounds are: C2H2n (cycloalkane), C2H2n-2 (cycloalkene), C2H2n-4 (cycloalkane).

Non-Polar

Prefix is cyclo

Aromatic nomenclature

F	Flourobenzene
Br	Bromobenzene
Cl	Chlorobenzene
NO2	Nitrobenzene
COOH	Benzoic acid
OH	Phenol/hydroxy benzene
NH2	aniline/aminobenzene
CH3	Toluene/methylbenzene
if 1,2 position	Ortho (o-)
if 1,3 position	Meta (m-)

Aromatic nomenclature (cont)

if 1,4 position	Para (p-)

Aromatics hydrocarbons are benzene or compounds containing a benzene ring. Benzene has the chemical formula C_6H_6

Geometric Isomer/Structural Isomer

Structural Isomers are when compounds have the same chemical formula, but a different arrangement of atoms.
{{/popup}}
Geometric Isomers are isomers where atoms are arranged the same but have a different 3-d arrangement. Alkenes can form cis-trans isomers Alkenes can form cis-trans isomers.

Intermolecular Forces

LDF	Very weak forces that exist in all atoms/molecules caused by **instantaneous dipoles**, become stronger as molecule gets larger
Dipole-Dipole	Strong attraction force between opposite charges of polar molecules
Hydrogen bonding	Very strong dipole-dipole forces with H atoms covalently bonded with an N, O or F atom

(strength is in descending order)

Emprical and Molecular Formulas

n = m/MM

m = m x MM

E.F = simplest formula

M.F = MM actual/MM empirical formula

Functional Groups in descending order

Functional Group	Prefix	Suffix
Carboxylic Acid		-oic acid
Ester		[branch]-yl [root]-oate
Amide		-amide
Aldehyde	formyl / oxo	-al
Ketone	oxo	-one
Alcohol	hydroxy	-ol
Amine	amino	-amine
Alkene/Alkyne		-ene/-yne
Alkane		
Ether	-oxy	
Alkyl Halide	flouro/chloro/bromo/iodo	

Note: for Alkene/Alkynes, to determine which takes higher priority, choose for which ever gives the better number combination for side groups, if same then go alphabetically (ene > yne)

Functional Groups characteristics

Functional Group	Polarity	Solubility	B.P/M.P
Alkane	Non-Polar	Slightly Soluble	Depends on Length, more C = Higher, less C = Lower
Alkene	Non-Polar	Slightly Soluble	Depends on Length of parent C chain
Alkyne	Non-Polar	Slightly Soluble	Depends on Length of parent C chain
Cycloalkyl	Non-Polar	Slightly Soluble	Depends on Length of parent C chain
Alcohol	Polar	Very Soluble	Depends on Length of parent C chain
Aldehydes/Ketone	Polar	Very Soluble	Very High
Carboxylic Acids/Esters	Polar	Very Soluble	Very High
Ethers	Polar	Very Soluble	Depends on Length of parent C chain
Amines/Amides	Polar	Very Soluble	Depends on Length of parent C chain

Organic Reactions I

Combustion/Complete Oxidation	Adding Oxygen or Removing Hydrogen
Substitution	Replacing a hydrogen for a Halogen (Halogenation)
Addition of Alkanes	Breaking double bond by adding Halogen (Halogenation) , Hydrogen (Hydrogenation), or Water (Hydration)
Elimination of Alkanes	The opposite of Addition
Mild Oxidation Reactions	Using Oxidizing agents to turn Primary alcohols into aldehydes/carboxylic acids, and secondary alcohols into ketones.

Remember Markovniks Rule: "Rich get richer"
Tertiary alcohols do not react in mild oxidation reactions

Benzene Reactions

Halogenation	Benzene + Halogen
Nitration (Dehydration)	Benzene + HNO_3 (in acidic conditions)
Alkylation	Benzene + Alkylhalide

Organic Reactions II Reactions

Formation of Ethers (Condensation/Dehydration)	Alcohol + Alcohol --> Ether
Formation of Esters (Condensation/Dehydration)	Alcohol + Carboxylic Acid --> ester
Decomposition of Esters (Hydrolosis)	Ester --> Alcohol + Carboxylic Acid
Formation of Amides (Condensation/Dehydration)	Amine + Carboxylic Acid --> Amide + H_2O
Decomposition of Amides (Hydrolosis)	Amide + H_2O ---> Amine + Carboxylic Acid
Synthesis of Primary Amines (Substitution)	Alkyl Halide + ammonia ---> Primary Amine
Synthesis of Secondary Amines (Substitution)	Alkyl Halide + Primary Amine ---> Secondary Amine
Synthesis of Tertiary Amines (Substitution)	Alkyl Halide + Secondary Amine ---> Tertiary Amine

Polymers

Large Molecule that are composed of many repeated subunits are called monomers

Created through polymerization

Polymerization (addition - chain reaction of alkene) $C_xH_y + C_xH_y + C_xH_y +$ ... --> $[C_xH_y]_n$

Polymerization (condensation with alcohol - polyester) $HOC_xH_yOH + HOOCC_xH_yCOOH +$ ... ---> $[O_2CC_xH_yO_2CC_xH_yO_2]_n$

Polymerization (condensation with alcohol - polyamide) $H_2NC_xH_yNH_2 + HOOCC_xH_yCOOH +$ ... --> $[NOCC_xH_yO_2CC_xH_yON]_n$

Polymerization (condensation) need the reacting functional groups to be on both sides of the monomers to be able to complete the chain reaction (-dioic acid, -diol, -diamine)