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

CH_3	methyl
C_2H_5	ethyl
C_3H_7	propyk
C_4H_9	butyl
C_5H_{11}	pentyl
C_6H_{13}	hexyl
C_7H_{15}	heptyl
C_8H_{17}	octyle
C_9H_{19}	nonyl
$C_{10}H_{21}$	decyl

Alkanes

CH_4	Methane
C_2H_6	Ethane
C_3H_8	Propane
C_4H_{10}	Butane
C_5H_{12}	Pentane
C_6H_{14}	Hexane
C_7H_{16}	Heptane
C_8H_{18}	Octane
C_9H_{20}	Nonane
$C_{10}H_{22}$	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
NO_2	nitro
NH_2	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: C_2H_{2n} (cycloalkane), C_2H_{2n-2} (cycloalkene), C_2H_{2n-4} (cycloalkane).

Non-Polar

Prefix is cyclo

Aromatic nomenclature

F	Flourobenzene
Br	Bromobenzene
Cl	Chlorobenzene
NO_2	Nitrobenzene
COOH	Benzoic acid
OH	Phenol/hydroxy benzene
NH_2	aniline/aminobenzene
CH_3	Toluene/methylbenzene
if 1,2 position	Ortho (o-)
if 1,3 position	Meta (m-)

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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 + HNO3 (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 + H2O
Decomposition of Amides (Hydrolosis)	Amide + H2O ---> 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) CxHy + CxHy+ CxHy+ ... --> [CxHy]n

Polymerization (condensation with alcohol - polyester) HOCxHyOH + HOOCCxHyCOOH + ... ---> [O2CCxHyO2CxHyO2]n

Polymerization (condensation with alcohol - polyamide) H2NCxHyNH2 + HOOCCxHyCOOH + ... --> [NOCCxHyO2CxHyON]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)