

## Summary Sheet - Introduction to Chemical Reactivity, Nomenclature, Boiling Points, and Water Solubility

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Reactant #1	Reactant #2	Product	Example	Notes
Alkene	Pd/C + H <sub>2</sub>	Alkane		cis addition (hydrogens go on same side of alkene)
Amine	Acid	Ammonium salt		amines but NOT amides (amides are not basic on nitrogen)
Carboxylic acid	Base	Salt (Carboxylate salt)		
Carboxylic acid	Alcohol, acid, heat	Ester		Alcohols used as solvent
Ester	Water, acid, heat	Carboxylic acid		This is the reverse of the above reaction. Here we use water as solvent.
Ester	Water, base	Carboxylic acid		This is called ester hydrolysis or saponification
Alkene	Water, acid	Alcohol		alcohol forms on most substituted carbon (Markovnikoff rule) proceeds through carbocation
Alkene	Strong acid	Alkyl halide		halide adds to most substituted carbon (Markovnikoff rule) proceeds through carbocation
Alkene	Br <sub>2</sub>	Dibromide		Results in trans product
Alcohol	K <sub>2</sub> CrO <sub>7</sub>	Carboxylic acid (primary alcohol) OR ketone (secondary alcohol)		Note that secondary alcohols stop at the ketone stage
Alcohol	KMnO <sub>4</sub>	Carboxylic acid (primary alcohol)		
Alkane	Cl <sub>2</sub> , hv (or peroxides)	Alkyl chloride		Free-radical reaction (number of new C-Cl bonds depends on # of equivalents)
Benzene derivative	Br <sub>2</sub> , FeCl <sub>3</sub>	Aryl bromide		Also gives 1,4 (para) product but never 1,3 (meta) product
Thiol	"Oxidant"	Disulfide		

### The Four Types of Intermolecular Bonding in Organic Chemistry

Name	Type of Interaction	Found in	Example	Strength	Notes
Ionic	Attraction between point charges	Salts		Strongest	gives rise to greatest water solubility (most polar) also highest boiling points
Hydrogen Bonding	Attraction between positively charged H and negatively charged O, N or F.	Water, alcohols, carboxylic acids, amides, amines		2nd strongest	2nd greatest for effect on water solubility and boiling points
Dipole-Dipole	Attraction between dipole moments caused by differences in electronegativity	ketones, aldehydes, esters, alkyl halides, etc. - any molecule with a strongly electronegative element (O, N, F, Cl, Br)		2nd weakest	Increases as electronegativity difference increases 3rd greatest for effect on water solubility and boiling points
Van Der Waals (London forces)	Attraction between temporary dipoles	Hydrocarbons	Name	Weakest	Increases with surface area (increasing length of carbon chains) worst for water solubility (least polar) best for solubility in non-polar solvents (e.g. pentane)

# Carbons	Root
1	Meth-
2	Eth-
3	Prop-
4	But-
5	Pent-
6	Hex-
7	Hept-
8	Oct-
9	Non-
10-	Dec-

**Primary carbon: attached to ONE carbon atom**

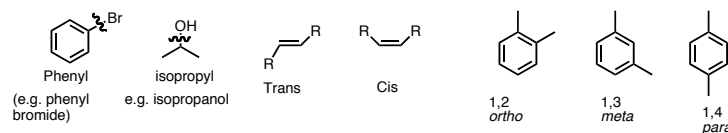
**Secondary: attached to TWO carbon atoms**

**Tertiary: attached to THREE carbon atoms**

**Quaternary: attached to FOUR carbon atoms**

Functional Group	Name	Example	Name
R-	Alkyl		Pentane
-OH	Hydroxyl		Pentanol or pentyl alcohol
-Cl, -Br, -F, -I	Halide		Pentyl chloride
-NH <sub>2</sub>	Amine		Pentylamine
R-O-R	Ether		Pentyl methyl ether
-SH	Thiol		Pentane thiol
C=C	Alkene		Pentene
R-C(=O)-H	Aldehyde		Pentanal
R-C(=O)-R	Ketone		Butyl methyl ketone OR 2-pentanone
R-C(=O)-OH	Carboxylic acid		Pentanoic acid
R-C(=O)-OR	Ester		Methyl pentanoate
R-C(=O)-NH <sub>2</sub>	Amide		N-methyl pentamide

### Other important nomenclature terms to remember



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