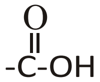
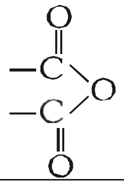
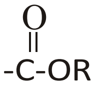
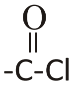
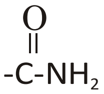
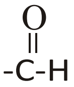
TABLE FOR IUPAC NOMENCLATURE

The order of priority of functional groups used in IUPAC nomenclature of organic compounds.

Functional group	Structure	Prefix	Suffix
Carboxylic acid	 $-\overset{O}{\overset{\|}{C}}-OH$	Carboxy	- oic acid
Sulphonic acid	$-SO_3H$	Sulpho	sulphonic acid
Anhydride		X	oic-anhydride
Ester	 $-\overset{O}{\overset{\|}{C}}-OR$	Alkoxy carbonyl or Carbalkoxy	alkyl……oate
Acid chloride	 $-\overset{O}{\overset{\|}{C}}-Cl$	Chloroformyl or Chlorocarbonyl	- oyl chloride
Acid amide	 $-\overset{O}{\overset{\|}{C}}-NH_2$	Carbamoyl/ Amido	- amide
Carbonitrile/Cyanide	$- C = N$	Cyano	nitrile
Aldehyde	 $-\overset{O}{\overset{\|}{C}}-H$	Formyl or Oxo	- al
Ketone	 $-\overset{O}{\overset{\|}{C}}-$	Keto or oxo	- one
Alcohol	$-OH$	Hydroxy	- ol
Thio alcohol	$-SH$	Mercapto	thiol
Amine	$-NH_2$	Amino	amine
Ether	$-O-R$	Alkoxy	–
Oxirane		Epoxy	–
Nitro derivative	$-NO_2$	Nitro	–
Nitroso derivative	$-NO$	Nitroso	–
Halide	$-X$	Halo	–
Double bond	$C = C$	–	ene
Triple bond	$C = C$	–	yne

ISOMERISM

DEFINITION

Compounds having same molecular formula but differ in atleast one physical or chemical or biological properties are called isomers and this phenomena is known as isomerism.

TYPES OF ISOMERISM

(A) Structural isomerism (B) Stereo isomerism

(A) STRUCTURAL ISOMERISM

Structural isomerism is a form of isomerism in which molecules with the same molecular formula have atoms bonded together in different orders.

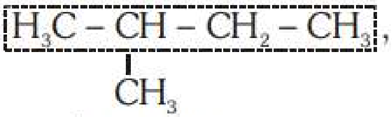
TYPES OF STRUCTURAL ISOMERISM

1. CHAIN ISOMERISM : This type of isomerism is due to difference in the arrangement of carbon atoms constituting the chain.

Key points : Parent carbon chain or side chain should be different.

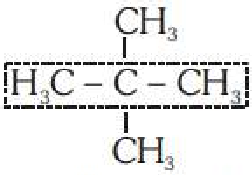
e.g. C_5H_{12} : $\boxed{CH_3-CH_2-CH_2-CH_2-CH_3}$

n-pentane



$H_3C-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$,

iso-pentane



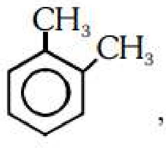
$H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$

neo-pentane

2. POSITIONAL ISOMERISM : It occurs when functional groups or multiple bonds or substituents are in different positions on the same carbon chain.

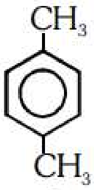
Key point : Parent carbon chain remain same and substituent, multiple bond and functional group changes its position.

e.g. $C_6H_4(CH_3)_2$:



o-xylene

m-xylene



p-xylene

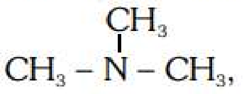
3. FUNCTIONAL ISOMERISM : It occurs when compounds have the same molecular formula but different functional groups.

e.g. C_3H_9N : $CH_3-CH_2-CH_2-NH_2$,

1-propanamine

$CH_3-CH_2-NH-CH_3$,

N-methylethanamine



$CH_3-\underset{}{\overset{CH_3}{\overset{|}{N}}}-CH_3$,

N, N-dimethylmethanamine

4. **METAMERISM :** This type of isomerism occurs when the isomers differ with respect to the nature of alkyl groups around the same polyvalent functional group.

e.g. $C_4H_{10}O$:

$CH_3-O-CH_2-CH_2-CH_3$

n-propyl methylether

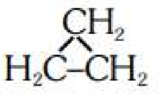
$CH_3-CH_2-O-CH_2-CH_3$

diethyl ether

5. **RING-CHAIN ISOMERISM :** In this type of isomerism, one isomer is open chain but another is cyclic.

e.g. C_3H_6 : $CH_3-CH=CH_2$

propene

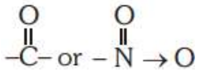


cyclopropane

- For chain, positional and metamerism, functional group must be same.
- Metamerism may also show chain and position isomerism but priority is given to metamerism.

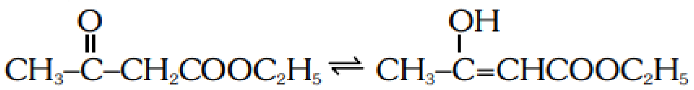
6. **TAUTOMERISM :** This type of isomerism is due to spontaneous interconversion of two isomeric forms into each other with different functional groups in dynamic equilibrium.

Conditions :

(i) Presence of  $-\overset{\overset{O}{\|}}{C}-$ or $-\overset{\overset{O}{\|}}{N}\rightarrow O$

(ii) Presence of at least one α-H atom which is attached to a saturated C-atom.

e.g. Acetoacetic ester.



$$CH_3-\overset{\overset{O}{\|}}{C}-CH_2COOC_2H_5 \rightleftharpoons CH_3-\overset{\overset{OH}{|}}{C}=CHCOOC_2H_5$$

keto form enol form

ENOL CONTENT ENHANCE BY:

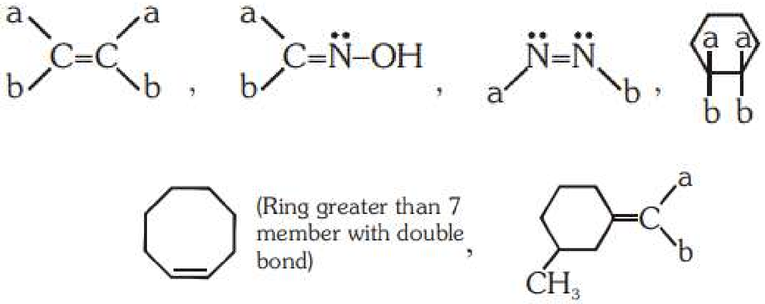
- Acidity of α-H of keto form
- Intra molecular H-Bonding in enol form
- Resonance in enol form
- Aromatisation in enol form

(B) STEREOISOMERISM

Compounds with the same molecular formula and structural formula but having difference in the spatial arrangement of atoms or groups in 3D space are called stereoisomers and the phenomenon is called stereoisomerism.

TYPES OF STEREOISOMERISM

1. **GEOMETRICAL ISOMERISM :** It is due to restricted rotation and is observed in following systems



- **Cis-trans isomerism :** The cis compound is the one with the same groups on the same side of the bond, and the trans has the same groups on the opposite sides. Both isomers have different physical and chemical properties.

e.g.

cis maleic acid   trans fumaric acid

- General physical properties of geometrical isomer of but-2-ene

(i) Stability	trans > cis
(ii) Dipole moment	cis > trans
(iii) Boiling point	cis > trans
(iv) Melting point	trans > cis

Calculation of number of geometrical isomer

Unsymmetrical	2^n
Symmetrical	$2^{n-1} + 2^{m-1}$ $m = \frac{n}{2}$ (If n is even) $m = \frac{n+1}{2}$ (If n is odd)

* Where n = number of sites where GI is possible.

2. **OPTICAL ISOMERISM :** Compounds having similar molecular and structural formula but differing in the stereo chemical formula and behaviour towards plane polarised light are called optical isomers and this phenomenon is

called optical isomersim.

- **Types of optical isomers**

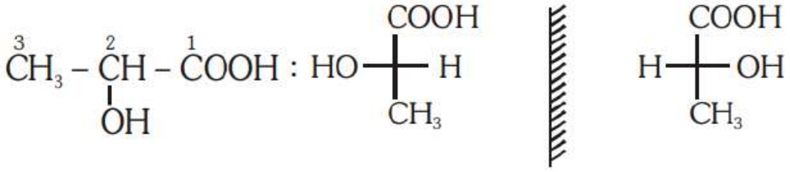
(1) Optically active	(2) Optically inactive
• dextrorotatory (d) • laevorotatory (ℓ)	• meso

- **Condition :** Molecule should be asymmetric or chiral i.e. symmetry element (POS & COS) should be absent.

- The carbon atom linked to four different groups is called **chiral carbon.**

- **Fischer projection :** An optical isomer can be represented by Fischer projection which is planar representation of three dimensional structure.

  Fischer projection representation of lactic acid (2-hydroxypropanoic acid)



- **Configuration of optical isomer :**

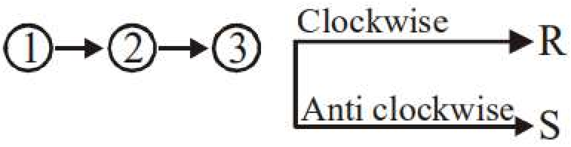
  (a) Absolute configuration (R/S system)

  (b) Relative configuration (D/L system)

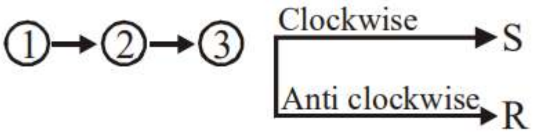
- **Determination of R/S configuration :**

  Rule-1 Assign the priority to the four groups attached to the chiral carbon according to priority rule.

  Rule-2 If lowest priority ④ is bonded to vertical line then moving

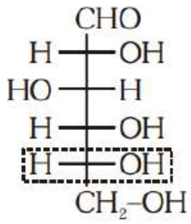


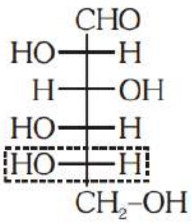
  Rule-3 If lowest priority ④ is bonded to horizontal line then moving



DETERMINATION OF D/L SYSTEM :

- Reference molecule glyceraldehyde
- It is used to assign configuration in carbohydrate, amino acid and similar compounds
  Rule : Arrange parent carbon chain on the vertical line
- Placed most oxidised carbon on the top or nearest to top.
- On highest IUPAC numbered chiral carbon
  If OH group on RHS → D
  If OH group on LHS → L


D–Glucose


L–Glucose

- **CIP SEQUENCE RULE :**

  The following rules are followed for deciding the precedence order of the atoms or groups :-

  (i) Highest priority is assigned to the atoms of higher atomic number attached to asymmetric carbon atom.

  (ii) In case of isotopes, isotopes having higher atomic mass is given priority.

  (iii) If the first atom of a group attached to asymmetric carbon atom is same then we consider the atomic number of 2nd atom or subsequent atoms in group.

  (iv) If there is a double bond or triple bond, both atoms are considered to be duplicated or triplicated.

- Non-superimposable mirror images are called **enantiomers** which rotate the plane polarised light up to same extent but in opposite direction.
- **Diastereomers** are stereoisomers which are not mirror images of each other. They have different physical and chemical properties.
- **Meso compounds** are those compounds whose molecules are superimposable on their mirror images inspite of the presence of asymmetric carbon atom.
- An equimolar mixture of the enantiomers (d & ℓ) is called **racemic mixture**. The process of converting d-or ℓ- form of an optically active compound into racemic form is called **racemisation.**
- The process by which dℓ mixture is separated into d and ℓ forms with the help of chiral reagents or chiral catalyst is known as **resolution.**
- Compound containing chiral carbon may or may not be optically active but show optical isomerism.
- For optical isomer chiral carbon is not the necessary condition.

Calculation of number of optical isomers

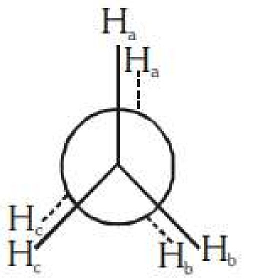
The compound	Optically active forms	Optically inactive forms (meso)
Unsymmetrical	2^{n}	Zero
Symmetrical If n = even	$2^{(n-1)}$	$2^{\frac{n}{2}-1}$
Symmetrical If n = odd	$2^{(n-1)} - 2^{(n-1)/2}$	$2^{(n-1)/2}$

* Where n = no. of chiral carbon

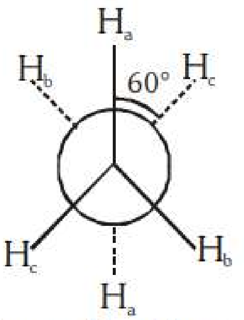
The different arrangement of atoms in space that results from the carbon-carbon single bond free rotation by 0-360° are called conformations or conformational isomers or rotational isomers and this phenomenon is called conformational isomerism.

3. CONFORMATIONAL ISOMERISM

Newmann projection : Here two carbon atoms forming the σ bond are represented one by circle and other by centre of the circle. Circle represents rear side C and its centre represents front side carbon. The C–H bonds of front carbon are depicted from the centre of the circle while C–H bond of the back carbon are drawn from the circumference of the circle.

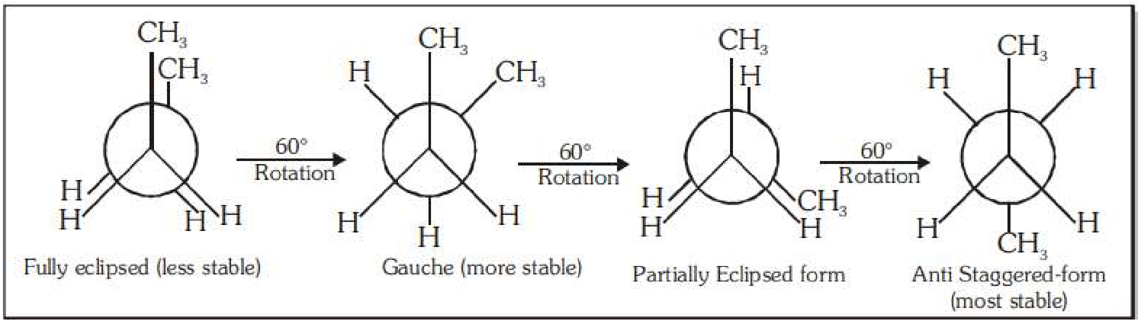


Eclipsed form (least stable)



Staggered form (most stable)

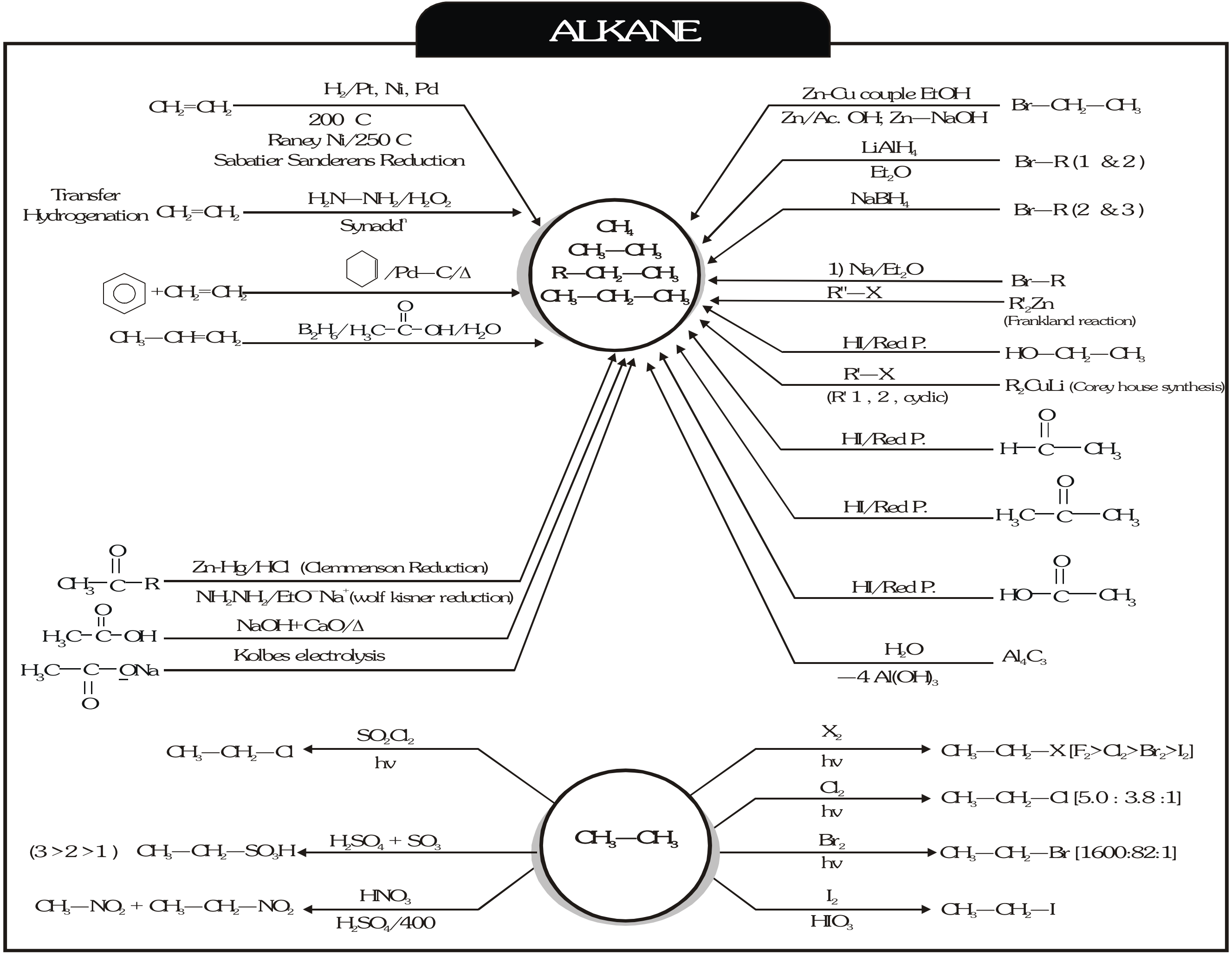
- **Conformations of butane :** $\overset{4}{C}H_3 - \overset{3}{C}H_2 - \overset{2}{C}H_2 - \overset{1}{C}H_3$



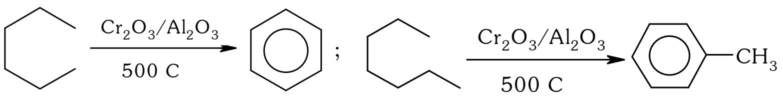
Fully eclipsed (less stable) Gauche (more stable) Partially Eclipsed form Anti Staggered-form (most stable)

- The order of stability of conformations of n-butane.
  Anti staggered > Gauche > Partially eclipsed > Fully eclipsed.
- Relative stability of various conformation of cyclohexane is Chair > twist boat > boat > half chair

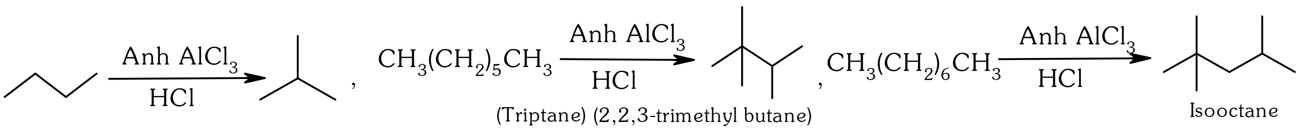
ALKANE



Aromatization :



Isomerization :



Combustion :

$$C_nH_{2n+2} + \frac{3n+1}{2}O_2 \xrightarrow{\Delta} nCO_2 + (n+1)H_2O$$

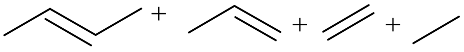
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

$$CH_3 - CH_3 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

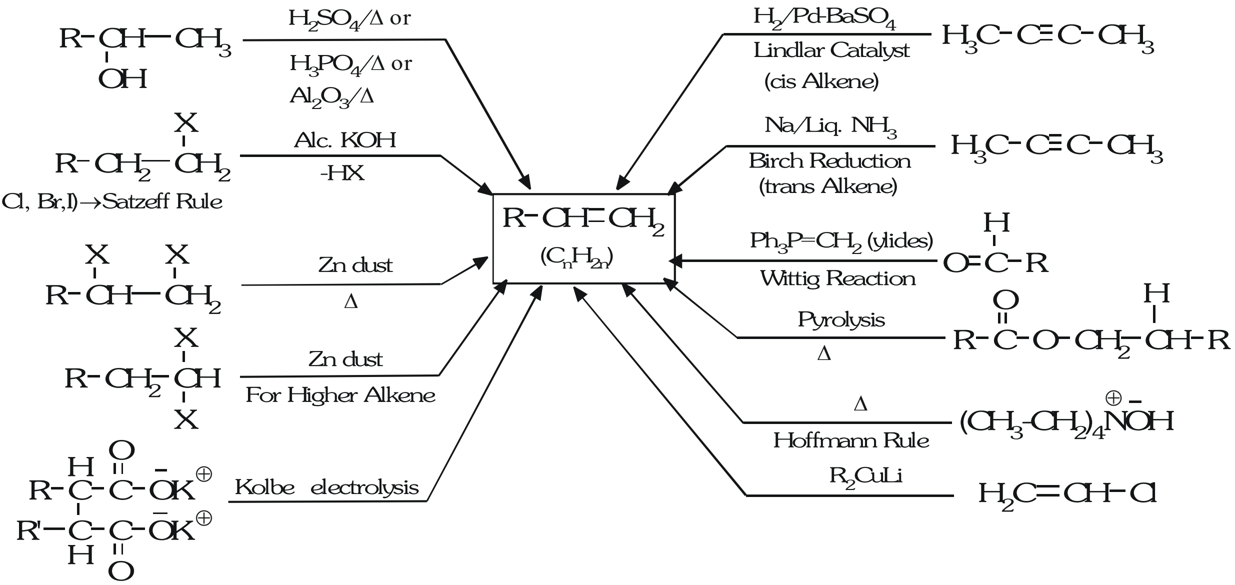
Pyrolysis:

$$2CH_3 - CH_2 - CH_3 \xrightarrow[600^\circ C]{\Delta} CH_3 - CH = CH_2 + CH_3 - CH_3 + CH_4 + H_2$$

$$CH_3 - CH_2 - CH_2 - CH_3 \xrightarrow[600^\circ C]{\Delta} CH_3 - CH_2 - CH = CH_2$$

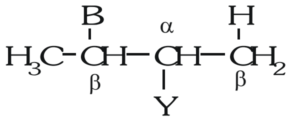


Nutshell Preparation of
ALKENE



Elimination Reaction

E^1, E^2 & E^1CB



$H_3C-\underset{\beta}{\overset{B}{CH}}-\overset{\alpha}{\underset{Y}{CH}}-\underset{\beta}{\overset{H}{CH_2}}$

$H_3C-CH=CH-CH_3$

more substituted
alkene is major product

↓

Satzeff Rule

Ⓨ I,Br, Cl, OTs, OBS
in presence of base

$\overset{-}{O}H$ / $Me\overset{-}{O}$ / $Et\overset{-}{O}$

(Alc. KOH)

6:1 (trans to cis)

Y : $OH/Conc.\ H_2SO_4/\Delta$
: $OH/H_3PO_4/\Delta$
: $OH/Al_2O_3/\Delta$
: OH/P_2O_5 or $ZnCl_2/\Delta$

$H_3C-CH_2-CH=CH_2$

Least substituted alkene
is major product

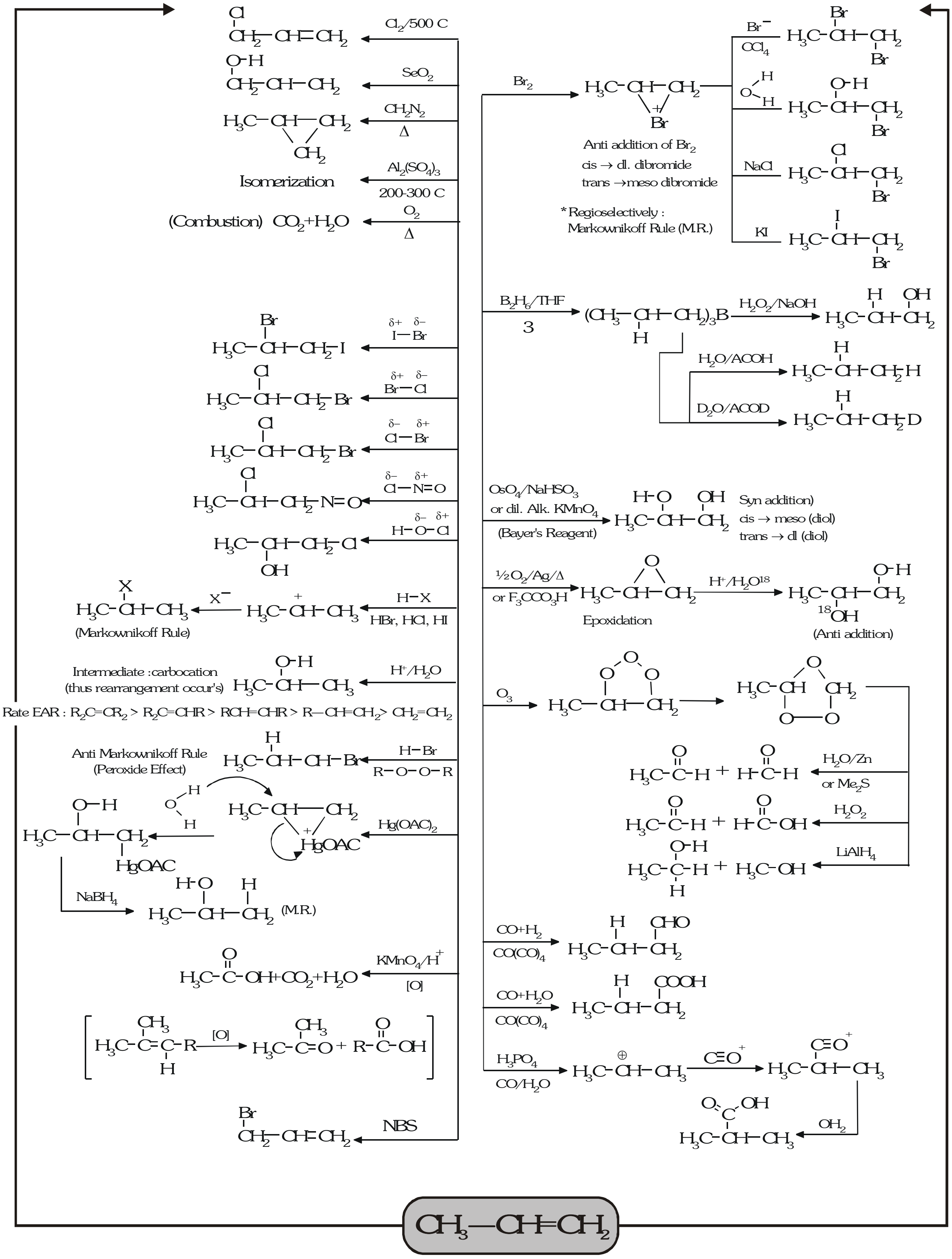
↓

Hoffman Rule

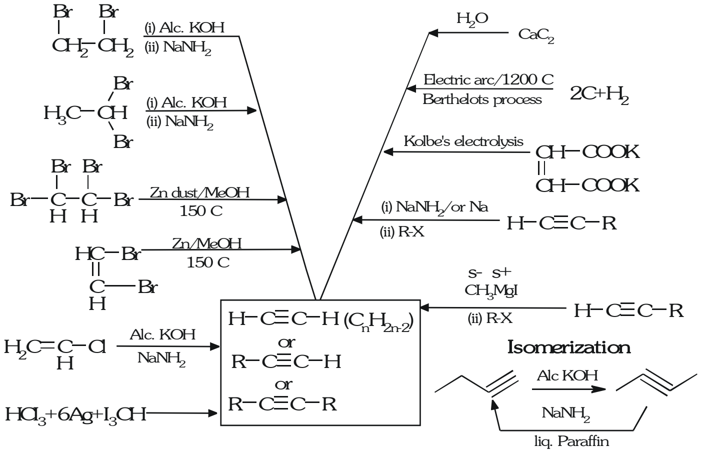
: In presence of bulky base
: When more bulky groups are present around B(C)
: When y; is $\overset{+}{N}Me_3/OH/\Delta$
: $\overset{+}{S}R_2/B/\Delta$
: $\overset{+}{N}R_2/\Delta$ with $\overset{-}{O}$ attached to N
: F / Base
: Pyrolysis of ester

Y : $OH/ThO_2/\Delta$

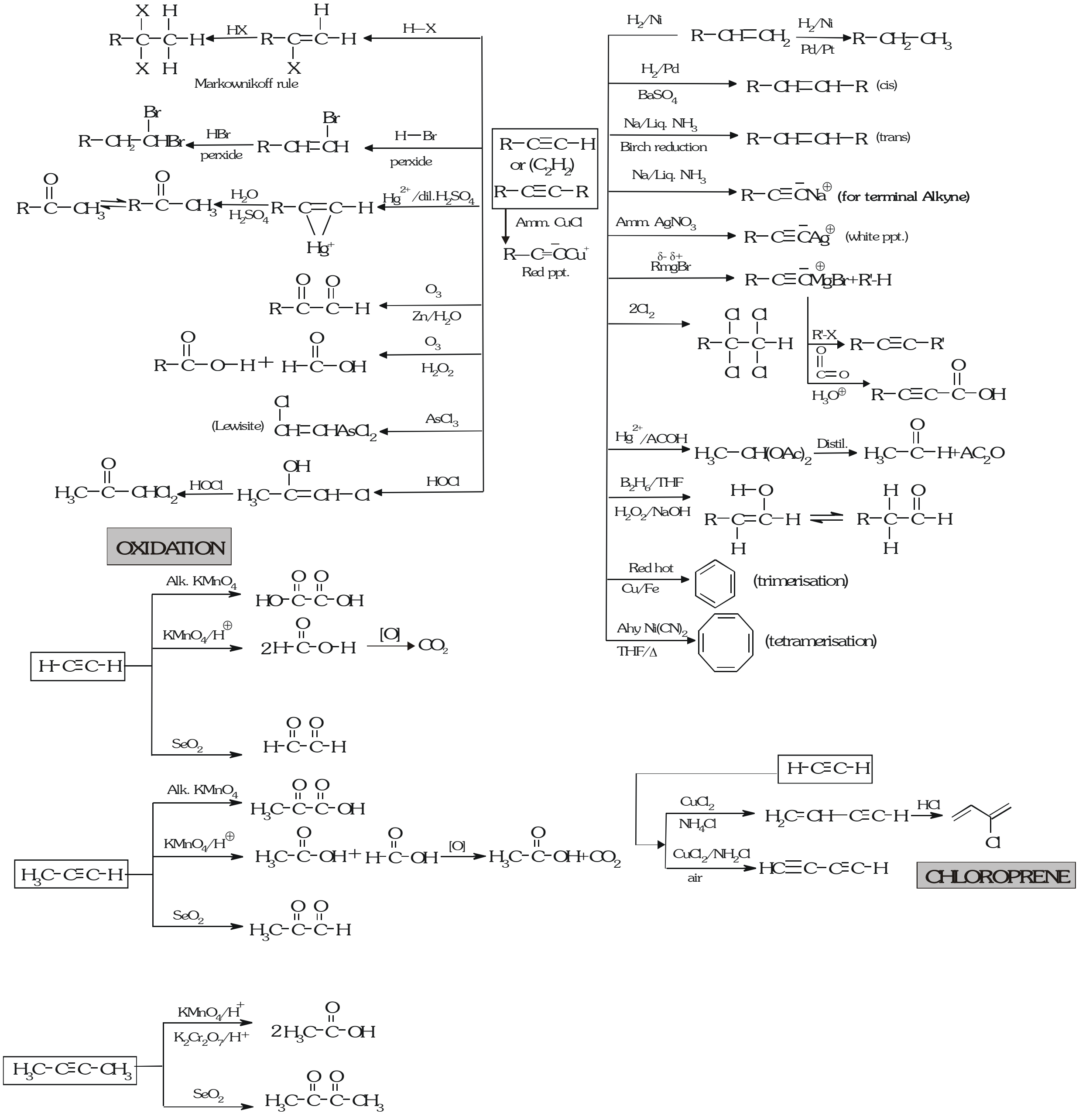
Nutshell reaction of Alkene



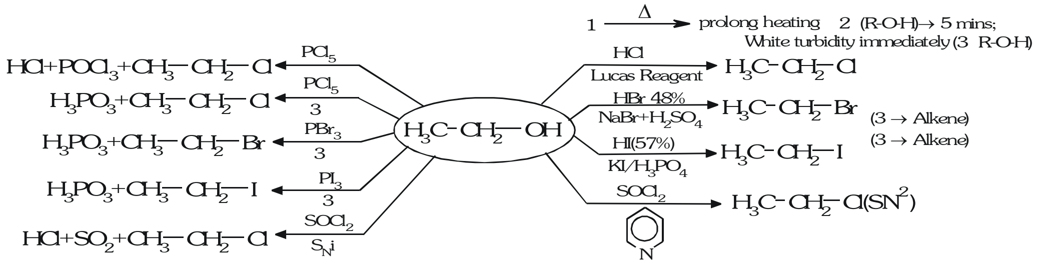
Nutshell Preparation of Alkyne

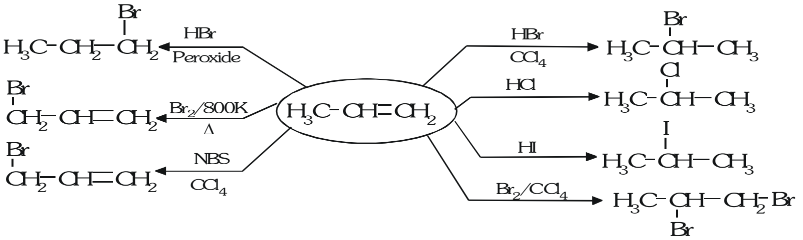


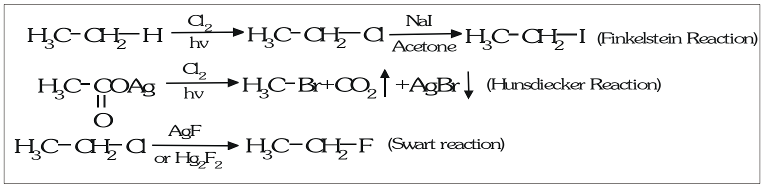
Nutshell reaction of Alkyne



Nutshell Preparation of ALKYL HALIDE



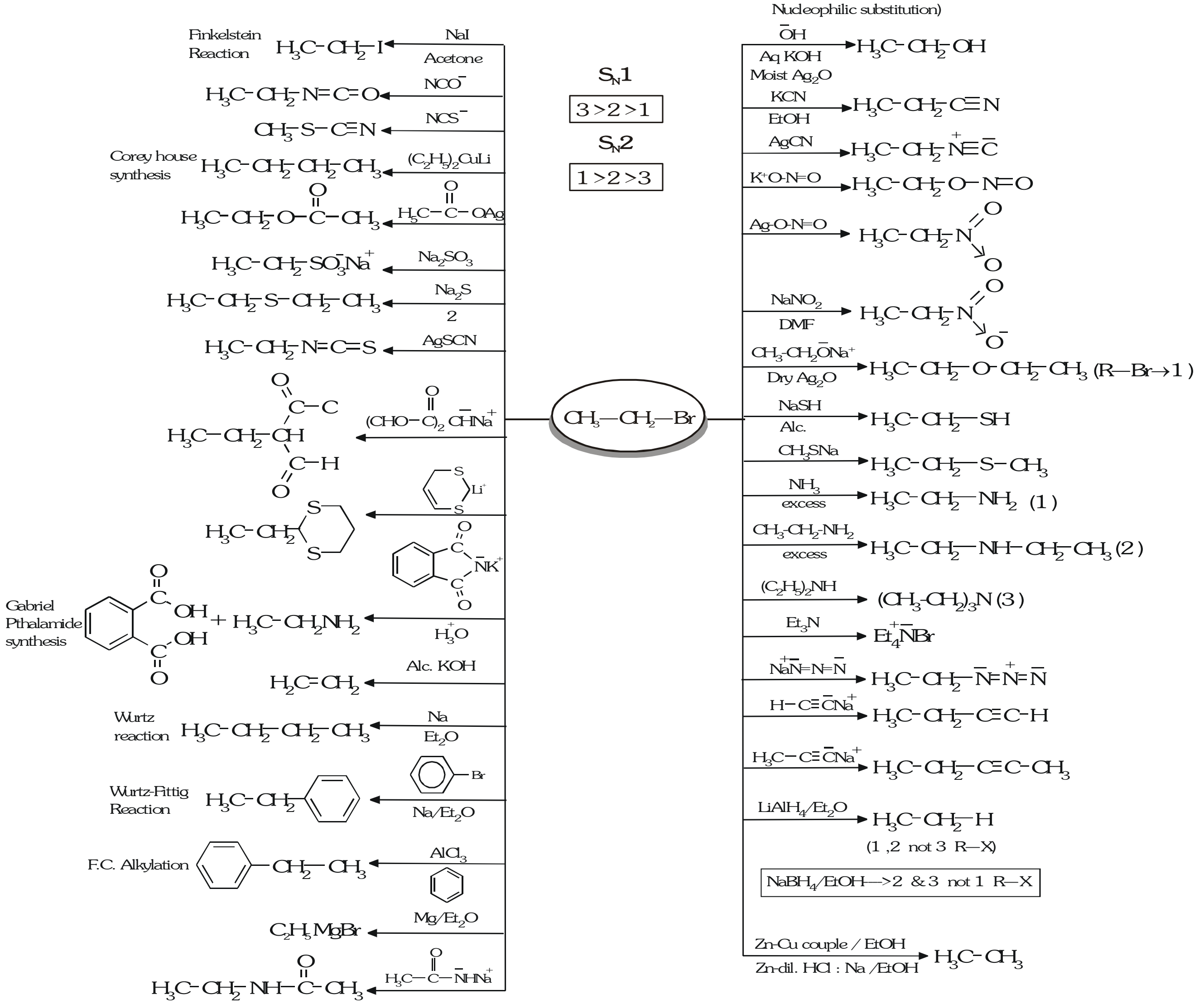




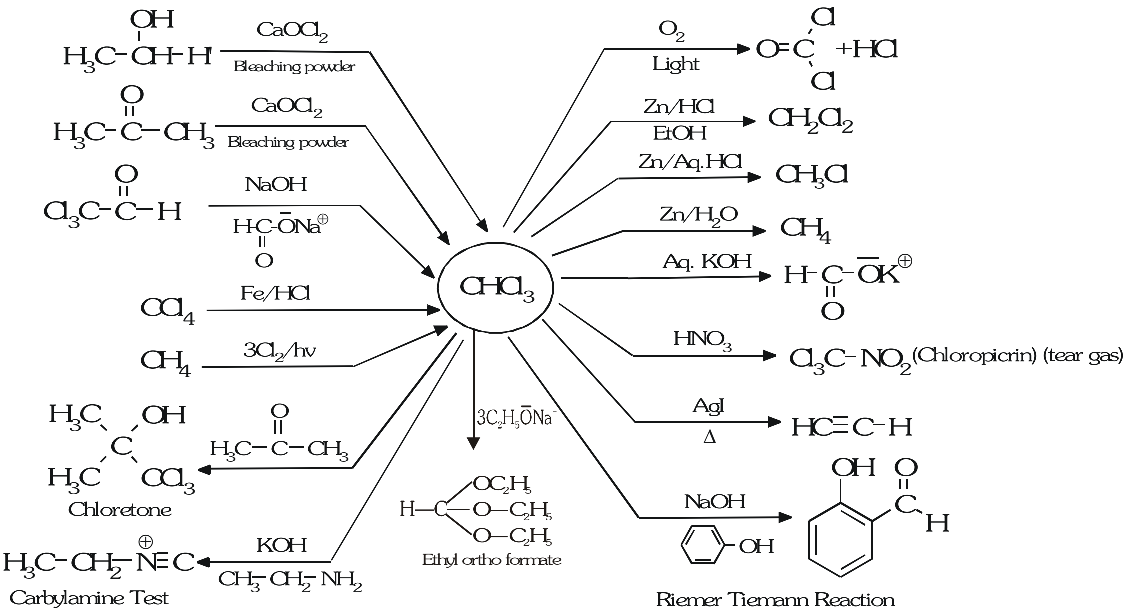
$$H_3C-CH_2-H \xrightarrow[hv]{Cl_2} H_3C-CH_2-Cl \xrightarrow[Acetone]{NaI} H_3C-CH_2-I$$ (Finkelstein Reaction)

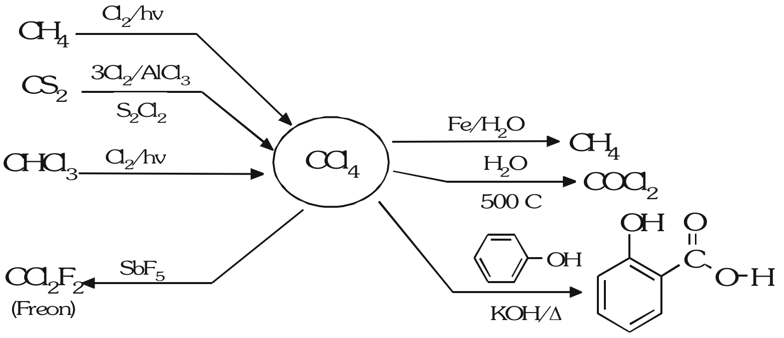
$$H_3C-\underset{\underset{O}{\parallel}}{C}OAg \xrightarrow[hv]{Cl_2} H_3C-Br+CO_2\uparrow+AgBr\downarrow$$ (Hunsdiecker Reaction)

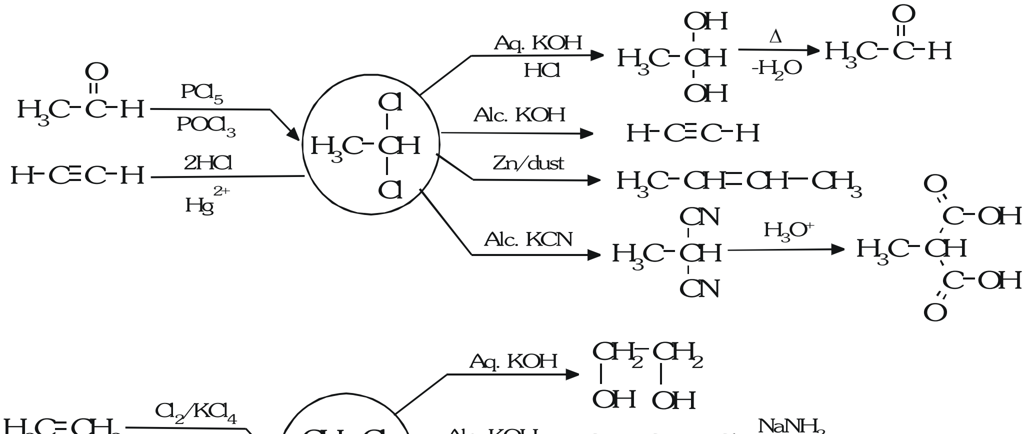
$$H_3C-CH_2-Cl \xrightarrow[or\ Hg_2F_2]{AgF} H_3C-CH_2-F$$ (Swart reaction)

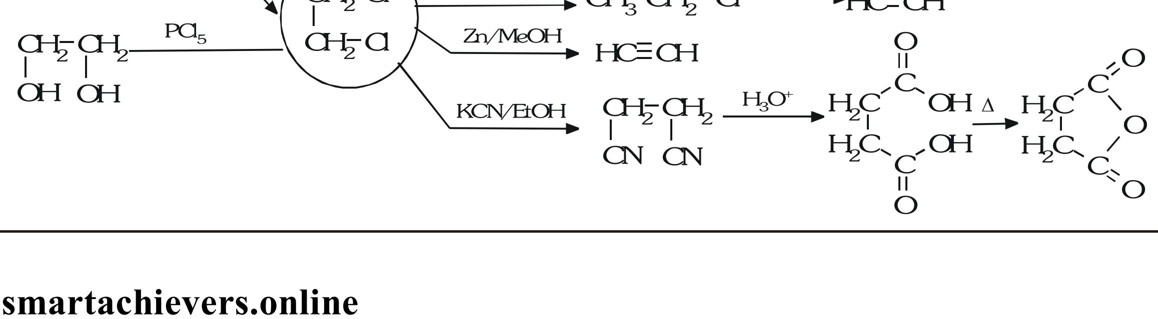


Nutshell Preparation & Properties of DI, TRI and Tetra Halides









Comparison of S_N1 and S_N2

		S_N1	S_N2
A	Kinetics	1st order	2nd order
B	Rate	k[RX]	k[RX][Nu:$^-$]
C	Stereochemistry	Racemisation	Inversion
D	Substrate	3 > 2 >1 > MeX	MeX > 1 > 2 >3
E	Nucleophile	Not important	Needs Strong Nu
F	Solvent	Good ionizing	Faster in aprotic
G	Leaving Group	Needs Good LG	Needs Good LG
H	Rearrangement	Possible	Not Possible

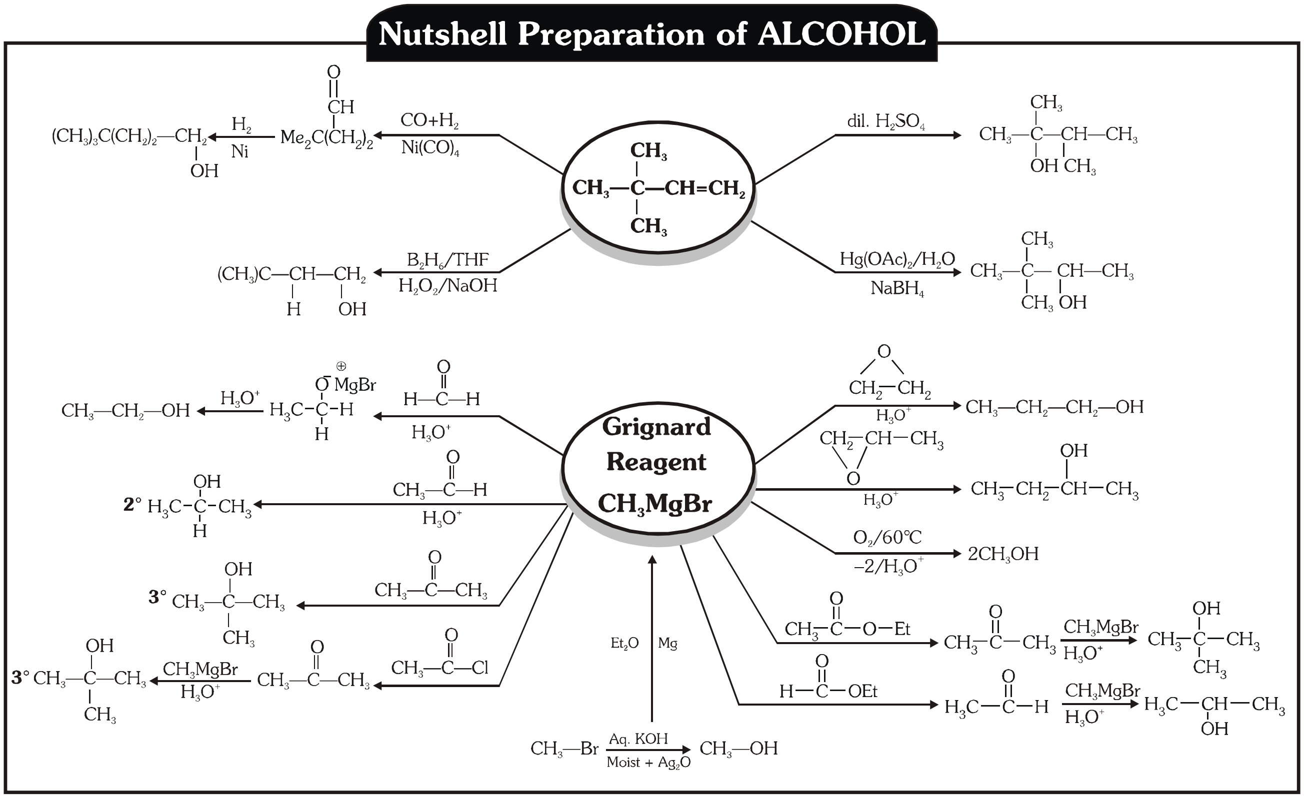
Comparision of E1 and E2

		E1	E2
A	Kinetics	1st order	2nd order
B	Rate	k[RX]	k[RX][B:$^-$]
C	Stereochemistry	No special geometry	Anti-periplanar
D	Substrate	3 > 2 >>>1	3 >2 >1
E	Base Strength	Not important	Needs Strong bases
F	Solvent	Good ionizing	Polarity not import
G	Leaving Group	Needs Good LG	Needs Good LG
H	Rearrangement	Possible	Not Possible

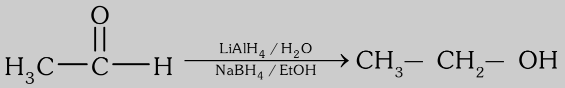
Summary of S_N1, S_N2, E1, and E2 reactions

RX	Mechanism	Nu:$^-$/:B$^-$	Solvent	Temp.
1	S_N2	Better Nu:$^-$ HO:$^-$, $C_2H_5O:^-$	Polar aprotic	Low
	E2	Strong & bulky base $(CH_3)_3CO:^-$		High
2	S_N2	HO:$^-$ $C_2H_5O:^-$	Polar aprotic	Low
	E2	$(CH_3)_3CO:^-$		High
	(S_N1)	(Solvent	Polar aprotic	(Low)
	(E1)	(Solvent)		(High)
3	S_N1	Solvent	Protic	Low
	E1	Solvent	Protic	High

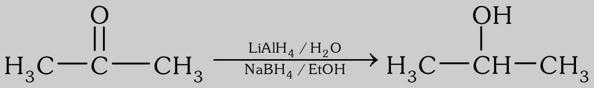
Nutshell Preparation of ALCOHOL



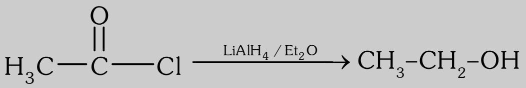
- Reduction



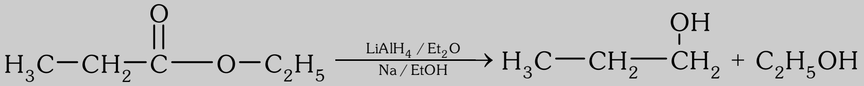
$$H_3C-\overset{\overset{\large O}{\|}}{C}-H \xrightarrow[\text{NaBH}_4/\text{EtOH}]{\text{LiAlH}_4/H_2O} CH_3-CH_2-OH$$



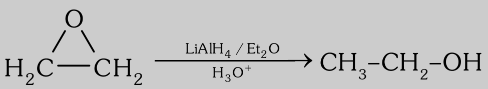
$$H_3C-\overset{\overset{\large O}{\|}}{C}-CH_3 \xrightarrow[\text{NaBH}_4/\text{EtOH}]{\text{LiAlH}_4/H_2O} H_3C-\overset{\overset{\large OH}{|}}{CH}-CH_3$$



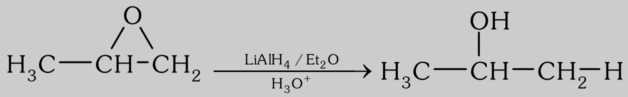
$$H_3C-\overset{\overset{\large O}{\|}}{C}-Cl \xrightarrow{\text{LiAlH}_4/\text{Et}_2O} CH_3-CH_2-OH$$



$$H_3C-CH_2-\overset{\overset{\large O}{\|}}{C}-O-C_2H_5 \xrightarrow[\text{Na/EtOH}]{\text{LiAlH}_4/\text{Et}_2O} H_3C-CH_2-\overset{\overset{\large OH}{|}}{CH_2} + C_2H_5OH$$



$$H_2C-CH_2 \xrightarrow[H_3O^+]{\text{LiAlH}_4/\text{Et}_2O} CH_3-CH_2-OH$$



$$H_3C-CH-CH_2 \xrightarrow[H_3O^+]{\text{LiAlH}_4/\text{Et}_2O} H_3C-\overset{\overset{\large OH}{|}}{CH}-CH_2-H$$

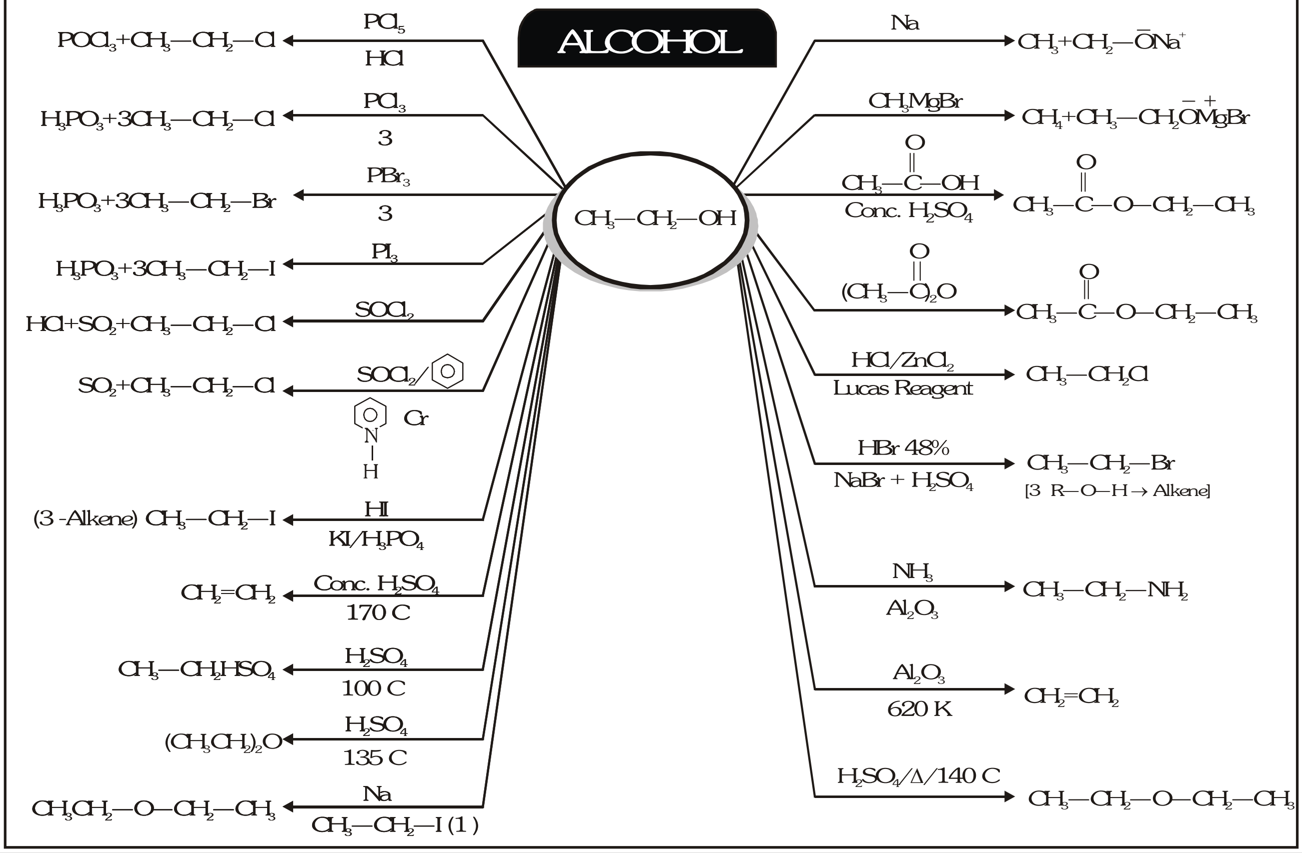
- By Fermentation

$$\underset{\text{sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} 2C_2H_5OH + CO_2$$

zymase ↑

$$\underset{\text{starch}}{2(C_6H_{10}O_5)_n} + nH_2O \xrightarrow{\text{Diastase}} nC_{12}H_{22}O_{11} \xrightarrow[H_2O]{\text{Maltose}} 2C_6H_{12}O_6$$

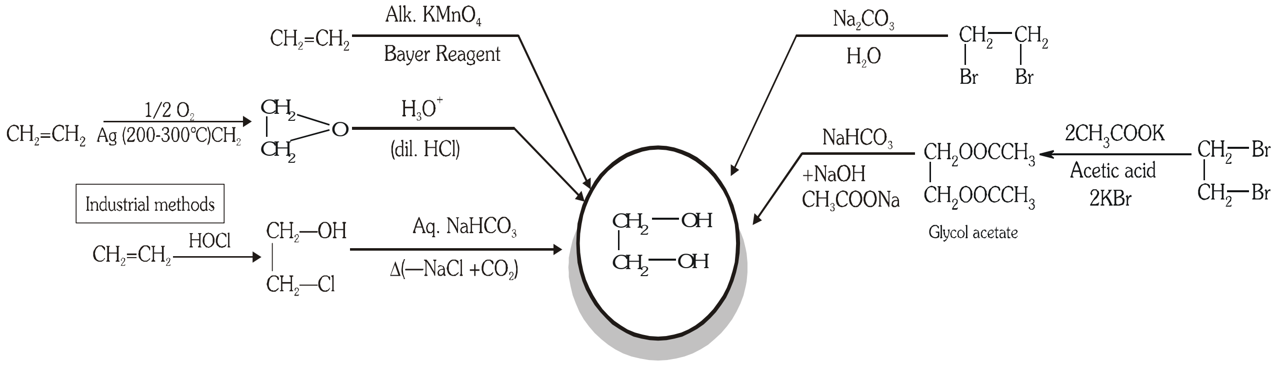
'NUTSHELL REVIEW AND PREVIEW OF ALCOHOL REACTIONS'



Reagent	$H_3C-CH_2-CH_2-\overset{OH}{CH_2}$ 1 Alcohol	$H_3C-CH_2-\overset{^{18}OH}{CH}-CH_3$ 2 Alcohol	$H_3C-\overset{CH_3}{\underset{CH_3}{C}}-OH$ 3 Alcohol
PCC/CH_2Cl_2 PDC/CH_2Cl_2 Jones Reagent H_2CrO_4/Aq. Acetone	$H_3C-CH_2-CH_2-\overset{O}{C}-H$	$H_3C-CH_2-\overset{O\,.8}{C}-CH_3$	No reaction
$K_2Cr_2O_7/H^{\oplus}$ $KMnO_4/H^+/\bar{O}H/\Delta$	$H_3C-CH_2-CH_2-\overset{O}{C}-H$	$H_3C-\overset{O}{C}-OH+CH_3-\overset{O\,.8}{C}-OH$	
Cu/500 C	$H_3C-CH_2-CH_2-\overset{O}{C}-H$	$CH_3-CH_2-\overset{O}{C}-CH_3$	$H_3C-\overset{CH_3}{C}=CH_2$
$\xrightarrow[\text{Acetone}]{Al(OBu^t)_3}$ or cyclohexanone	$H_3C-CH_2-CH_2-\overset{O}{C}-H$	$H_3C-CH_2-\overset{O}{C}-CH_3$	-
Lucas Reagent $HCl/ZnCl_2$	Cloudiness appear upon heating after 30 mins. at normal temp. no. reaction	within five min.	Immediately
Victor Mayer's Test			
P/I_2	$CH_3-CH_2-CH_2-CH_2-I$	$H_3C-CH_2-\overset{CH_3}{CH}-I$	$H_3C-\overset{CH_3}{\underset{CH_3}{C}}-I$
$AgNO_3$	$CH_3-CH_2-CH_2-NO_2$	$H_3C-CH_2-\overset{CH_3}{CH}-NO_2$	$(CH_3)_3-NO_2$
HNO_2 NaOH	$H_3C-CH_2-\underset{N-OH}{\overset{}{C}}-NO_2$ Nitrolic acid	$H_3C-CH_2-\overset{CH_3}{\underset{N=O}{CH}}-NO_2$	No reaction ↓

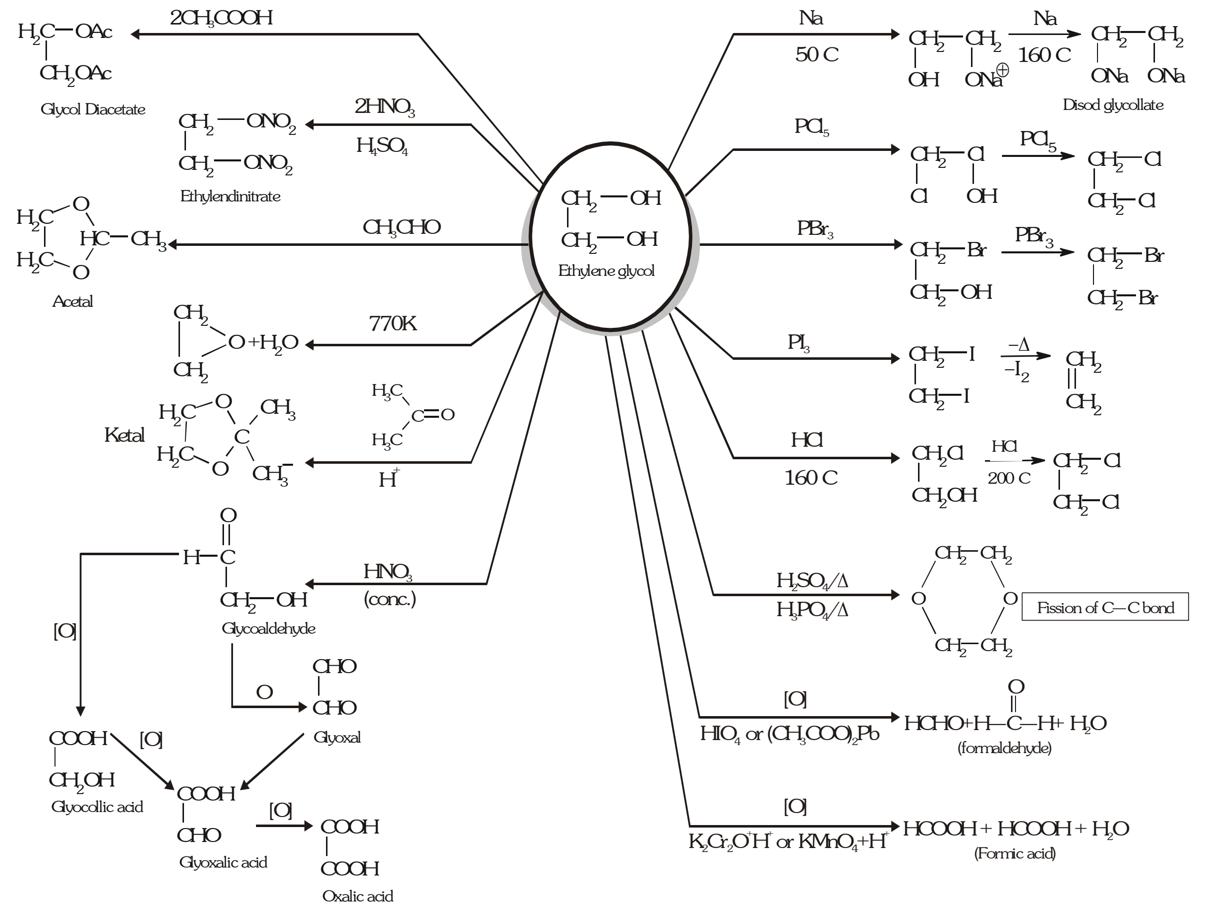
Dihydric Alcohol

Methods of Preparation (Antifreeze Agent)

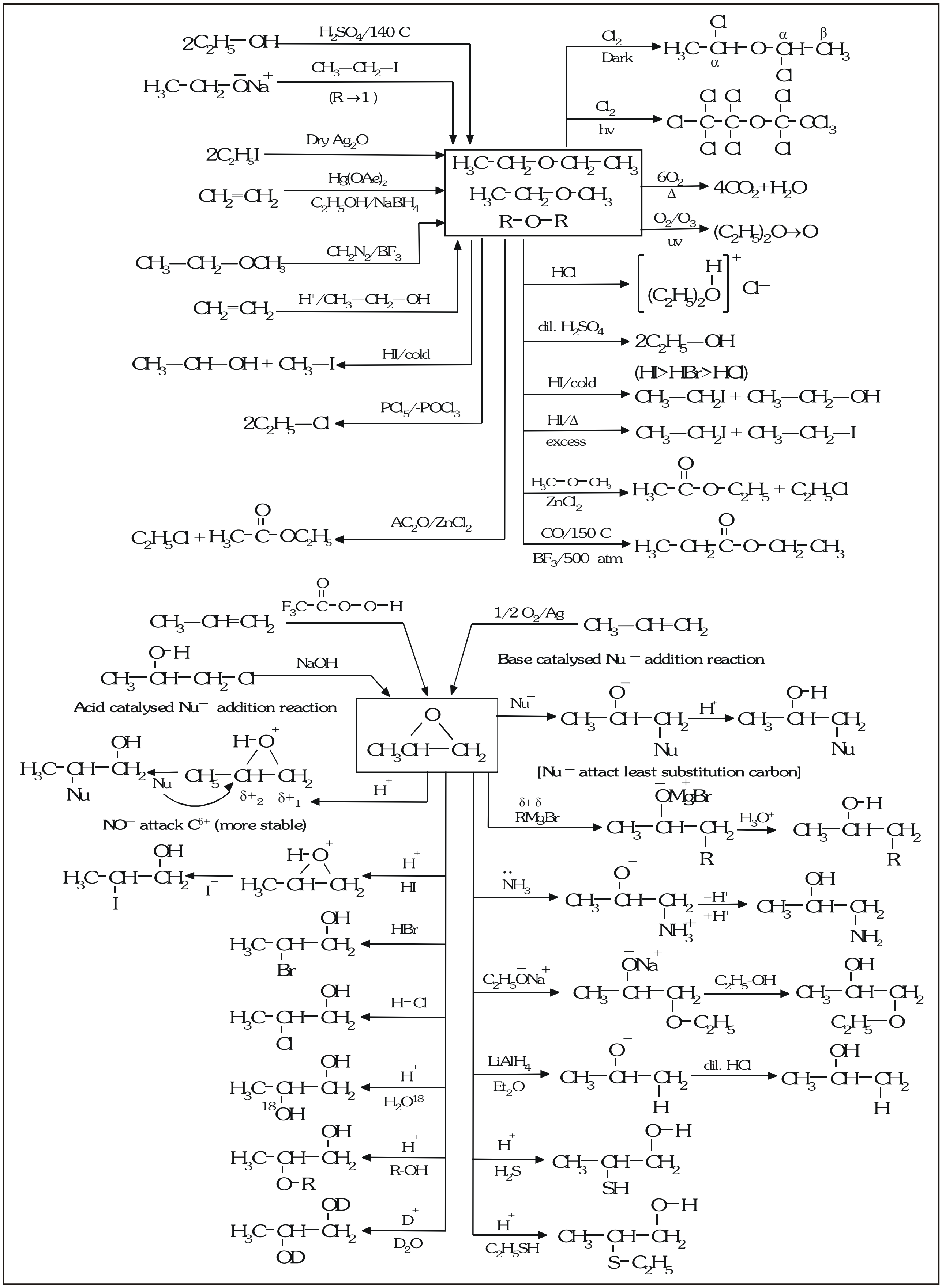


Chemical Properties

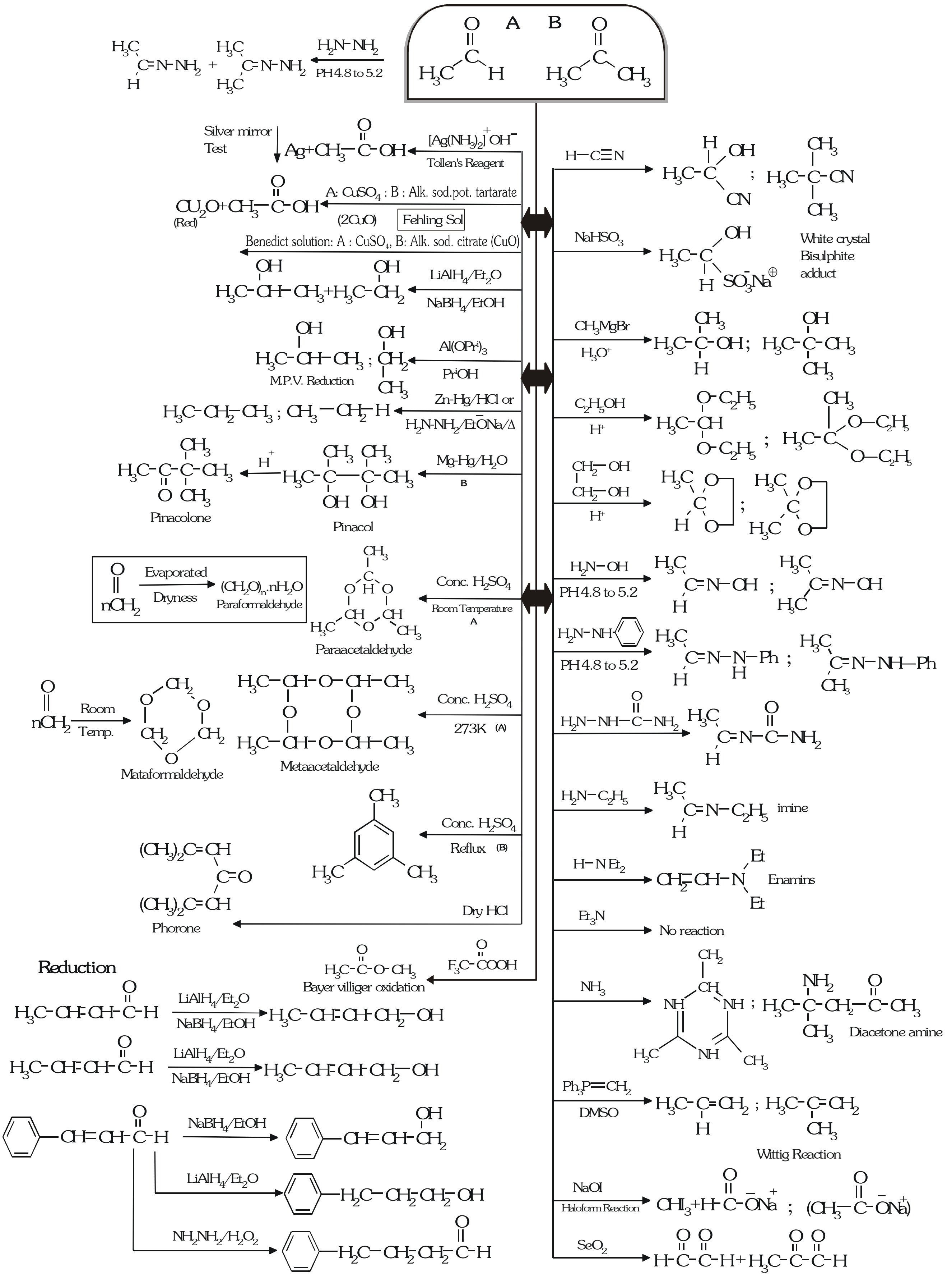
Two 1_0 Alcoholic group : one OH group always react completely before other group react



Nutshell review and preview Ether & Epoxides



Nutshell preview and review of Carbonyl Reaction

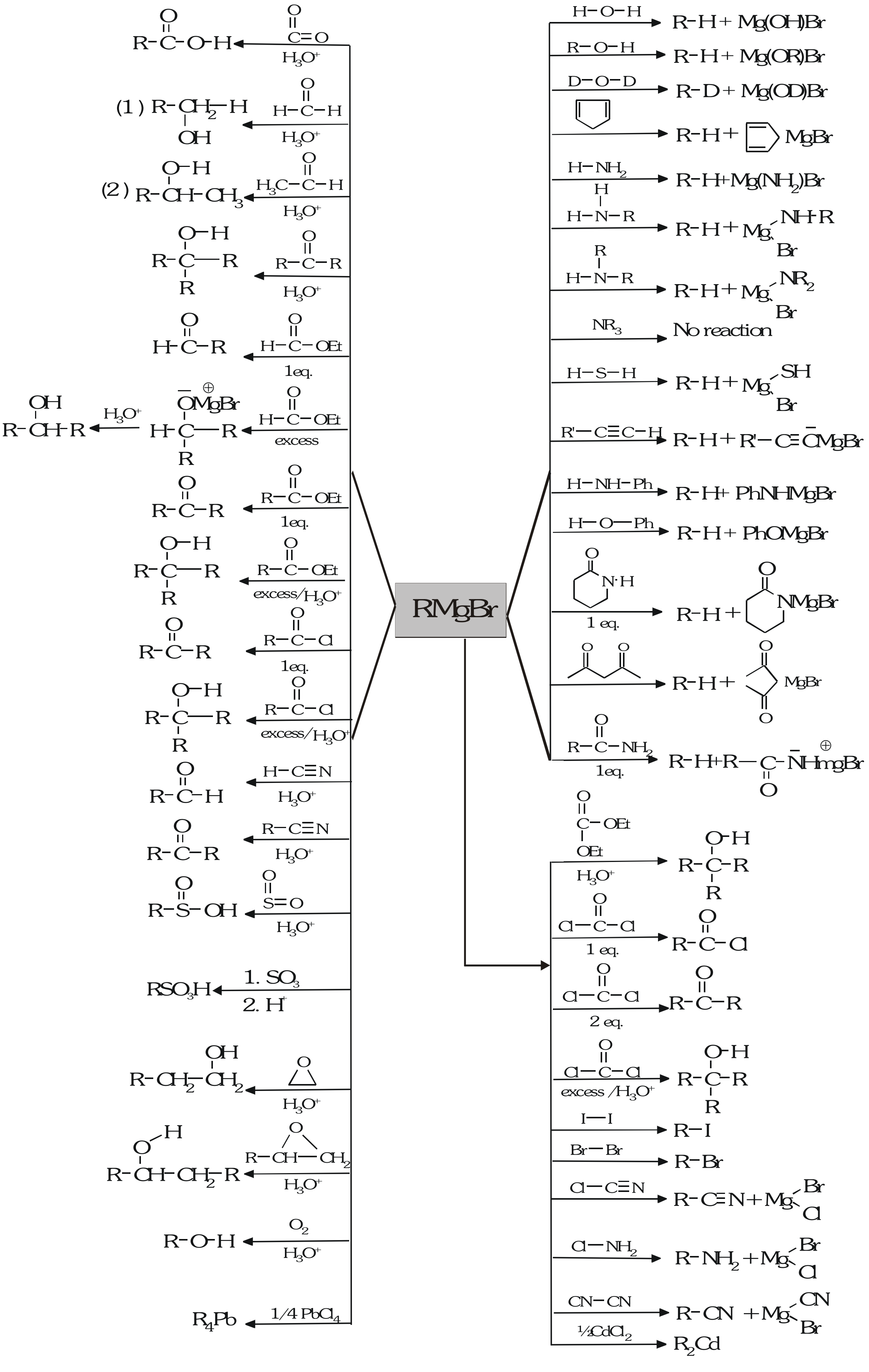


As Nucleophile :

GRIGNARD -REAGENT

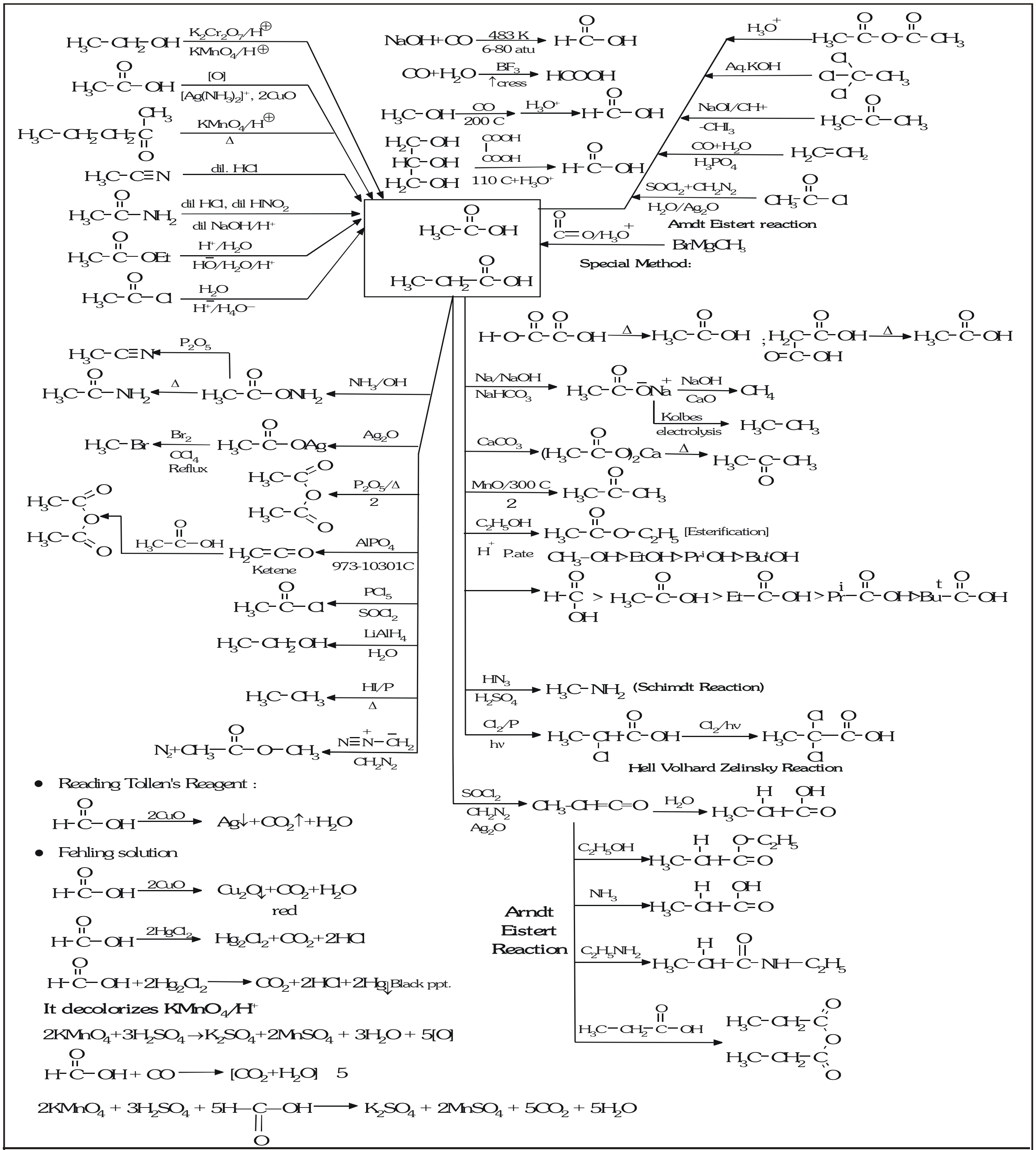
(Active H-containing comp)

GRIGNARD REAGENT as BASE

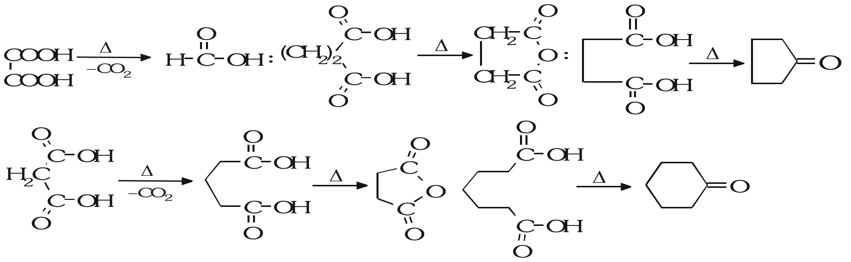


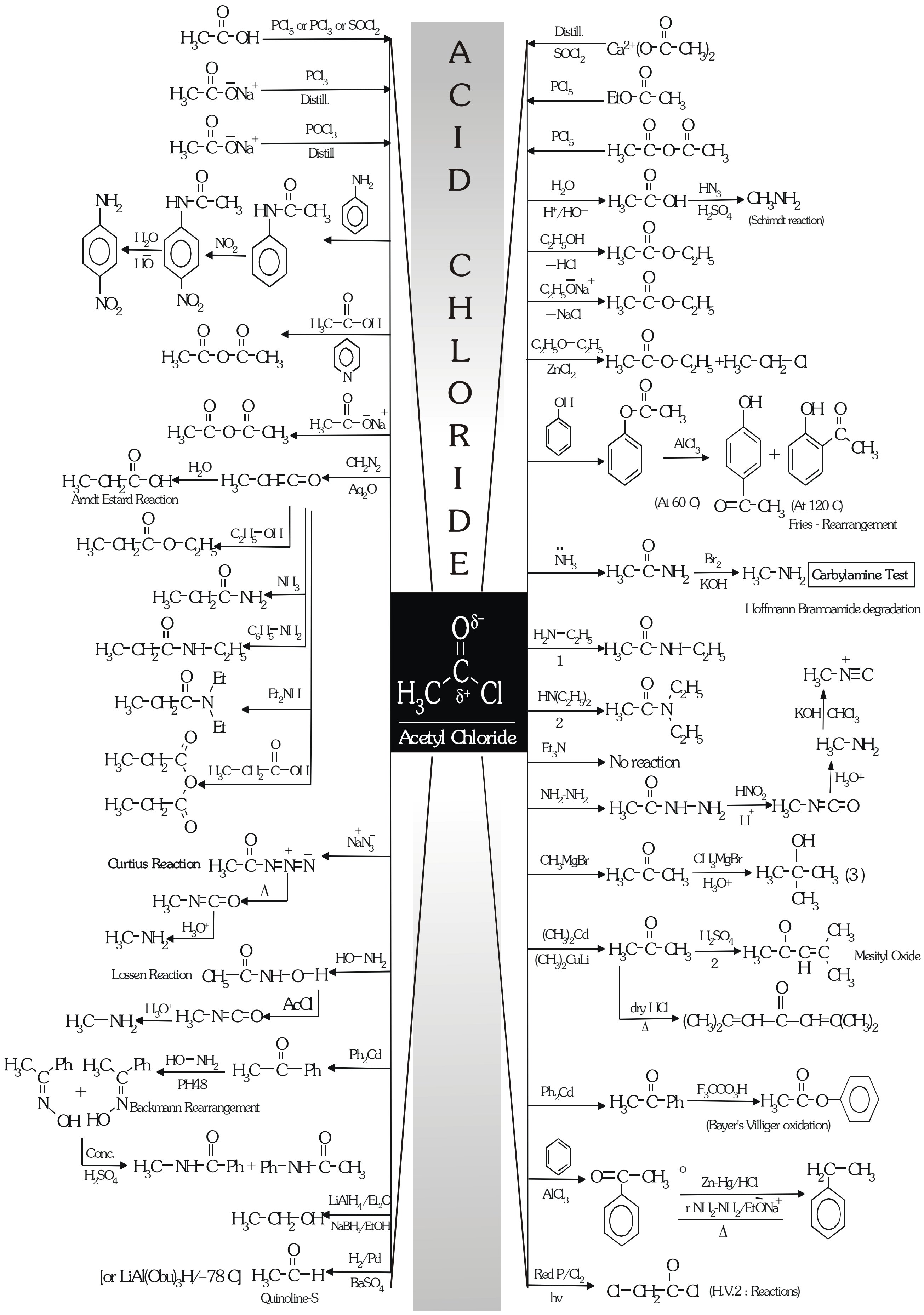
Nutshell preview and review of Carboxylic Acids

PREPARATION & REACTION

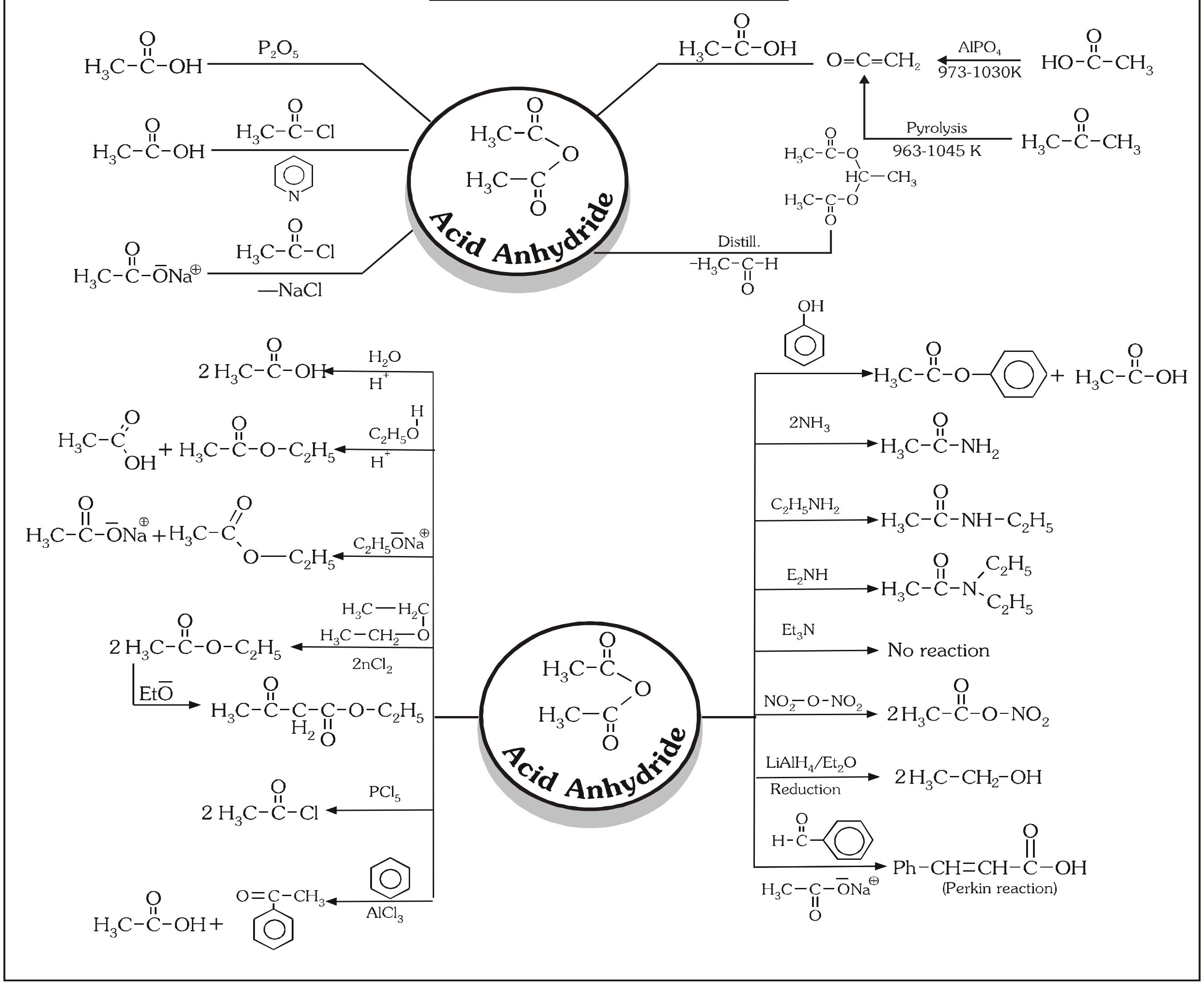


Note : Formic acid does not react with NH_2OH; secarbazide & phenyl / hydraze



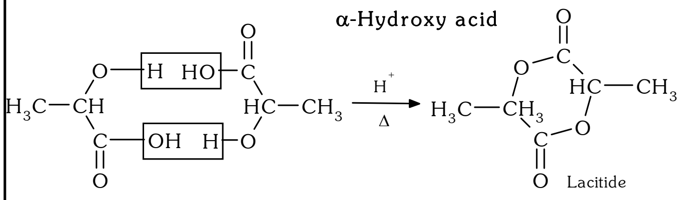

ACID CHLORIDE
Acetyl Chloride
PCl5 or PCl3 or SOCl2
PCl3 Distill.
POCl3 Distill
H2O HO−
NO2
Pyridine
CH2N2 Ag2O
H2O
Arndt Estard Reaction
C2H5−OH
NH3
C6H5−NH2
Et2NH
NaN3
Δ
Curtius Reaction
H3O+
Lossen Reaction
HO−NH2
AcCl
Ph2Cd
HO−NH2 PH4.8
Backmann Rearrangement
Conc. H2SO4
LiAlH4/Et2O
NaBH4/EtOH
H2/Pd BaSO4 Quinoline-S
[or LiAl(Obu)3H/−78 C]
Distill. SOCl2
PCl5
H2O H+/HO−
HN3 H2SO4
(Schimdt reaction)
C2H5OH −HCl
C2H5ONa −NaCl
C2H5O−C2H5 ZnCl2
AlCl3
(At 60 C)
(At 120 C)
Fries - Rearrangement
NH3
Br2 KOH
Carbylamine Test
Hoffmann Bramoamide degradation
H2N−C2H5 1
HN(C2H5)2 2
Et3N
No reaction
NH2-NH2
HNO2 H+
H3O+
KOH CHCl3
CH3MgBr
CH3MgBr H3O+
(CH3)2Cd
(CH3)2CuLi
H2SO4 2
Mesityl Oxide
dry HCl Δ
Ph2Cd
F3CCO3H
(Bayer's Villiger oxidation)
AlCl3
Zn-Hg/HCl
r NH2-NH2/EtONa Δ
Red P/Cl2 hv
(H.V.2 : Reactions)

ACID anhydride

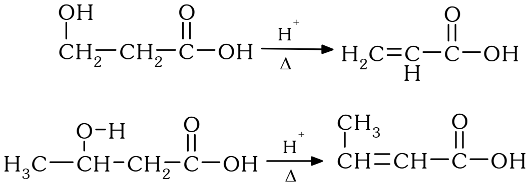


Heating effect

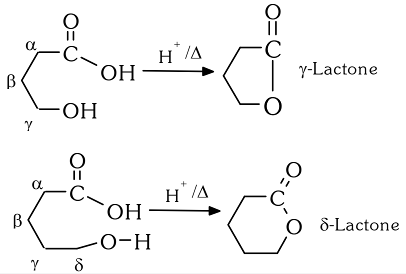
α-Hydroxy acid



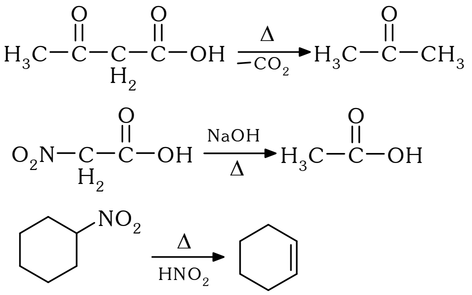
β-Hydroxy acid

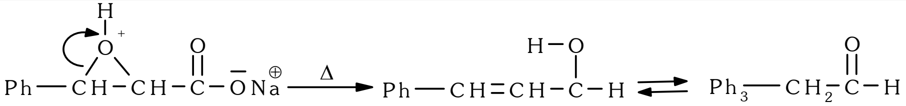


γ & δ–Hydroxy acid

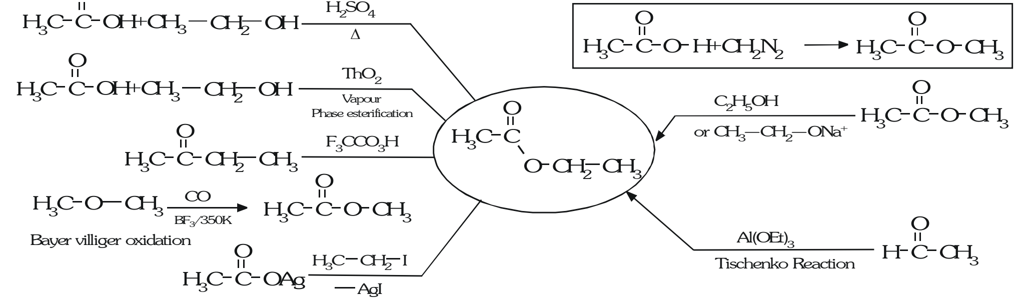


β –Keto acid:

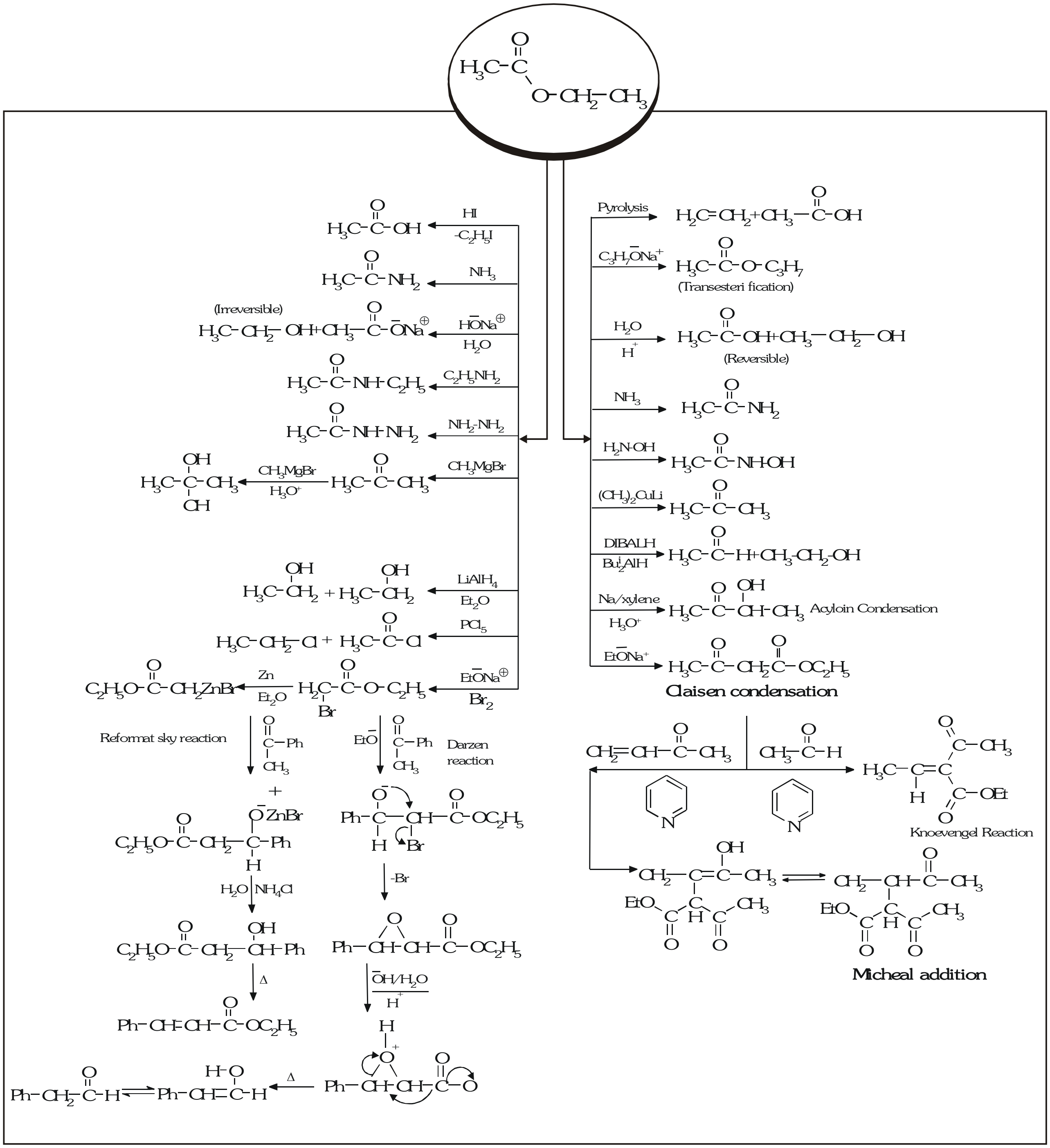




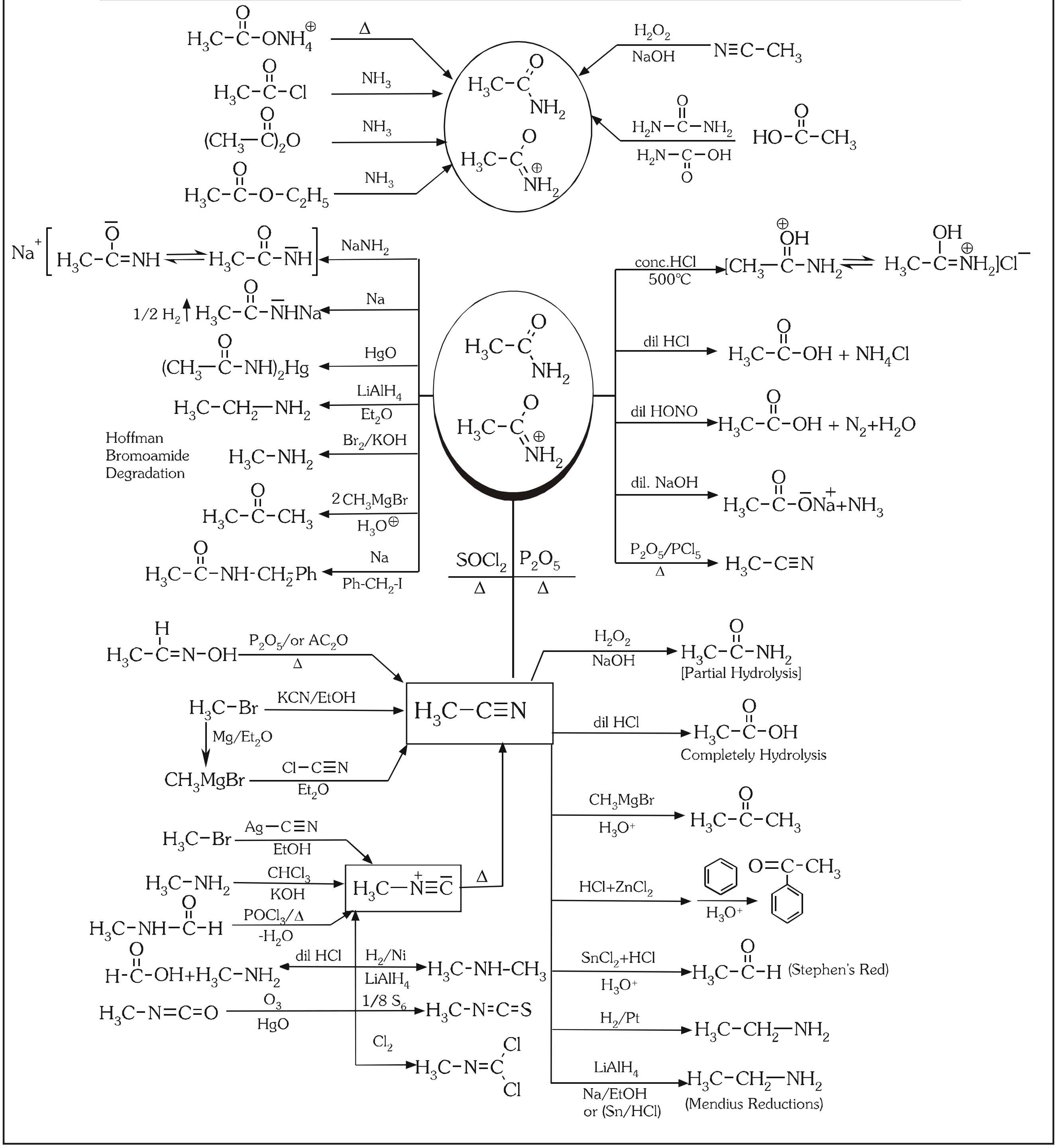
Nutshell preparation of Ester



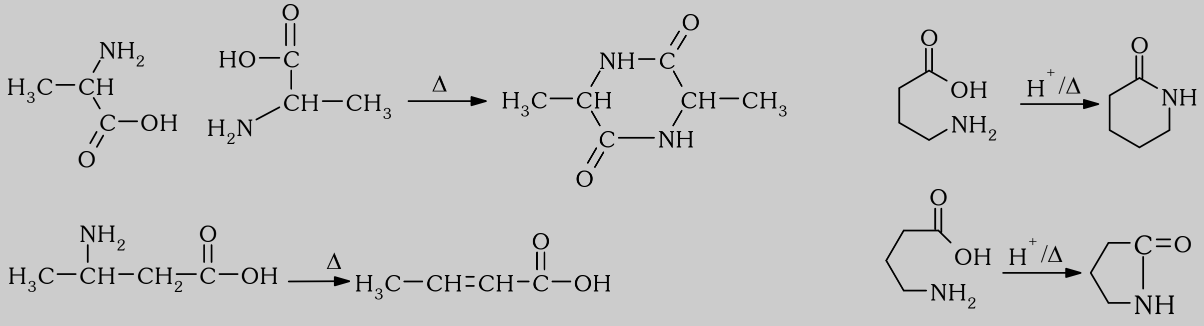
Nutshell chemical properties of Ester



Nutshell preview and review of Amide, Cyanide and Isocyanide



Amino Acid :



METHOD OF PREPARATION OF AMINE

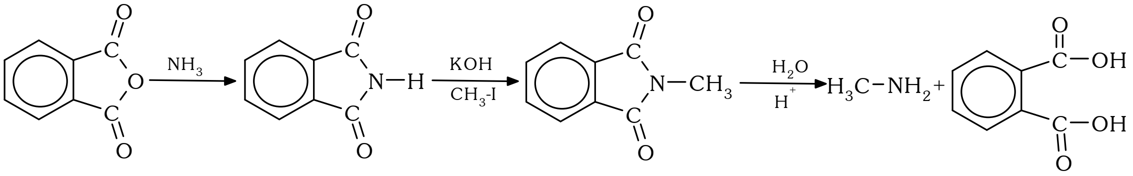
- **Hoffmann's Ammonolysis**

$$H_3C-CH_2-Br \xrightarrow[-HX]{NH_3} H_3C-CH_2-NH_2 \xrightarrow{H_3C-CH_2-I} (CH_3-CH_2)_2NH \xrightarrow{H_3C-CH_2I} (C_2H_5)_3N \xrightarrow{C_2H_5I} (C_2H_5)_4\overset{+}{N}I$$

Good yield 1 Amine (If NH_3 1 excess) / Not suitable for Aryl Amine)

Reactivity - R-I > R-Br > R-Cl

- **Gabriel / Phthalimide Synthesis :**



2 & 3 → can't be prepared : Aromatic amine can't prepared

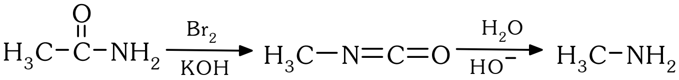
- **Reduction**

$$H_3C-C\equiv N \xrightarrow[LiAlH_4/Et_2O]{Na/EtOH} H_3C-CH_2-NH_2$$

$$H_3C-\overset{+}{N}\equiv\overset{-}{C} \xrightarrow[LiAlH_4/Et_2O]{Na/EtOH} H_3C-CH_2-NH_2$$

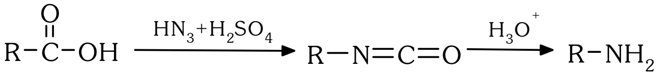
$$R-CH=N-OH \xrightarrow[\text{or } Na/EtOH \text{ or } B_2H_6/THF]{LiAlH_4/Et_2O} R-CH_2-NH_2$$

- **Hoffmann Boroamide Degradation :**



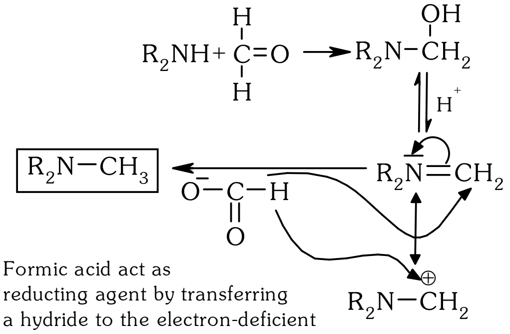
$$H_3C-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow[KOH]{Br_2} H_3C-N=C=O \xrightarrow[HO^-]{H_2O} H_3C-NH_2$$

- **Schimdt Reaction :**



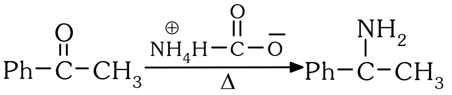
$$R-\overset{O}{\overset{\|}{C}}-OH \xrightarrow{HN_3+H_2SO_4} R-N=C=O \xrightarrow{H_3O^+} R-NH_2$$

Eschweiler Blarke synthesis

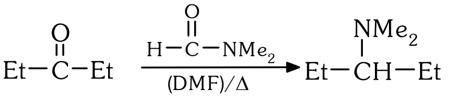


Formic acid act as reducting agent by transferring a hydride to the electron-deficient carbon & is oxidized to CO_2

Reductive Amination Leuckart reaction

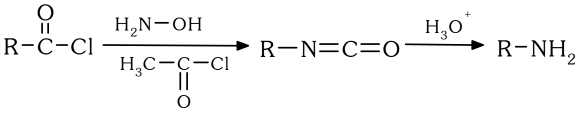


$$Ph-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[\Delta]{\overset{\oplus}{N}H_4\,H-\overset{O}{\overset{\|}{C}}-\overset{-}{O}} Ph-\overset{NH_2}{\overset{|}{C}}-CH_3$$

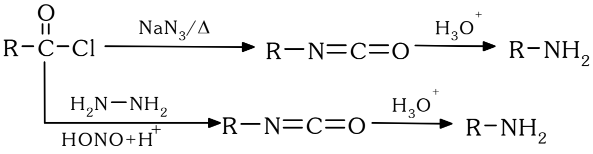


$$Et-\overset{O}{\overset{\|}{C}}-Et \xrightarrow[(DMF)/\Delta]{H-\overset{O}{\overset{\|}{C}}-NMe_2} Et-\overset{NMe_2}{\overset{|}{C}H}-Et$$

- **Lossen Reaction**



$$R-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow[H_3C-\underset{\underset{O}{\|}}{C}-Cl]{H_2N-OH} R-N=C=O \xrightarrow{H_3O^+} R-NH_2$$

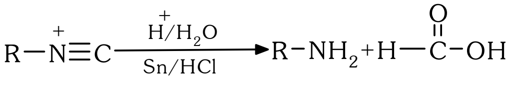


$$R-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{NaN_3/\Delta} R-N=C=O \xrightarrow{H_3O^+} R-NH_2$$

$$R-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow[HONO+H^+]{H_2N-NH_2} R-N=C=O \xrightarrow{H_3O^+} R-NH_2$$

$$R-NO_2 \xrightarrow[\substack{Sn/HCl \\ SnCl_2+HCl}]{Fe/HCl} R-NH_2$$

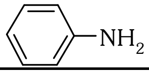
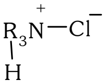
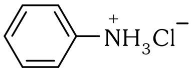
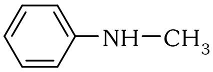
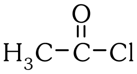
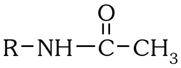
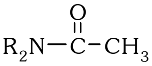
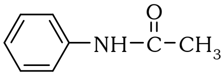
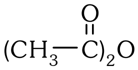
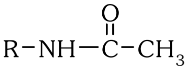
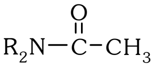
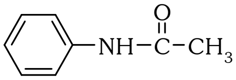
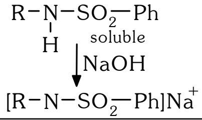
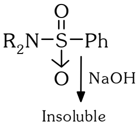
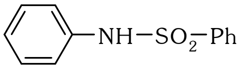
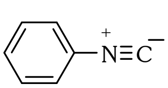
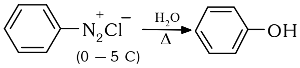
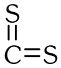
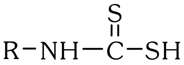
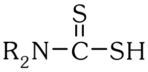
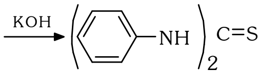
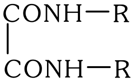
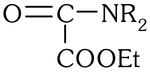
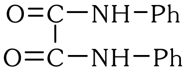
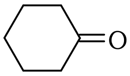
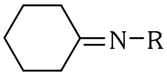
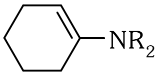
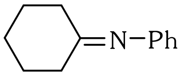
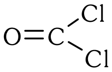
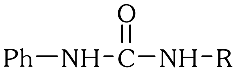
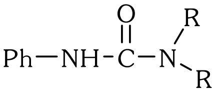
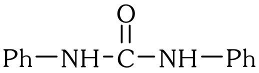
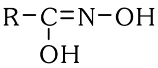
$$R-N=C=O \xrightarrow[HO/H_2O]{\overset{+}{H}/H_2O} R-NH_2$$



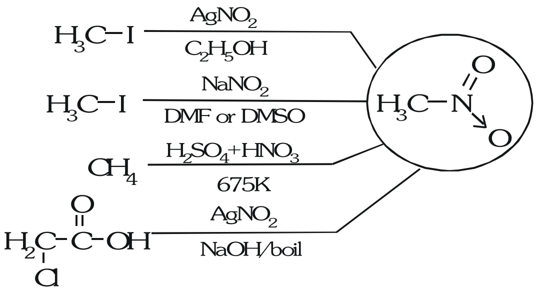
$$R-\overset{+}{N}\equiv C \xrightarrow[Sn/HCl]{\overset{+}{H}/H_2O} R-NH_2+H-\overset{O}{\overset{\|}{C}}-OH$$

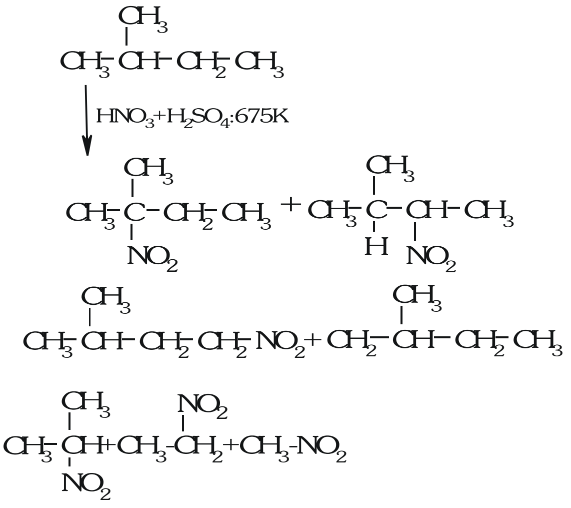
$$R-Mgx \xrightarrow{Cl\text{-}NH_2} R-NH_2$$

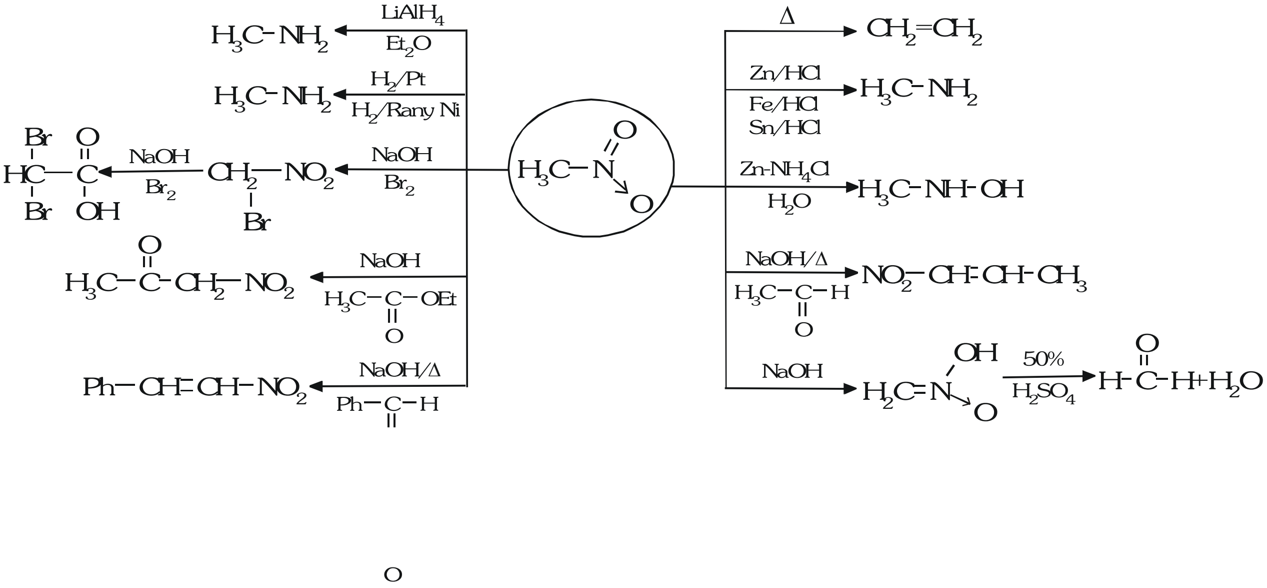
CHEMICAL PROPERTIES OF AMINES

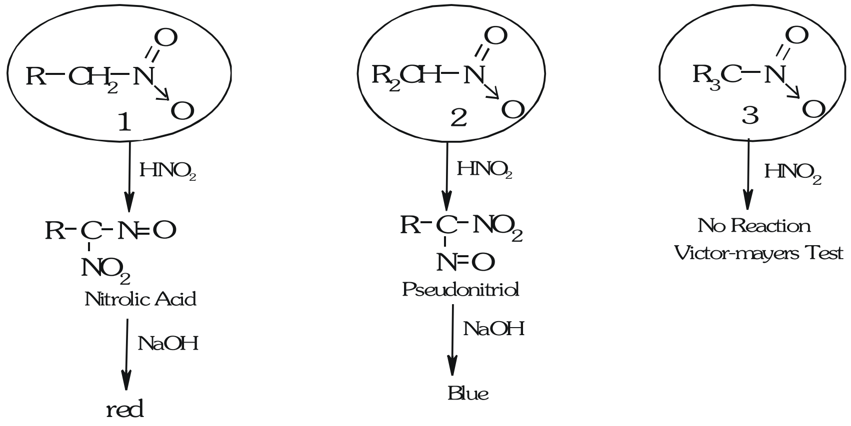
Reagent	$R-\ddot{N}H_2$ (1)	R_2NH(2)	R_3N (3)	
1. HCl	$R-\overset{+}{N}H_3Cl^-$	$R_2\overset{+}{N}H_2Cl^-$	 $R_3\overset{+}{N}(H)-Cl^-$	
2. CH_3-Br	$R-NH-CH_3$	R_2NH-CH_3	$R_3\overset{+}{N}-CH_3Br^-$	
3.  $H_3C-\overset{O}{\overset{\|}{C}}-Cl$	 $R-NH-\overset{O}{\overset{\|}{C}}-CH_3$	 $R_2N-\overset{O}{\overset{\|}{C}}-CH_3$	No reaction	
4.  $(CH_3-\overset{O}{\overset{\|}{C}})_2O$	 $R-NH-\overset{O}{\overset{\|}{C}}-CH_3$	 $R_2N-\overset{O}{\overset{\|}{C}}-CH_3$	No reaction	
5. $Ph-SO_2Cl$	 $R-N(H)-SO_2-Ph$ soluble $\xrightarrow{NaOH}$ $[R-N-SO_2-Ph]Na^+$	 $R_2N-S(=O)(=O)-Ph$ $\xrightarrow{NaOH}$ Insoluble	No reaction	
6. Carbylamine Test $CHCl_3/KOH$ $(:CCl_2)$	$R-\overset{+}{N}\equiv C^-$	No reaction	No reaction	
7. $HNO=O$ $/H^+$	$R-OH+N_2+HCl$	$R_2N-N=O$	$R_3\overset{+}{N}-H\overline{O}N=O$	
8. Hoffmann Mustard Oil Test				
1.  $\overset{S}{\overset{\|}{C}}=S$ $\Delta/HgCl_2$	 $R-NH-\overset{S}{\overset{\|}{C}}-SH$ $R-N=C=S$ + HgS	 $R_2N-\overset{S}{\overset{\|}{C}}-SH$ No reaction	– No reaction	 $\xrightarrow{HCl} Ph-N=C=S + Ph\text{-}NH_2$
2. Hoffmann Test  $COOEt-COOEt$	 $CONH-R$ / $CONH-R$ Oxamide (solid)	 $O=C(-NR_2)-COOEt$ Oxamic ester (liquid)	No reaction	 $O=C-NH-Ph$ / $O=C-NH-Ph$
R'MgX	R'-H+R-NHMgBr	R"H+R_2NMgBr	No reaction	R'H+PhNHMgBr
			No reaction	
	$(RNH)_2C=O$	$(R_2N)_2C=O$	No reaction	$Ph-N=C=O$
$Ph-N=C=O$	 $Ph-NH-\overset{O}{\overset{\|}{C}}-NH-R$		No reaction	 $Ph-NH-\overset{O}{\overset{\|}{C}}-NH-Ph$
Oxidation	$R-CH_2-NH_2$	R_2NH	R_3N	
$KMnO_4$	$R-CH=NH \xrightarrow{H_3O^+} RCHO$	R_2N-NR_2	No reaction	
H_2SO_5	$R-CH_2-NH-OH$  $R-C(OH)=N-OH$	R_2N-O-H	$R_3N=O$	
$KMnO_4$	R_2CH-NH_2 : $R_2C=NH \xrightarrow{H_3O^+} R_2C=O$			
H_2SO_5		$\boxed{R_3C-NH_2 \xrightarrow{KMnO_4} R_3C-NH_2}$		

Nutshell preview and review of Nitro and Nitrite

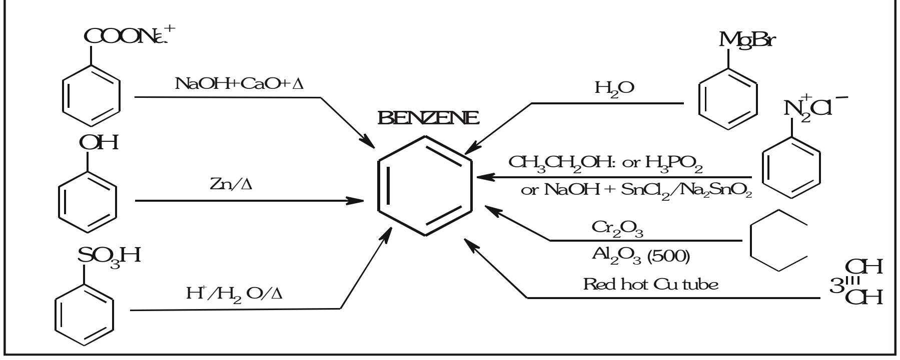




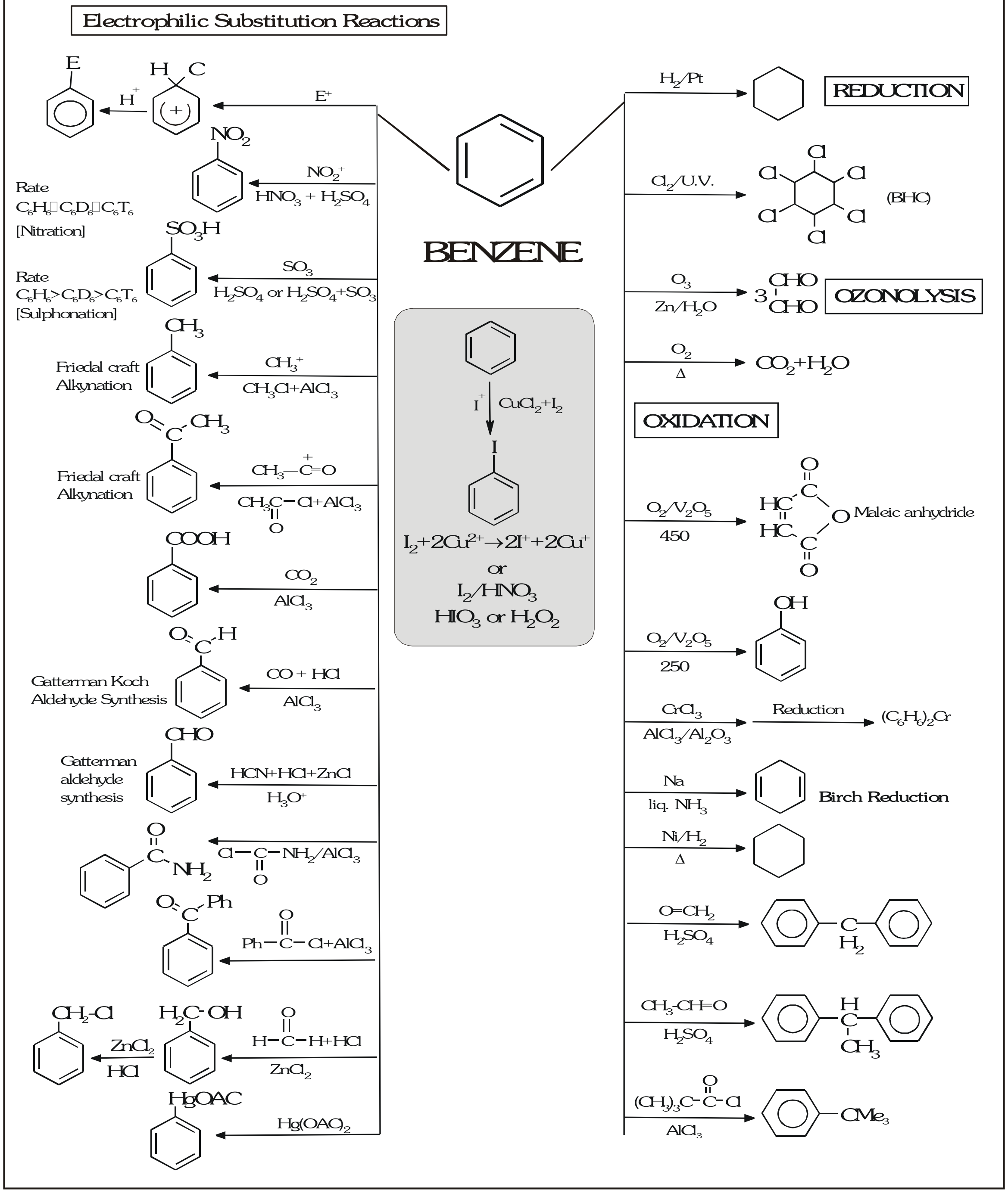




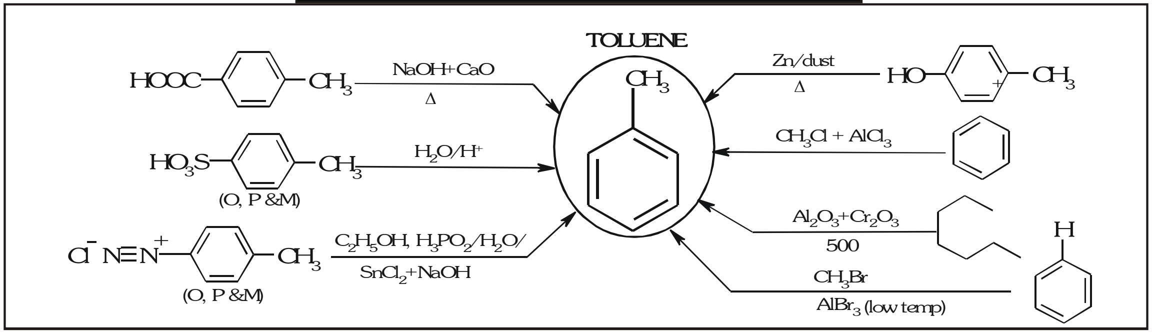
Nutshell Preparation of Benzene



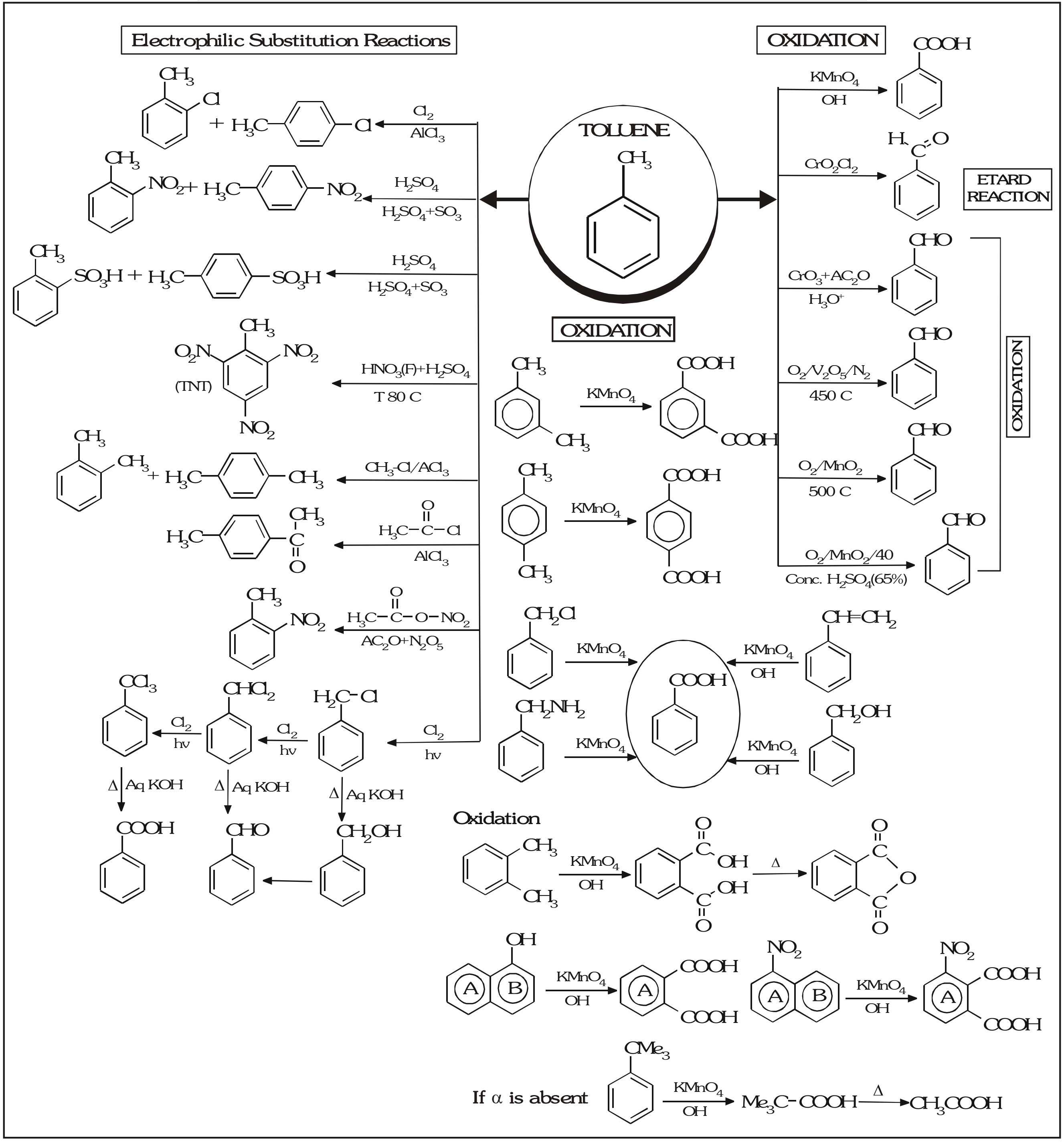
Nutshell Review and Preview of Benzene Reactions



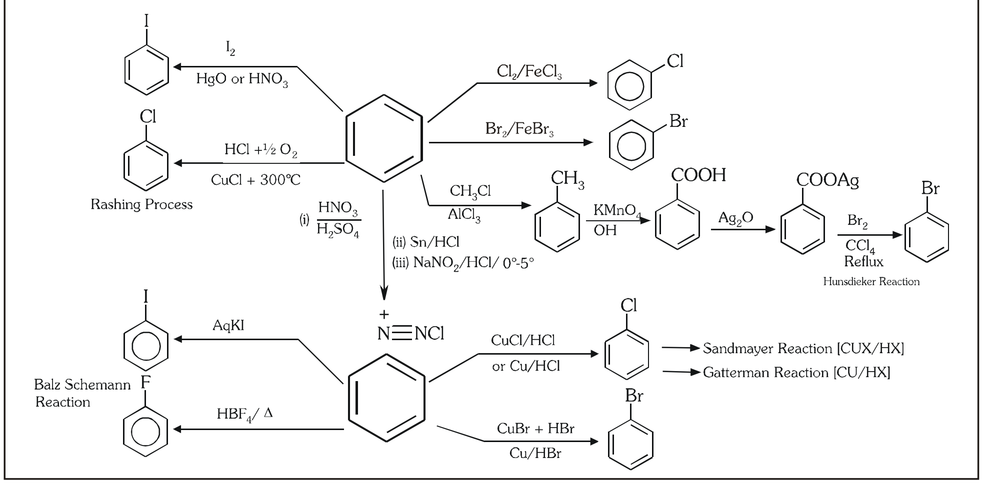
Nutshell Preparation of Toluene



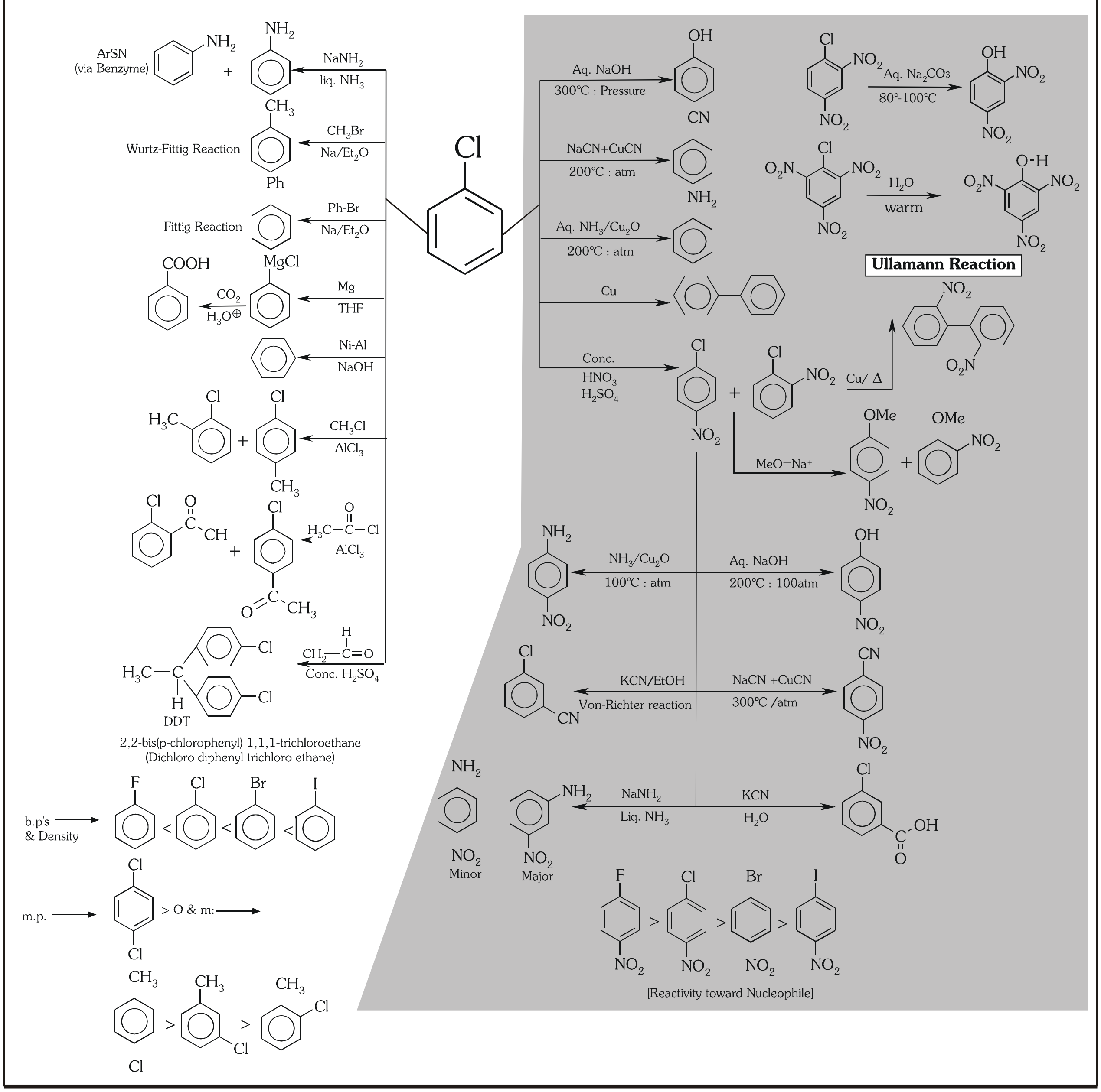
Nutshell Review and Preview of Toluene Reactions



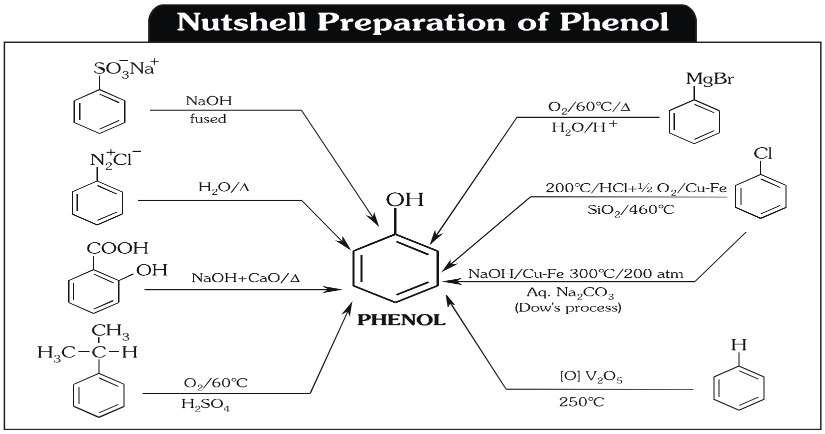
Nut Shell preparation 'Aromatic Halogen Compound'



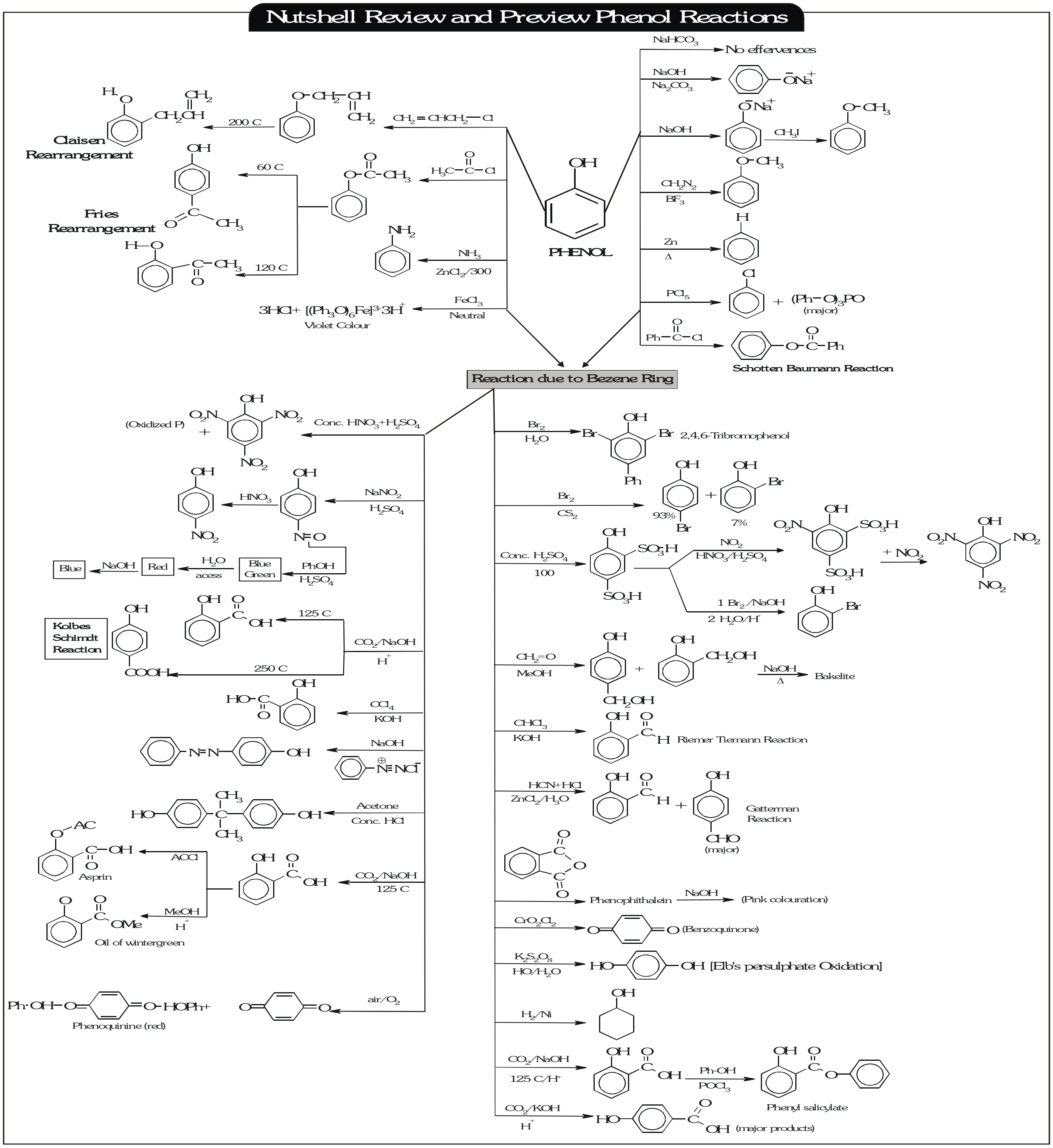
Nutshell review and Preview of Aromatic Halogen Reactions



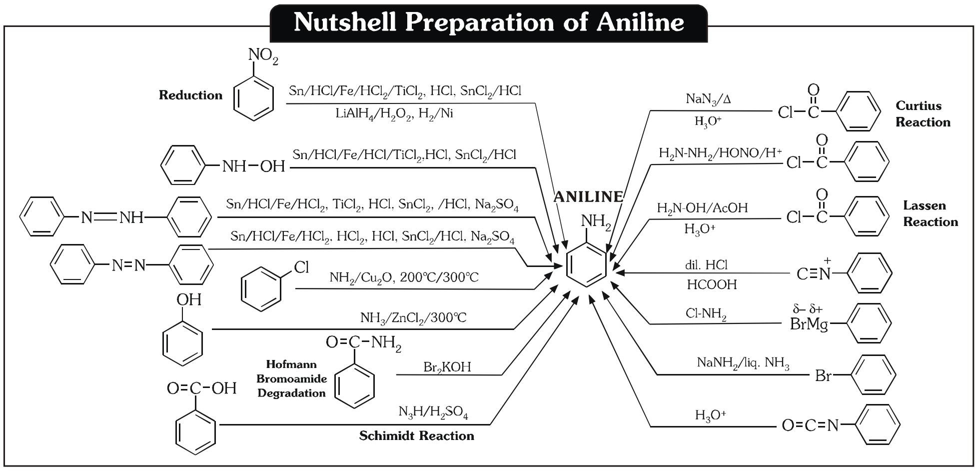
Nutshell Preparation of Phenol



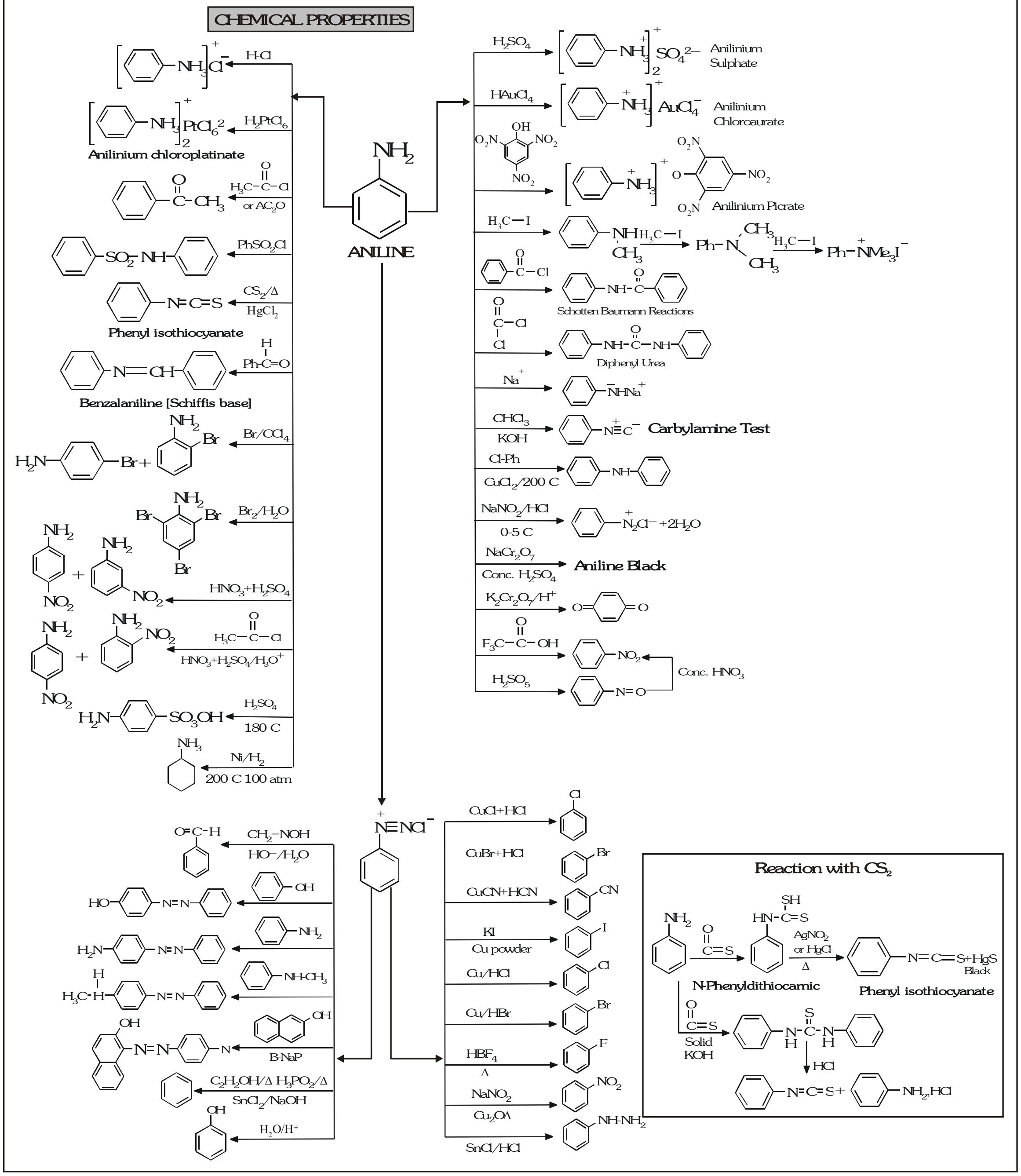
Nutshell Review and Preview Phenol Reactions



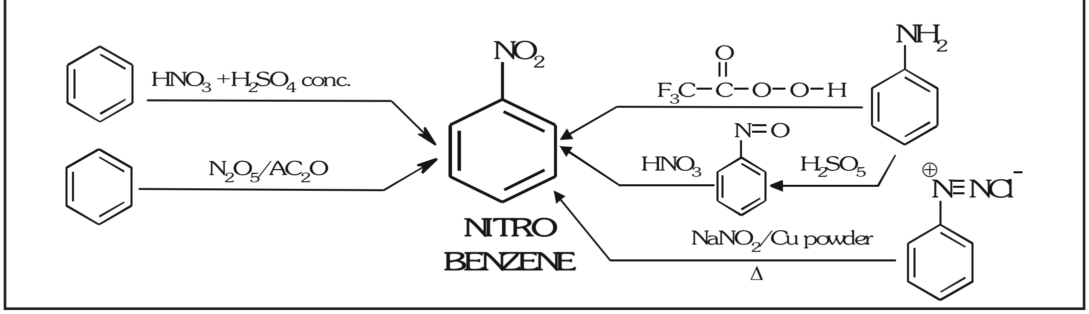
Nutshell Preparation of Aniline



Nutshell Review and Preview of Aniline

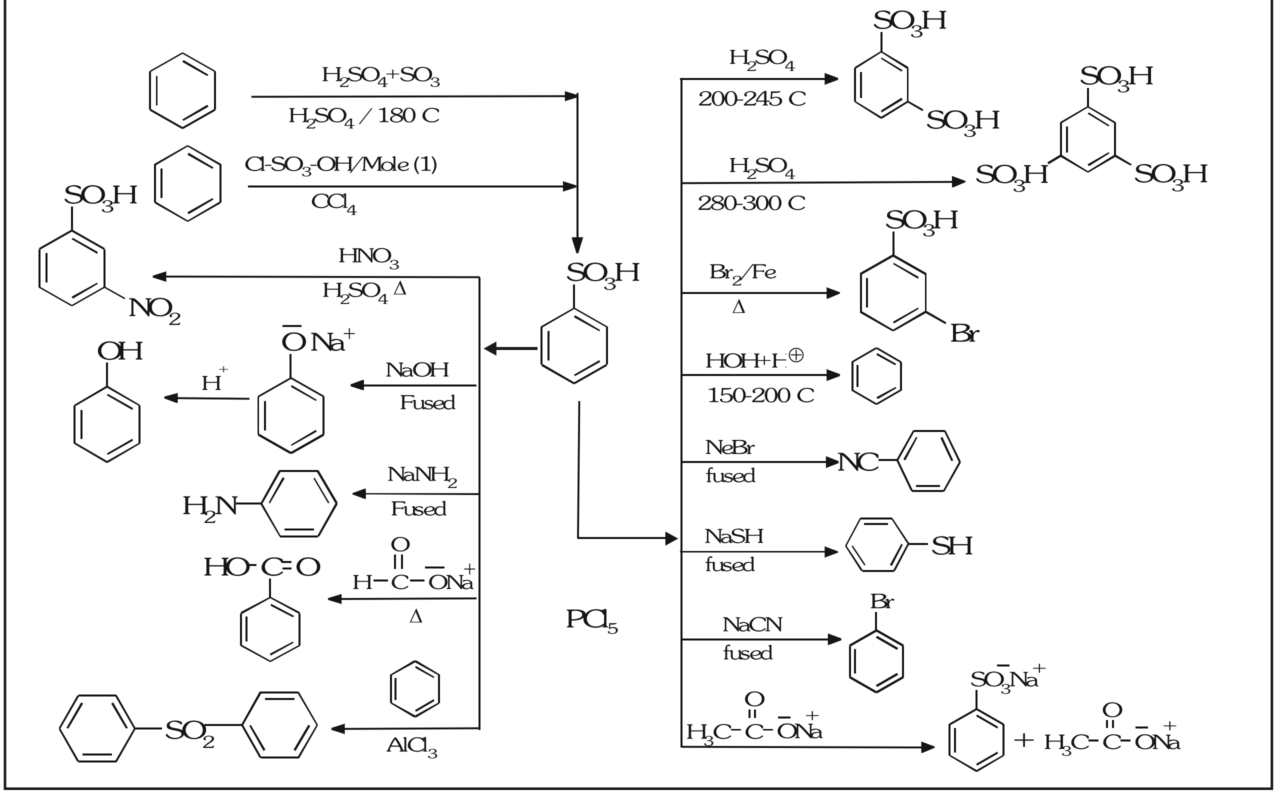


Nutshell Preparation of Nitro Benzene

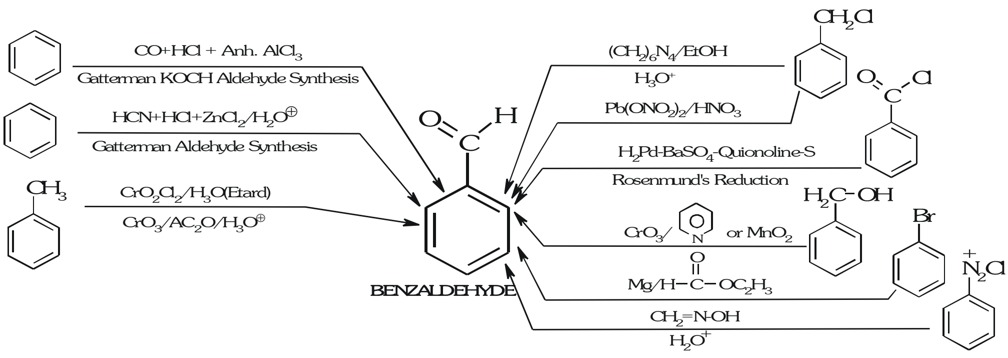


Nutshell Sulphonic Acid

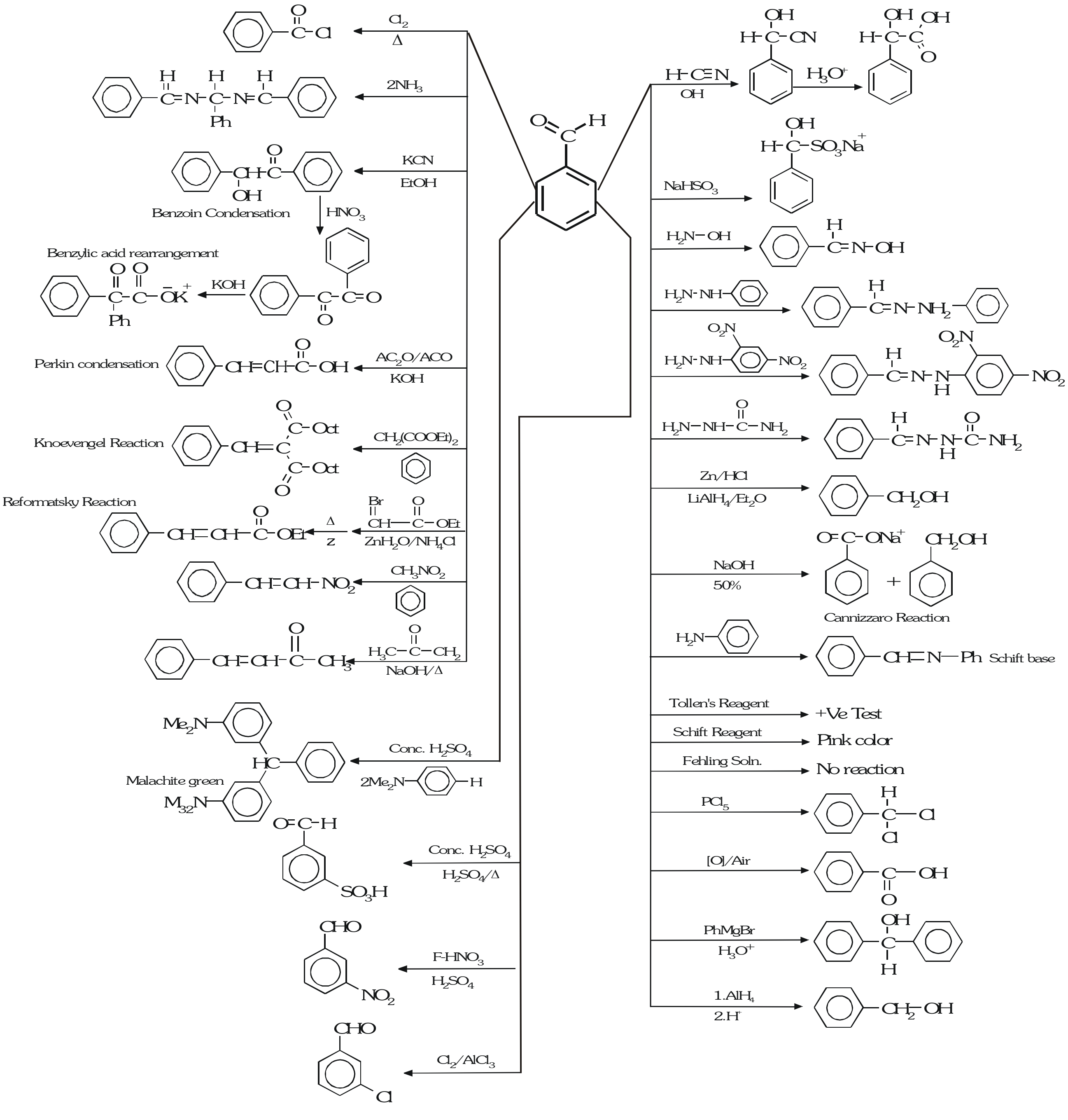
BENZENE SULPHONIC ACID



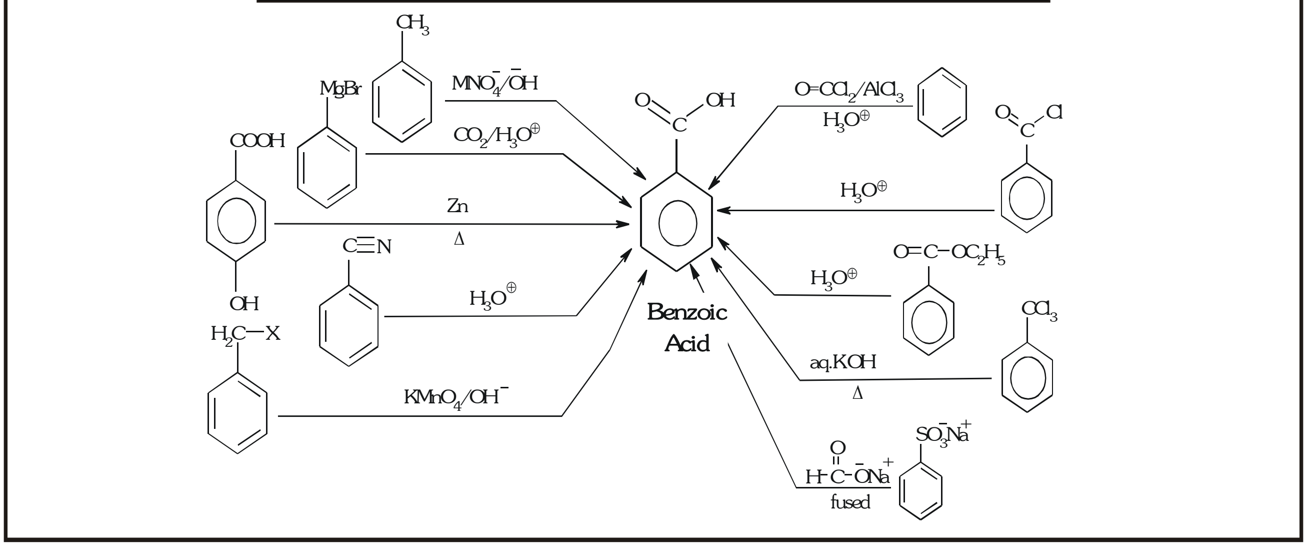
Nutshell Preparation of Benzaldehyde



Nutshell Review and Review of Benzaldehyde Reactions



NUTSHELL PREPARATION OF BENZOIC ACID



NUTSHELL REVIEW AND PREVIEW OF BENZOIC ACID REACTIONS