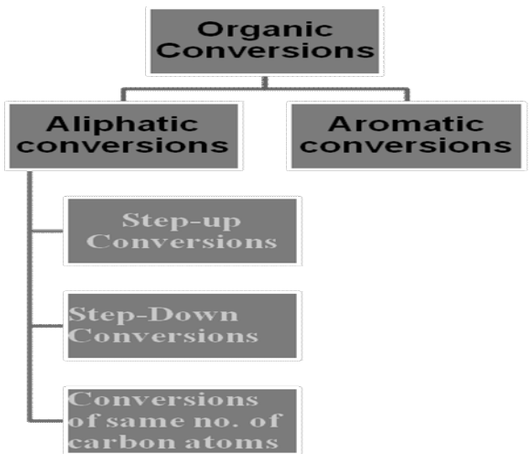
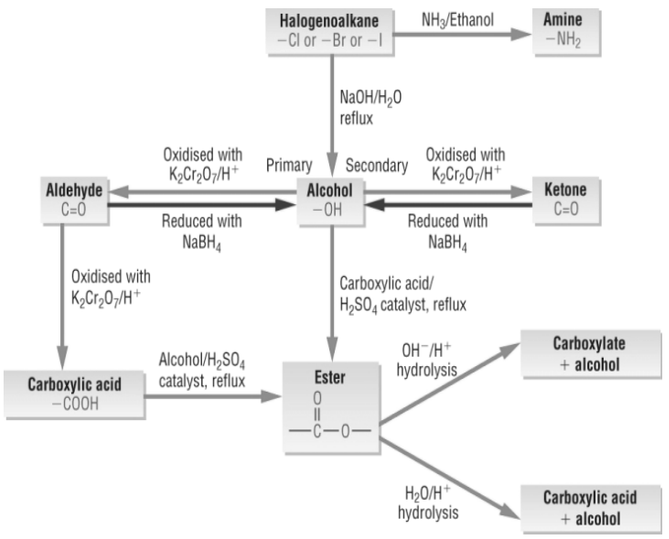
ORGANIC CONVERSIONS

METHOD:- Organic conversions are classified as:-

A. Aliphatic conversions.

B. Aromatic conversions





(A) ALIPHATIC CONVERSIONS: Aliphatic conversions further classified as

Step-up conversions

(i) By Wurtz reaction:

$$RX \xrightarrow{Na} R - R$$

(ii) Through cyanide:

$$RX \xrightarrow{KCN} R - CN$$

(iii) Through Grignard reagent:

$$RX \xrightarrow{Mg} RMgX \xrightarrow{>C=O} > \underset{\underset{R}{|}}{C} - OH$$

(iv) Through Alkyne:

$$RX \xrightarrow{HC\equiv C-Na} H - C \equiv C - R$$

Step-down conversions

(i) Through carboxylic acid:

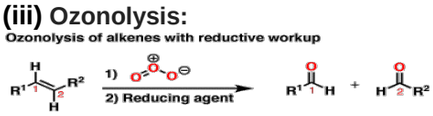
$$RCOOH \xrightarrow{NaOH + CaO} RH$$

(ii) By Hofmann bromamide reaction:

$$RCONH_2 \xrightarrow{Br_2+KOH} R - NH_2$$

(iii) Ozonolysis:

Ozonolysis of alkenes with reductive workup



(common reducing agents are zinc (Zn) or dimethyl sulfide $(CH_3)_2S$)

KEY FOR CONVERSIONS

Sl No	Reagent	Group Out	Group In	Remark
1	$KMnO_4$ / H+	$-CH_2OH$	-COOH	**Strong Oxidation** (2^0 alc→ ketone)
2	$LiAlH_4$	-COOH	$-CH_2OH$	**Strong Reduction** (ketone → 2^0 alc)
3	Cu / 573 K or CrO_3	$-CH_2OH$	-CHO	Dehydrogenation
4	PCl_5 or $SOCl_2$	-OH	-Cl	
5	Cl_2 / Δ or Cl_2 / UV	-H	-Cl	Free radical substitution
6	Aq NaOH / KOH	-X	-OH	Nucleophilic substitution
7	KCN	-X	-CN	Step Up
8	AgCN	-X	-NC	
9	Alcoholic KOH	-HX	=	Dehydrohalogenation (Stzf)
10	Mg / dry ether		Mg	R-X → R-MgX
11	HBr	>=<	H, Br	Merkovnikov
12	H_2 / Pd-$BaSO_4$	-COCl	-CHO	Rosenmund Reduction

13	Zn-Hg / HCl	>C=O	$-CH_2-$	Clemmension Reduction
14	NH_3 / Δ	-COOH	$-CONH_2$	-COOH + NH_3 → $-COONH_4$
15	Br_2 / NaOH or NaOBr	$-CONH_2$	$-NH_2$	Step Down (Hoffmann)
16	HNO_2 or $NaNO_2$/HCl	$-NH_2$	-OH	HONO
17	$CHCl_3$ / alc KOH	$-NH_2$	-NC	Carbyl amine
18	P_2O_5	$-CONH_2$	-CN	Dehydration
19	H_3O^+	-CN	-COOH	Hydrolysis
20	OH^-	-CN	$-CONH_2$	
21	$LiAlH_4$	-CN	$-CH_2NH_2$	Reduction
22	Red P / Cl_2	α-H of acid	-Cl	HVZ Reaction
	In BENZENE RING			
23	Fe / X_2 /dark	-H	-X	Halogination
24	CH_3Cl / $AlCl_3$(anhyd)	-H	$-CH_3$	Friedel Craft alkylation
25	CH_3COCl / $AlCl_3$(anhyd)	-H	$-COCH_3$	Friedel Craft acylation
26	Conc.HNO_3/con.H_2SO_4	-H	$-NO_2$	Nitration
27	Conc H_2SO_4	-H	$-SO_3H$	Sulphonation
28	$KMnO_4$ / H+	-R	-COOH	Oxidation
29	CrO_2Cl_2 / H+	$-CH_3$	-CHO	Mild oxidation(Etard Reaction)
30	Sn / HCl or Fe/HCl	$-NO_2$	$-NH_2$	Reduction
31	NaOH / 623K / 300 atm	-Cl	-OH	
32	Zn dust / Δ	-OH	-H	
33	$NaNO_2$ / dil HCl / 273-278 K	$-NH_2$	$-N_2^+Cl^-$	Diazo reaction
34	CuCl / HCl or Cu/HCl	$-N_2^+Cl^-$	-Cl	Sandmeyer or Gattermann
35	CuBr / HBr or Cu/HBr	$-N_2^+Cl^-$	-Br	Sandmeyer or Gattermann
36	CuCN / KCN	$-N_2^+Cl^-$	-CN	Sandmeyer
37	KI	$-N_2^+Cl^-$	-I	
38	HBF_4 / Δ	$-N_2^+Cl^-$	-F	
39	H_3PO_2 or CH_3CH_2OH	$-N_2^+Cl^-$	-H	
40	H_2O / 283 K	$-N_2^+Cl^-$	-OH	
41	HBF_4/ $NaNO_2$, Cu / Δ	$-N_2^+Cl^-$	$-NO_2$	
42	C_6H_5-OH	$-N_2^+Cl^-$	$-N=N-C_6H_5$-OH	Coupling (p-hydroxy)
43	$C_6H_5-NH_2$	$-N_2^+Cl^-$	$-N=N-C_6H_5-NH_2$	Coupling (p-amino)

Reactions of Grignard Reagent

Grignard reagent +	Any one below + H_2O →	Product
R-MgX	H_2O or ROH or RNH_2	R-H
	H-CHO	$R-CH_2-OH$ (1^0 alc)
	R-CHO	R-CH(OH)-R (2^0 alc)
	R-CO-R	$R_2C(OH)-R$ (3^0 alc)
	CO_2	R-COOH
	R-CN	R-CO-R
	HCOOR	Aldehyde
	RCOOR	Ketone

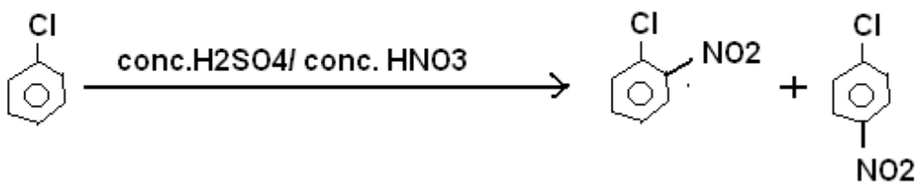
NB: i) During reaction generally changes take place in the functional group only
ii) Remember structural formula of all the common organic compounds (with their IUPAC and common names)
iii) Wurtz Reaction and Aldol Condensation are not included in the table although they are very important for conversions .

Directional Properties of groups in benzene ring for electrophilic substitution

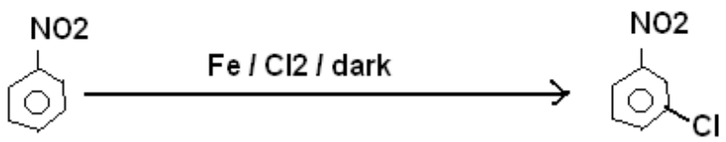
Ortho-para directing group: -R , -OH, $-NH_2$, -X, -OR, -NHR, $-NR_2$, $-NHCOCH_3$, $-CH_2Cl$, -SH, - Ph

Meta-directing group: $-NO_2$, -CHO , -COOH , COOR , -CN , $-SO_3H$, $-COCH_3$, $-CCl_3$, $-NH_3^+$,

-Cl is ortho-para directing group :-



-NO2 is meta directing group :-



(C) Conversions of same no. of carbon atoms