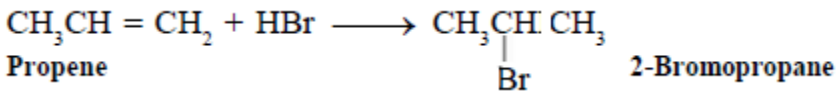
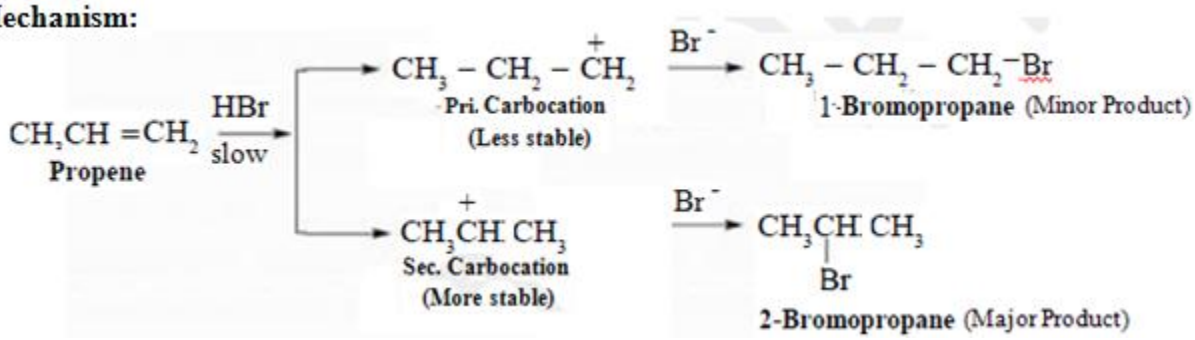
1. Kolbe's Electrolysis: Sodium or potassium salt of a carboxylic acid, on electrolysis, gives a higher alkane. The alkanes with even number of carbon atoms can easily be prepared by this method.

$$CH_3COONa + 2H_2O = CH_3CH_3 + 2CO_2 + H_2 + 2NaOH$$

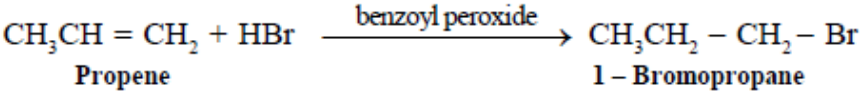
2. Markovnikov's rule for addition of HBr to unsymmetrical alkenes: In case of unsymmetrical alkenes the addition of HBr takes place according to the Markownikoff's rule. According to that in the addition of halogen acids (HX) to unsymmetrical alkenes, the halogen (negative part) of HX goes to that carbon atom of C = C bond which already has less H-atoms attached to it.



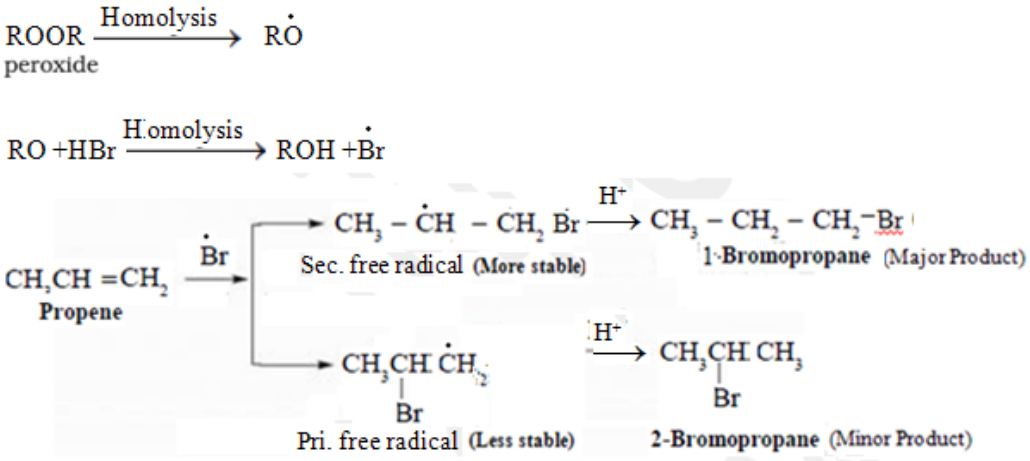
Mechanism:



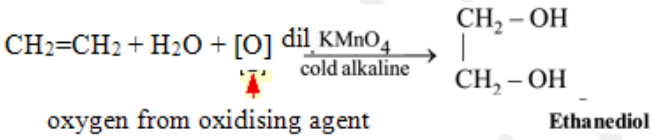
3. Anti Markovnikov's addition or **peroxide effect or Kharash Effect:** If the addition of HBr (This effect is not happen with HCl and HI) is carried out in the presence of peroxides such as ROOR or benzoyl peroxide $(C_6H_5CO)_2O$, then the reaction takes place contrary to Markovnikov's rule. This is also known as Anti Markovnikov's addition or peroxide effect.



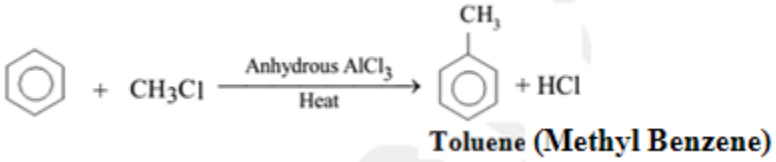
Mechanism:



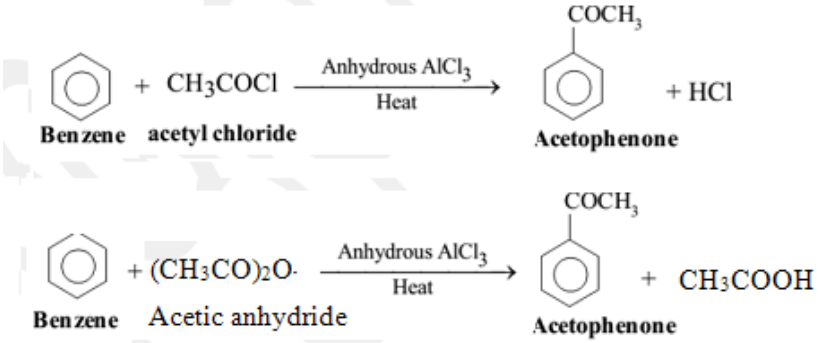
4. Bayer Test (Oxidation with dilute $KMnO_4$ or Hydroxylation): It reacts with 1% solution of potassium permanganate (Bayer reagent) and form vicinal glycols (Ethane diol). During reaction, color of $KMnO_4$ change from pink to colorless so this reaction also used as a test for unsaturation in hydrocarbon.



5. Friedel Crafts alkylation reaction:

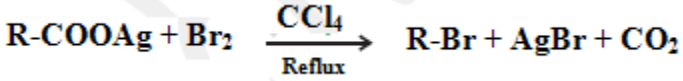


6. Friedel Crafts alcylation reaction:

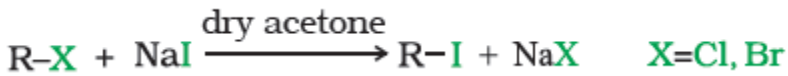


Chapter 10: Haloalkanes and Haloarenes

1. Hunsdiecker's Reaction: This method applied for decrease the number of carbon atoms.

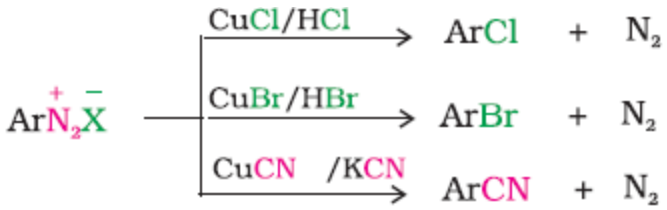


2. Finkelstein Reaction (Halide exchange):

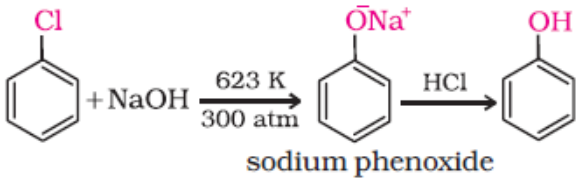


3. Swarts Reaction: It's carried out in the presence of metallic fluoride like AgF, Hg_2F_2, COF_2 or SbF_3.

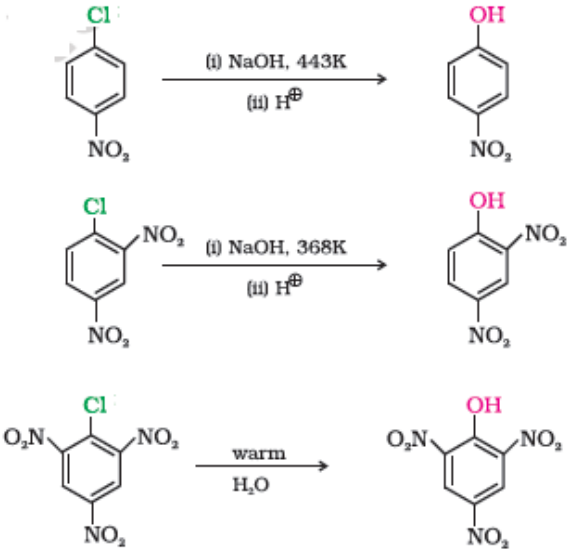
4. Sandmeyer's reaction:



5. Dow's Methods: at high temperature and pressure several nucleophilic substitution reaction are carried out like as

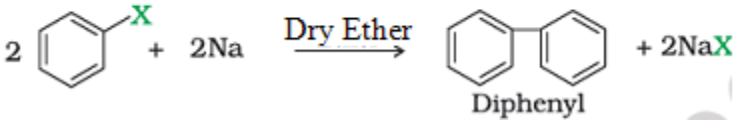


If aryl halides having electron withdrawing groups (like – NO_2, -SO_3H, etc.) at ortho and para positions, those increase the reactivity of Haloarenes and undergoes nucleophilic substitution reaction easily.



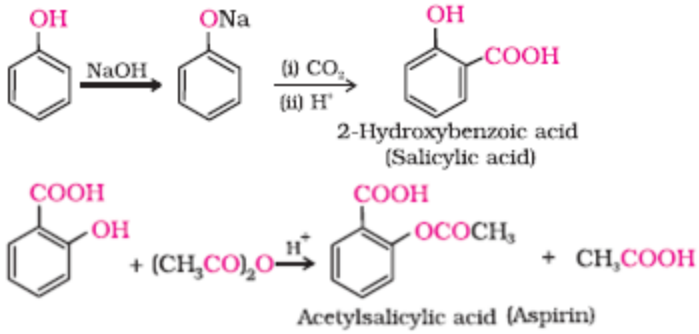
(i) Wurtz-Fittig reaction:

(ii) Fittig reaction:

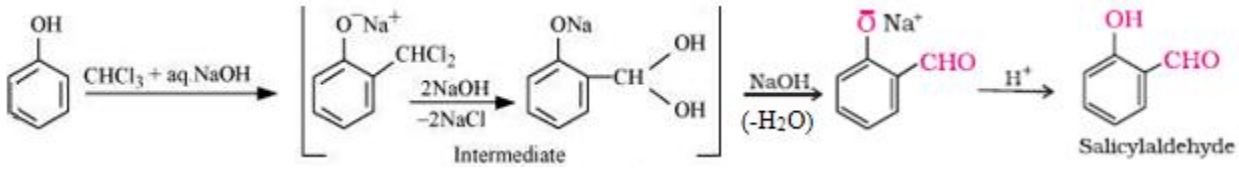


Chapter 11: Alcohol, Phenol and Ethers

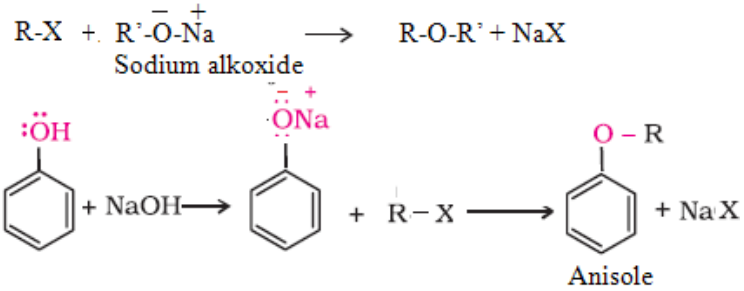
1. Kolbe's reaction: Sodium phenoxide is more reactive than phenol towards electrophile substitution reaction. Here CO_2 act as weak electrophile.



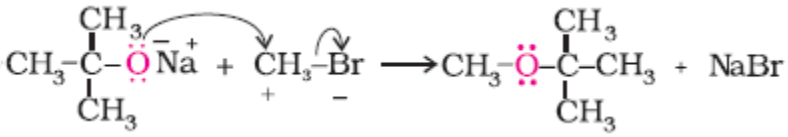
2. Reimer-Tiemann reaction: This reaction is an electrophilic substitution reaction and electrophile is dichlorocarbene. Similarly with carbon tetrachloride and alkali, o- and p-hydroxybenzoic acid are obtained.



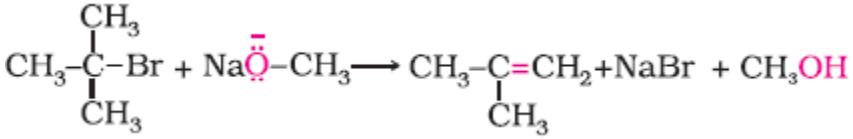
3. Williamson synthesis: Only **primary alkyl halides** when react with sodium alkoxide (strong base) give ether while tertiary alkyl halides give alkene due to steric hindrance.



Secondary and tertiary Ethers also prepared by this method. The reaction involves S_N2 attack of an alkoxide ion on primary alkyl halide.

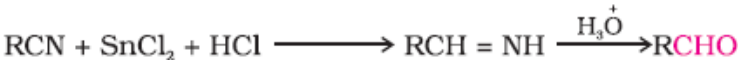


Secondary and tertiary alkyl halides give alkene due to steric hindrance.

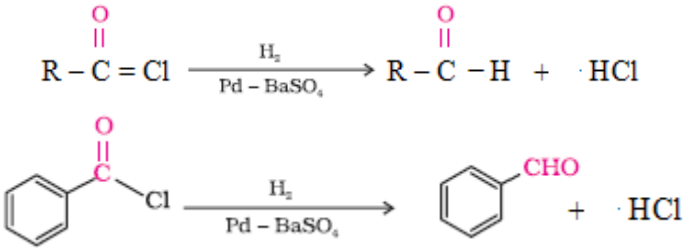


Chapter- 12: Aldehydes, Ketones and Carboxylic Acid

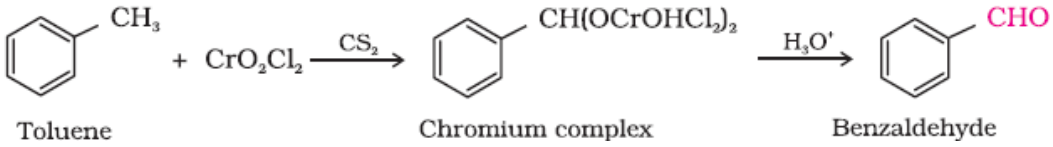
1. Stephen Reaction: By reduction of nitrile, it gives imine, which on hydrolysis given corresponding aldehyde**.**



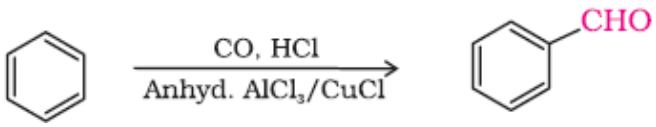
2. Rozenmund Reduction: Hydrogenation of Acyl Chloride in presence of Pd deposited over $BaSO_4$.



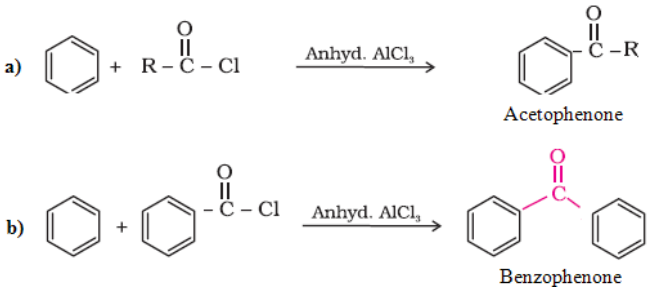
3. Etard Reaction (By Oxidation of Toluene): Chromyl chloride is oxidizes methyl group to a chromium complex which on hydrolysis given corresponding aldehyde**.**



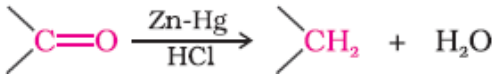
4. Gatterman-koch reaction:



5. Friedel Crafts acylation reaction:

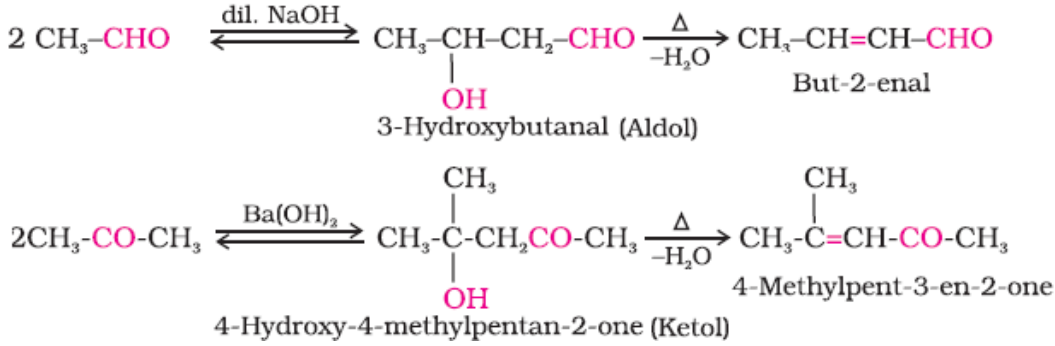


6. Clemmensen reduction:

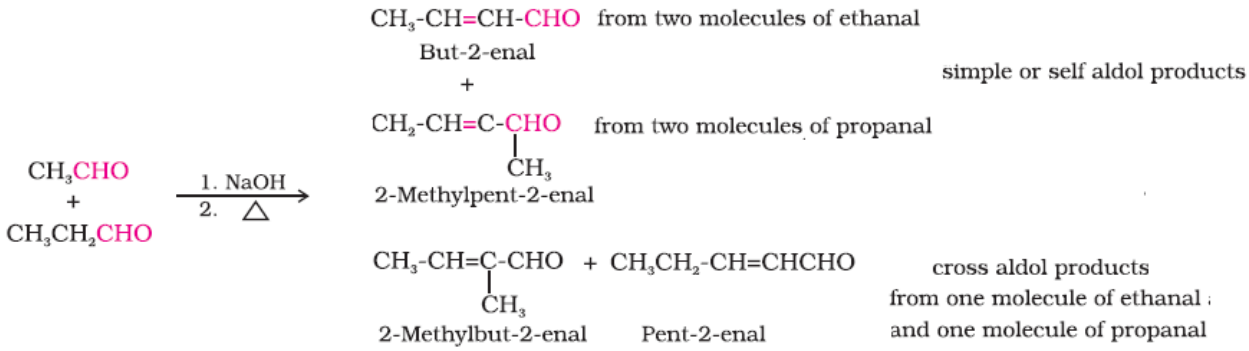


7. Wolff-Kishner reduction:

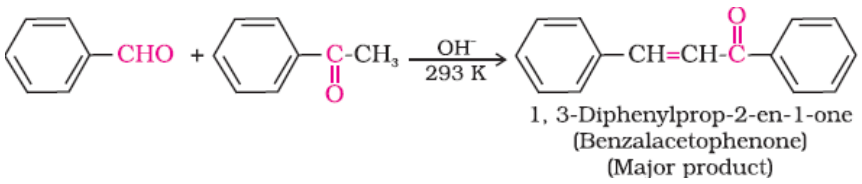
8. Aldol condensation: Aldehyde and ketone having atleast one α-hydrogen atom on treatment with dilute alkali to form β-hydroxyl aldehyde (aldol) or β-hydroxyl ketones (ketol) respectively.



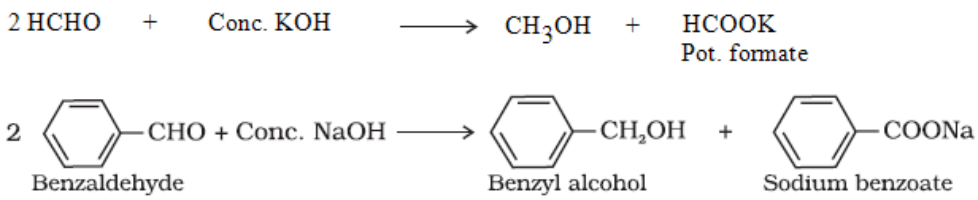
9. Cross aldol condensation: When aldol condensation is carried out b/w two different aldehyde or two different ketones or b/w aldehyde and ketone is called cross aldol condensation. If both of them contain α- hydrogen atoms, it gives a mixture of four products.



Aldehyde and ketone can also be used in cross aldol condensation like as

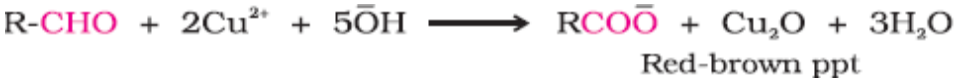


10. Cannizzaro reaction: Aldehyde which do not have α-hydrogen atom undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali to form alcohol and salt of acid.

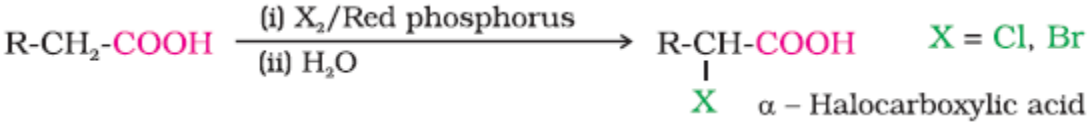


11. Tollen's test: When aldehydes are treated with Tollen's reagent (ammonical silver nitrate solution), they form silver mirror on the inner side of the test tube. Ketones do not form silver mirror image and so do not give this test.

12. Fehling test: Fehling solution is a mixture of two solution, Fehling solution A (aq. Solution of $CuSO_4$) and Fehling solution B (alkaline solution of sodium potassium tartarate). When aldehyde is heated with Fehling reagent it forms redish brown ppt of cuprous oxide but ketones do not give this test.

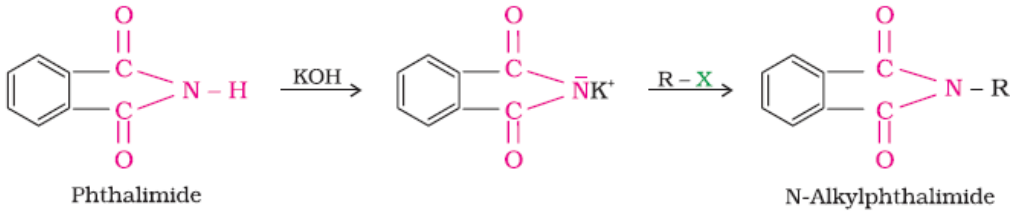


13. Hell- Volhard Zelinsky reaction (Halogenation): Carboxylic acid having an α- hydrogen are, halogenated at the α- position on treatment with chlorine or bromine.



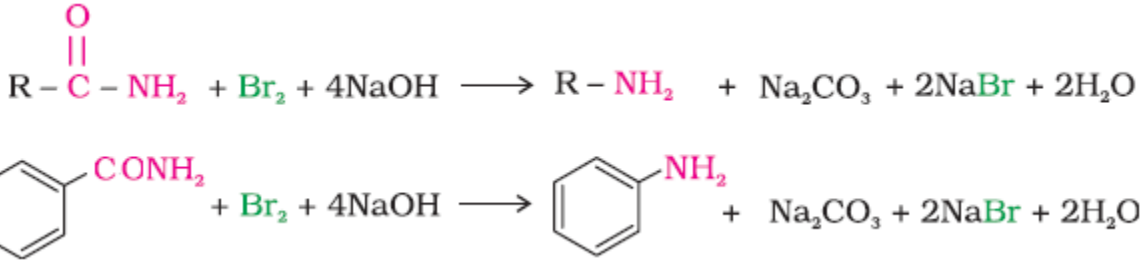
Chapter- 13: Amines

1. Gabriel phthalimide synthesis:

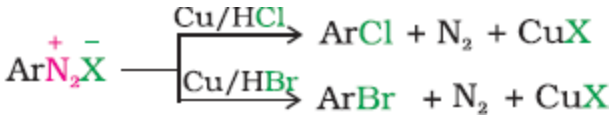


Aromatic amines cannot be prepared by this method b/c aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

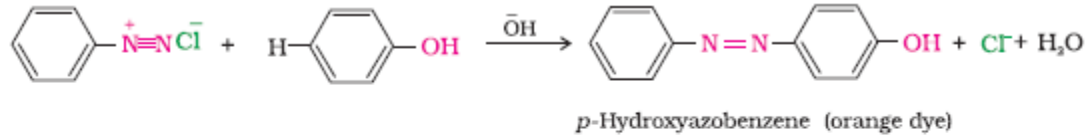
2. Hoffmann bromamide degradation reaction: Alkyl and aryl (aniline) both type amines can be prepared by this method.



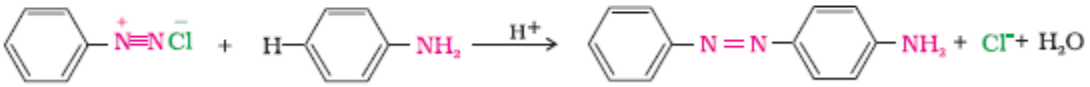
3. Gatterman's reaction:



4. Coupling reaction: The reaction of Diazonium salt with phenol and aniline to form azo compounds of the general formula Ar-N=N-Ar is called coupling reaction. The reaction is electrophilic substitution reaction where the Diazonium ion is act as electrophile. Coupling generally occurs at the p-position, w.r.t. the hydroxyl or the amino group, if free, otherwise it takes place at the o-position.



p-Hydroxyazobenzene (orange dye)



p-Aminoazobenzene (yellow dye)