CONCEPT MAP

AROMATIC COMPOUNDS

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- Planar, cyclic and completely conjugated
- Contains $(4n + 2)$ π-electrons, (Huckel's Rule) (where, n = an integer)
- If, on ring closure, the π-electron energy of an open chain polyene decreases
  e.g., [6] annulene (Benzene)

Non-aromatic Compounds

- Non-planar, non-cyclic and not completely conjugated
- If, on ring closure, the π-electron energy remains the same
  e.g., Alkanes, alkenes and 1, 3, 5-cycloheptatriene

Non-Benzenoids

- Do not contain benzene ring
  e.g., Azulene, tropolone, pyrrole, etc.

Anti-aromatic Compounds

- Planar, cyclic and completely conjugated
- Contains $4n$ π-electrons, (where, n = an integer)
- If, on ring closure, the π-electron energy increases
  e.g., cyclopentadienyl cation

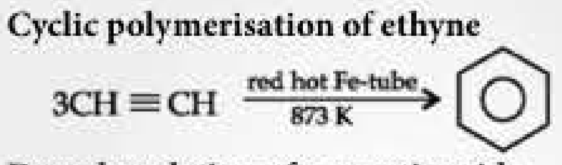
Benzenoids

Aromatic hydrocarbons containing a benzene ring are called benzenoids. Their general formula is C_nH_{2n-6m}, (where, n = no. of C-atoms, m = no. of rings.)

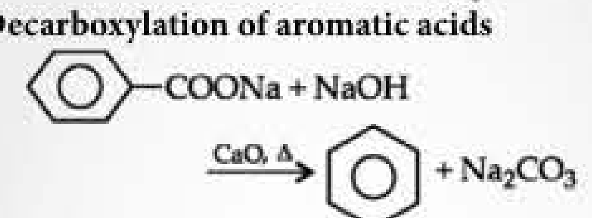
BENZENE

Preparation

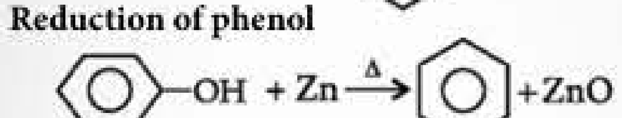
Cyclic polymerisation of ethyne



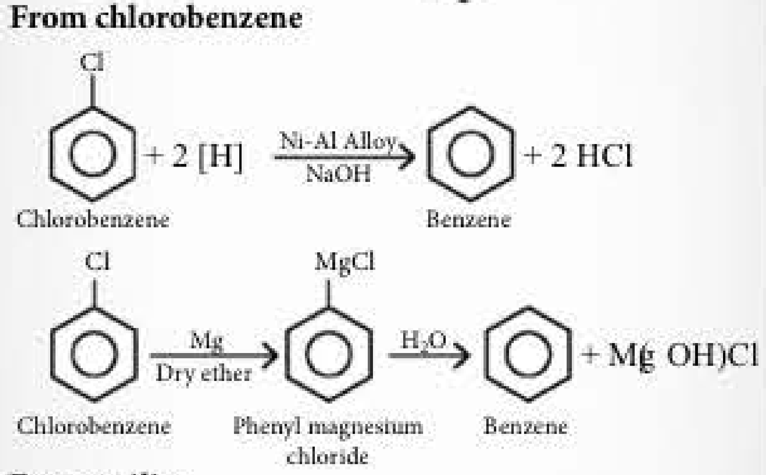
Decarboxylation of aromatic acids



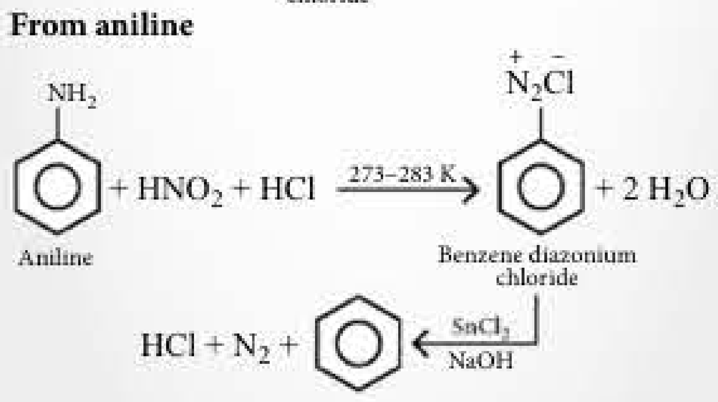
Reduction of phenol



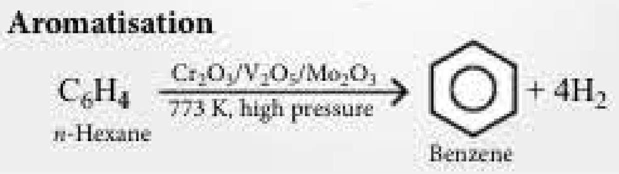
From chlorobenzene



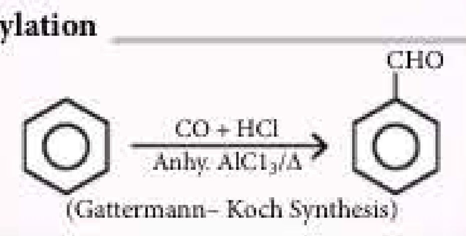
From aniline



Aromatisation

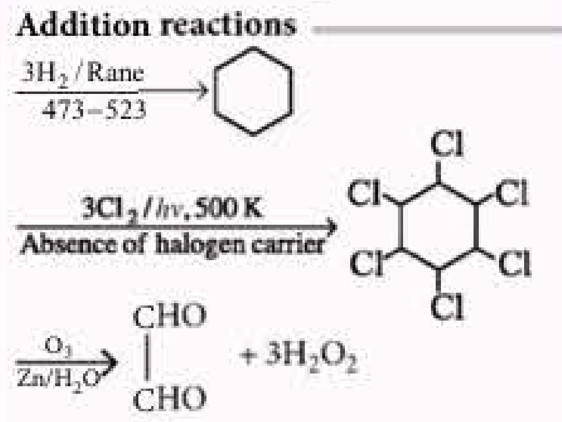


Formylation

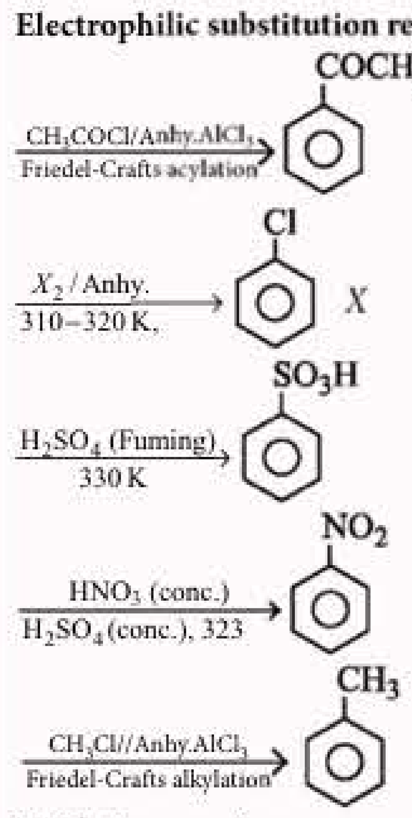


Properties

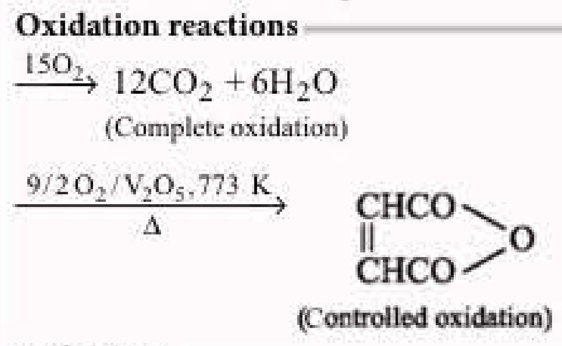
Addition reactions



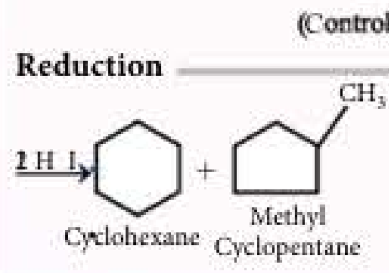
Electrophilic substitution reactions



Oxidation reactions



Reduction

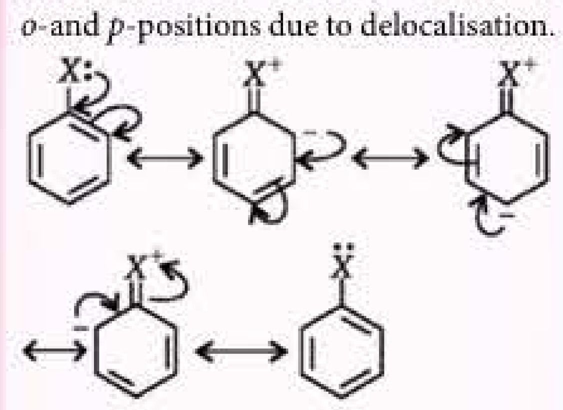


Directive Influence of Substituents

The ability of a group already present in the benzene ring to direct the incoming group to a particular position is called the directive influence of groups.

o, *p*-directive

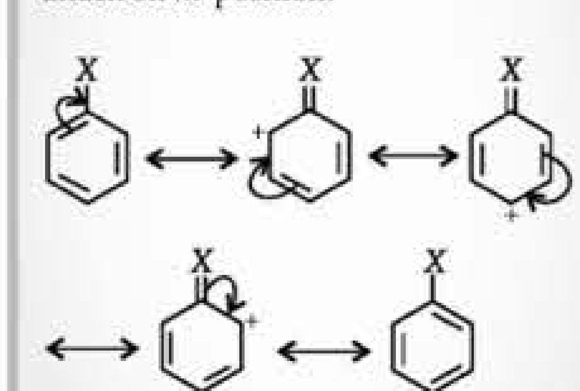
Groups with positive mesomeric effect (+*M*) increases electron density at *o*-and *p*-positions due to delocalisation.



(Here, *X* may be $—CH_3$, $—C_2H_5$, $—OCH_3$, $—NH_2$, —NH*R*, $NHCOCH_3$, —OH, —F, —Cl, —Br, —I.)
Thus, electrophile attacks on *o*- and *p*-positions because these are electron rich positions.

m-directive

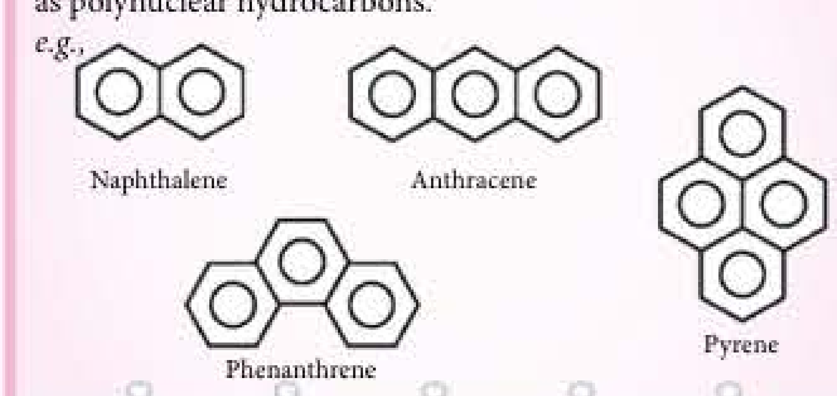
Groups with negative mesomeric effect (–*M*) decreases electron density on *o*- and *p*-positions, so electrophile will attack on *m*-position.



(Here, *X* may be $—NO_2$, —CHO, —CO*R*, —COOH, —COO*R*, $—SO_3H$, —CN.)

Polynuclear Hydrocarbons

Compounds having more than one aromatic ring are known as polynuclear hydrocarbons.
e.g.,



Carcinogenicity & Toxicity

- Radiations, chemicals and physical irritations, coal tar, hormones and certain viruses can be the cause of cancer. The most common out of these is polynuclear hydrocarbons (present in coal tar). Hence, such hydrocarbons are known as carcinogenic polynuclear hydrocarbons.
- These hydrocarbons are mainly formed by incomplete combustion of organic material like coal tar, tobacco, shoot, shale oil and petroleum etc.
- The degree of potency of producing cancerous hydrocarbons varies with the number and position of certain substitutents like $–CH_3$, –CN, –OH etc.