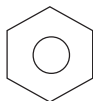


**Introduction :****Q.1. What are aromatic compounds.**

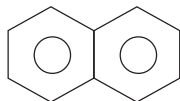
**Ans:** The name aromatic compounds was originally given to natural compounds which possessed aroma (i.e. fragrant odour).

*Benzene and its derivatives & the compounds which resemble benzene in chemical behaviour are called aromatic compounds.*

e.g.



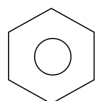
Benzene



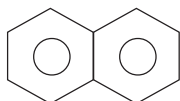
Napthalene

**Q.2. Give the some examples of aromatic compounds.**

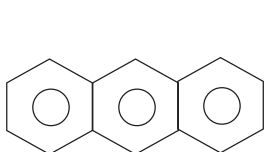
**Ans :**



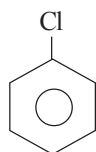
Benzene



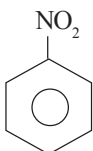
Napthalene



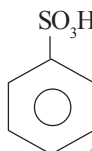
Anthracene



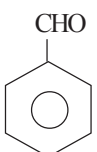
Chlorobenzene



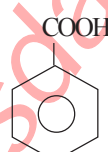
Nitrobenzene



Benzene sulphonic acid



Benzaldehyde



Benzoic acid

**Characteristics of aromatic compounds.****Q.3. Give the general characteristics of aromatic compounds.**

- Ans :**
- They are closed chain compounds.
  - They have alternate single, double bond.
  - They burn with sooty flame (smoky flame)
  - They contain high percentage of carbon atom.
  - They undergo addition as well as substitution reaction.
  - Their hydroxy compound (phenol) are less acidic.
  - They easily undergo nitration.

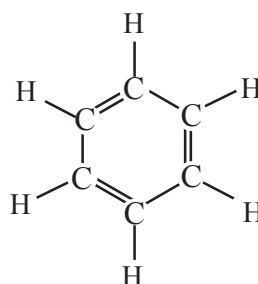
**Q.4. Distinguish between aromatic and aliphatic compounds.**

**Ans :**

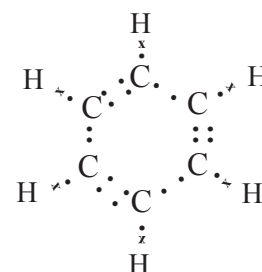
Aromatic comp.	Aliphatic comp.
i) They contain high percentage of carbon atoms.	i) They contain less percentage of carbon atoms.
ii) They are closed chain compounds.	ii) They are open chain compounds.
iii) They burn with sooty flame.	iii) They burn with non-sooty flame.
iv) They undergo addition as well as substitution reaction.	iv) They undergo addition or substitution reaction.
v) They are stable.	v) They are unstable
vi) They easily undergo nitration.	vi) They do not undergo nitration.

**STRUCTURAL AND ELECTRONIC FORMULA OF BENZENE****Q.5. Give the structural and electronic formula of benzene.**

**Ans :**



Structural formula



Electronic formula

Where

• = Electrons of carbon

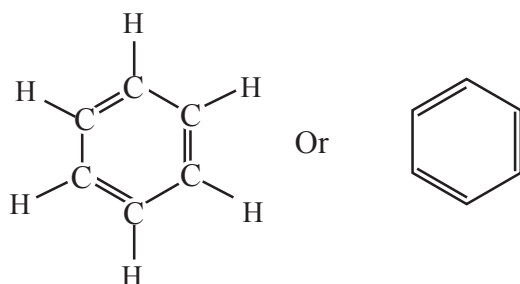
x = Electrons of hydrogen

**Kekule's structure of benzene.****Q.6. Explain the Kekule's structure of benzene.**

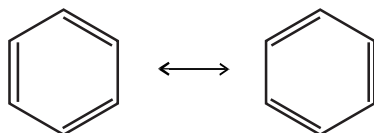
**Ans :** (Kekule in 1865 proposed following structure of benzene) :

- Molecular formula of benzene is  $C_6H_6$ .
- The six C-atom are present at the six corners of a regular hexagon.
- Each C-atom carries one H-atom.

- iv) To account for the fourth valency of each C, he suggested a system of alternate single and double bonds. (i.e. a conjugated system).



- v) The double bonds in benzene are not localised, but they are in a state of oscillation.
- vi) Benzene can be represented by two structures which are in dynamic equilibrium.



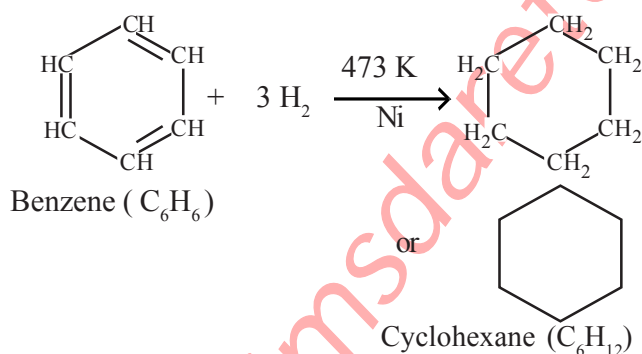
## CHEMICAL PROPERTIES OF BENZENE

### A) ADDITION REACTIONS :

#### a) Addition of $H_2$ (or catalytic hydrogenation) :

##### Q.7. Explain Addition of $H_2$ on benzene.

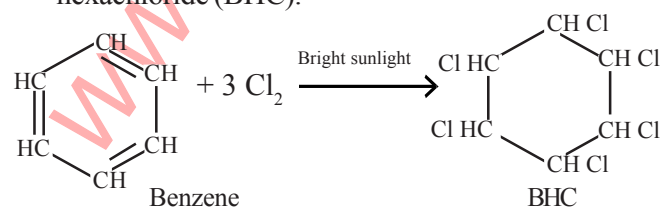
Ans : When benzene is heated with  $H_2$  gas in presence of Ni catalyst at 473 K, it forms cyclohexane. ( Three mole of  $H_2$  are added. )



#### b) Addition of $Cl_2$ :

##### Q.8. Explain Addition of $Cl_2$ on benzene.

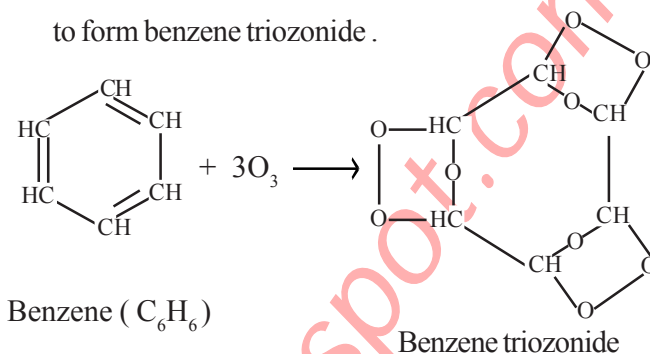
Ans : Benzene combines with three molecules of chlorine in presence of bright sunlight to form benzene hexachloride (BHC).



#### c) Addition of $O_3$ :

##### Q.9. Explain Addition of $O_3$ on benzene.

Ans : Benzene combines with three molecules of ozone to form benzene triozoneide .



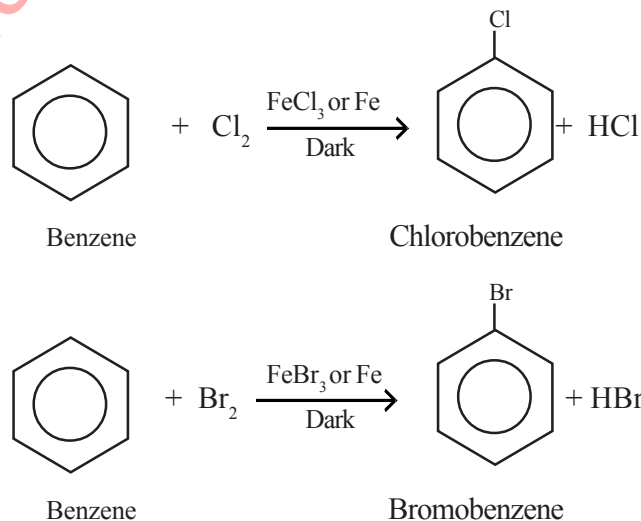
### B) Substitution reactions :

#### 1) Halogenation : ( Catalytic halogenation ) :

##### Q.10. Explain the halogenation of benzene.

Ans : It is the substitution of a hydrogen atom of benzene ring by a halogen atom.

Benzene reacts with halogens ( $Cl_2$  or  $Br_2$ ) in dark in presence of halogen carrier catalyst ( e.g  $FeCl_3$ ,  $FeBr_3$ ,  $AlCl_3$  etc. ) to give halogen derivatives.

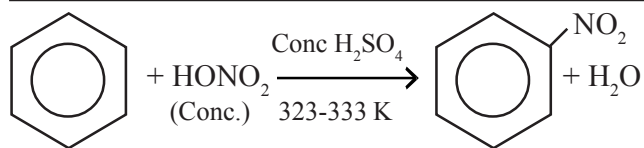


#### 2) Nitration :

##### Q.11. Explain the nitration of benzene.

Ans : It is the substitution of a hydrogen atom of benzene ring by a nitro group ( $-NO_2$ ).

When benzene is heated with nitrating mixture ( i.e conc.  $HNO_3$  and conc.  $H_2SO_4$  ) at 323 to 333 K nitrobenzene is formed.



Benzene

Nitrobenzene

**Q.12. What is nitrating mixture.**

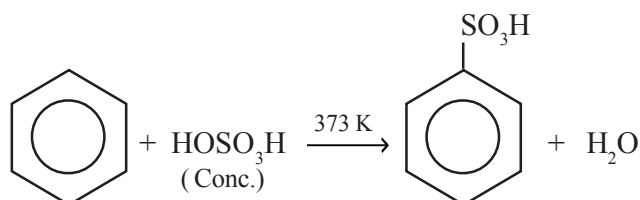
**Ans :** It is mixture of concentrated  $\text{HNO}_3$  and conc.  $\text{H}_2\text{SO}_4$ .

### 3) Sulphonation :

**Q.13. Explain the Sulphonation of benzene.**

**Ans :** It is the substitution of a hydrogen atom of benzene ring by a sulphonic acid group ( $-\text{SO}_3\text{H}$ ).

When benzene is heated with conc. sulphuric acid at 373 K benzene sulphonic acid is obtained.



Benzene

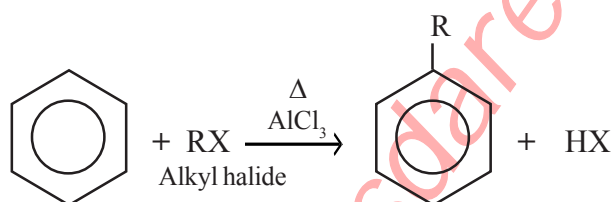
Benzene sulphonic acid

### 4) Friedel Craft alkylation :

**Q.14. Explain Friedel Craft alkylation of benzene.**

**Ans:** It is the reaction in which a ring hydrogen atom of benzene is replaced by alkyl group.

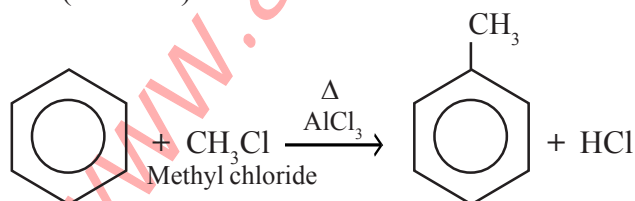
When benzene is heated with alkyl halide in presence of anhydrous  $\text{AlCl}_3$ , alkyl benzene is obtained.



Benzene

Alkyl benzene.

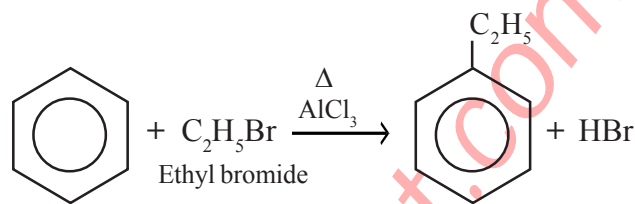
E.g. i) Benzene reacts with methyl chloride in the presence of anhydrous  $\text{AlCl}_3$  methyl benzene (Toluene) is obtained.



Benzene

Methyl benzene (Toluene)

ii) Benzene reacts with ethyl bromide in the presence of anhydrous  $\text{AlCl}_3$  ethyl benzene is obtained.



Benzene

Ethyl benzene

**Q.15. How will you prepare from benzene :**

i) Methyl benzene (Toluene)

ii) Ethyl benzene

OR

How will you convert benzene into

i) Methyl benzene (Toluene)

ii) Ethyl benzene

## MCQ's on Aromatic Compounds

- The hexagonal ring structure of benzene was proposed by**
  - Berzelius
  - Kekule
  - Friedel craft
  - Bayer
- The C – C bond length in benzene is**
  - 139 pm
  - 110 pm
  - 154 pm
  - 198 pm
- Which of the following statements is not correct - regarding aromatic compounds ?**
  - they are closed chain compounds
  - they contain special type of hexagonal ring
  - they on ignition gives non-sooty flame
  - they preferably undergo substitution reaction
- Benzene hexachloride (BHC) has the formula**
  - $\text{C}_6\text{H}_6$
  - $\text{C}_6\text{H}_6\text{Cl}_3$
  - $\text{C}_6\text{H}_6\text{Cl}_6$
  - $\text{C}_3\text{H}_3\text{Cl}_3$
- The reaction,  $\text{C}_2\text{H}_6 + \text{HNO}_3 \xrightarrow{\text{Z}/363\text{K}}$   $\text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}$ , where Z is**
  - $\text{H}_2\text{SO}_4$
  - $\text{H}_3\text{O}^+$
  - $\text{HCl}$
  - $\text{H}_2\text{O}$
- Ethyl benzene is prepared from benzene by the reaction**
  - halogenation
  - alkylation
  - nitration
  - sulphonation
- BHC is prepared by treating benzene with  $\text{Cl}_2$  in presence of**

- a)  $\text{AlCl}_3$                       b) sunlight  
c)  $\text{H}_2\text{SO}_4$   
d)  $\text{O}_3$  followed by reaction with lime and water

8. In the reaction  $\text{C}_6\text{H}_6 + \text{CH}_3\text{Cl} \xrightarrow{\text{anhydrous AlCl}_3} \text{A} + \text{HCl}$ , where A is

- a) Toluene                      b) Benzoic acid  
c) Ethyl benzene              d) Chlorobenzene

9. In the reaction,  $\text{C}_6\text{H}_6 + \text{H}_2\text{SO}_4 \rightarrow \text{A} + \text{H}_2\text{O}$ , where A is

- a) Benzoic acid                      b) Benzene sulphate  
c) benzene sulphononic acid      d) Toulene

10. The total number of  $\sigma$  and  $\pi$  bonds present in the molecule of benzene

- a) 12  $\sigma$  and 2  $\pi$                       b) 12  $\sigma$  and 3  $\pi$   
c) 3  $\pi$  and 6  $\sigma$                       d) 3  $\pi$  and 10  $\sigma$

### MCQ's on S- Block Elements

- The hydroxide of alkali metals are
  - acidic
  - basic
  - amphoteric
  - either 'a' or 'b'
- Which of the following is not an alkali metal
  - Cesium
  - Strontium
  - Rubidium
  - Potassium
- Chile salt petre is
  - $\text{NaCl}$
  - $\text{Na}_2\text{CO}_3$
  - $\text{NaNO}_3$
  - $\text{Na}_3\text{PO}_4$
- Which of the following does not belong to alkali earth metals family?
  - Mg
  - Ba
  - Rb
  - Ra
- Among alkaline earth elements, from Be to Ra atomic size
  - decreases
  - increases
  - does not change
  - increase but not regularly
- Borax is mineral of sodium. Its formula is
  - $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$
  - $\text{Na}_3\text{BO}_3$
  - $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$
  - $\text{H}_3\text{BO}_3$
- The formula of rock salt is
  - $\text{Na}_2\text{O}$
  - $\text{NaCl}$
  - $\text{Na}_2\text{SO}_4$
  - $\text{NaNO}_3$
- Which of the following statements is not correct regarding alkaline earth metals
  - they have the general electronic configuration (Noble gas)  $ns^2$

- b) they are bivalent  
c) they acts as an oxidising agent  
d) they act as reducing agents

9. In Castner's process for the extraction of sodium, the temperature of the electrolyte is maintained at about

- a) 373 K                      b) 603 K  
c) 973 K                      d) 1273 K

10. Which of the following is not correct about sodium ?

- a) It is not malleable and ductile  
b) It is lighter than water  
c) It is good conductor of heat and electricity  
d) It is soft silvery white metal

### MCQ's on Alkenes

- In IUPAC name of neo-hexane is
  - 2-methyl pentane
  - 2,2-dimethyl hexane
  - 2,2 dimethyl butane
  - 2,3- dimethyl butane
- When number of isomers possible for hexane is
  - 2
  - 3
  - 4
  - 5
- $\xrightarrow{373\text{K}}$  Ethyl iodide reacts with sodium in dry ether to form
  - ethane
  - Isobutane
  - Sodim ethoxide
  - n-butane
- When ethene is treated with bromine gives ethyl bromide. In this reaction catalyst used is
  - Aq.  $\text{AlBr}_3$
  - Anhydrous  $\text{AlBr}_3$
  - U.V. light
  - $\text{HNO}_3$
- The process  $\text{CH}_3\text{CH}_2\text{CH}_3 \xrightarrow{573\text{K}} \text{CH}_3\text{CH}=\text{CH}_2 + \text{H}_2$  is called
  - combustion
  - Substitution
  - Dehydrohalogenation
  - Wurtz reaction
- Iodination of ethene is carried out in the presence of
  - HI
  - $\text{CCl}_4$
  - $\text{HIO}_3$
  - HCl
- Alkanes are represented by general formula
  - $\text{C}_n\text{H}_{2n-2}$
  - $\text{C}_n\text{H}_{2n+2}$
  - $\text{C}_n\text{H}_{2n}$
  - $\text{C}_n\text{H}_n$
- When sodium propionate is heated with soda lime, the product obtained is
  - ethane
  - propane
  - mixture of ethane and propane
  - sodium propionate