

In chemical science classification of organic compounds is done on the basis of functional group present in organic compound. Normally in hydrocarbon tetra valency of C-atom is connected with hydrogen atoms by substituting hydrogen atom/atoms, new functional group can be introduced. On the basis of characteristic chemical reaction of functional groups in organic compound number of organic compounds can be synthesized. The organic compound which has more than one functional group, then class of organic compound is determined on the basis of most reactive functional group.

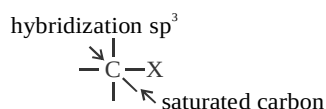
- **Organic compounds with halogen**

(Compounds with $\begin{array}{c} | \\ -\text{C}-\text{X} \\ | \end{array}$ bond)

On the basis of C-atom attached with halogen atom organic halide compounds are classified.

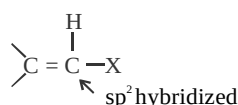
- **Halo alkane/alkylhalide**

If carbon atom of alkyl or-alkyl chain attached with halogen atom is sp^3 hybridized saturated carbon, then such compounds are called alkyl halide haloalkane or halogenated alkane.



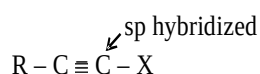
- **Halo alkene or alkenyl halide compounds**

If in the given hydrocarbon compound the hydrogen atom attached with unsaturated carbon i.e. sp^2 hybridized ethylenic carbon bonded by double bond is substituted by halogen atom ($X = F, Cl, Br, I$) then it is called **halo alkene compound**.



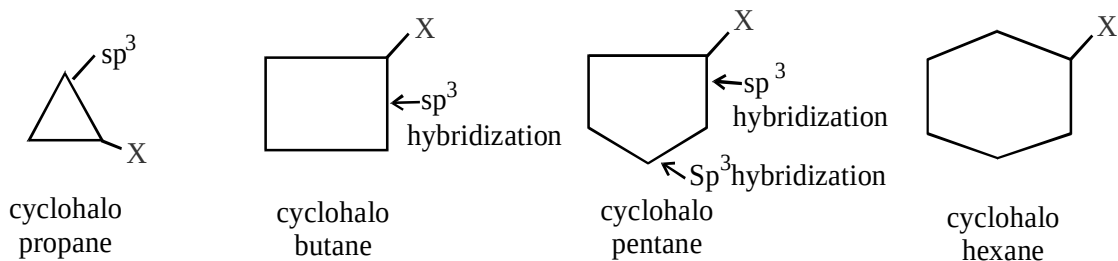
- **Halo alkyne or alkynyl halide compounds**

If in the given hydrocarbon compound the hydrogen atom attached with unsaturated carbon i.e. sp hybridized ethynyl carbon bonded by triple bond is substituted by halogen atom ($X = F, Cl, Br, I$) then it is called **halo alkyne compounds**.



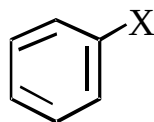
- **Halo cyclo alkane or cyclo alkyl halide organic compounds**

If the saturated hydrocarbon compounds in which all sp^3 hybridized carbon are arranged in cyclic chain and any of the hydrogen atom is substituted by halogen atom ($X = F, Cl, Br, I$), then such compounds are called halo cyclo alkane compounds.



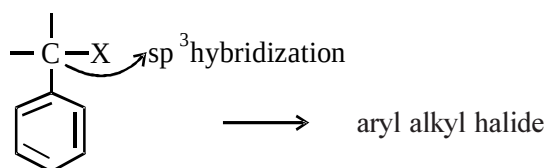
- **Haloarene/Aromatic halide compounds**

If the hydrogen atom bonded with C atom of arene in a hydrocarbon is substituted by halogen atom ($X = F, Cl, Br, I$), then it is called halo arene compounds.



- **Aryl alkylhalide**

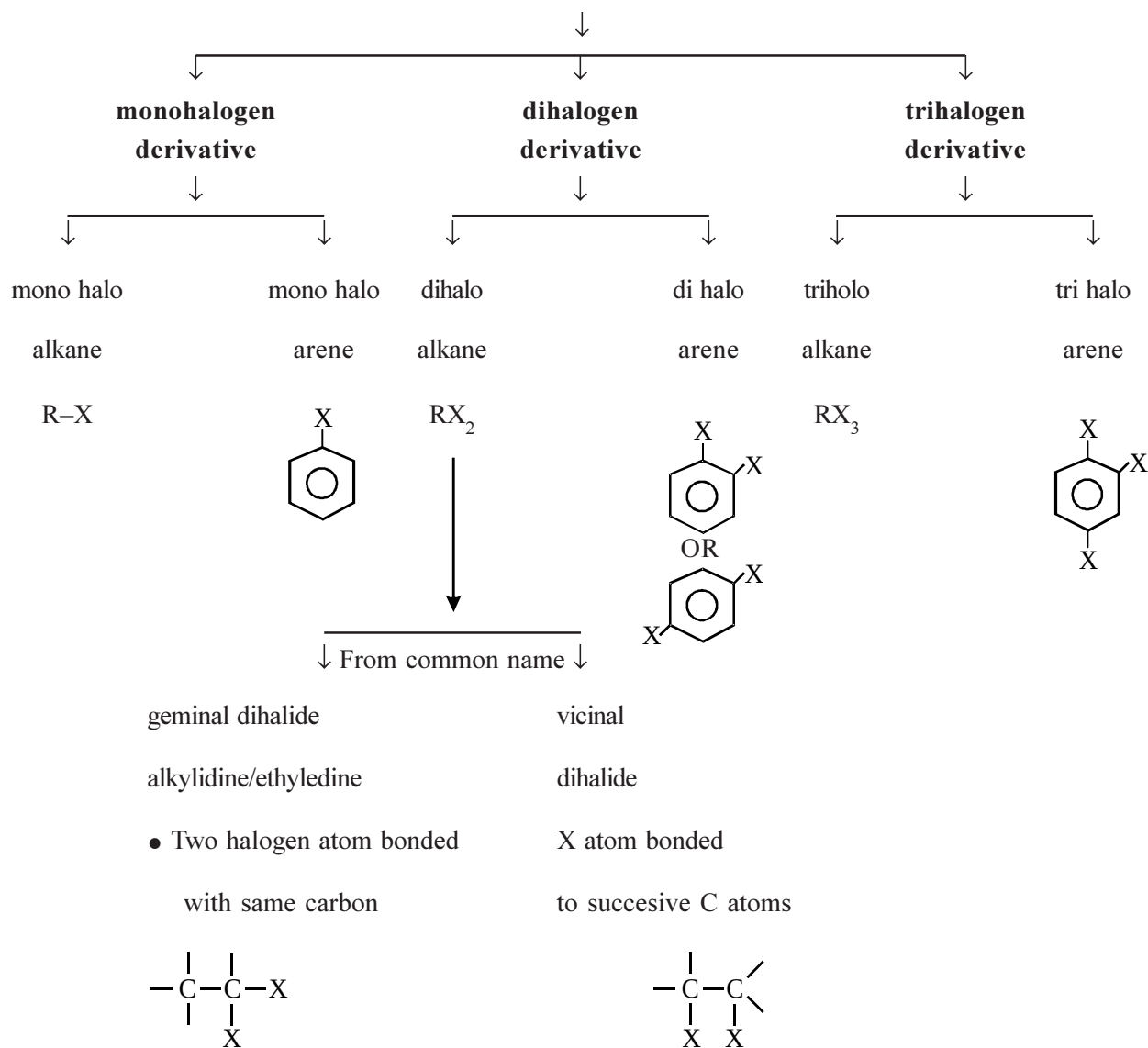
If the H-atom present in alkyl chain which is bonded with C-atom of arene hydrocarbon is substituted by X atom then it is called aryl alkyl halide.



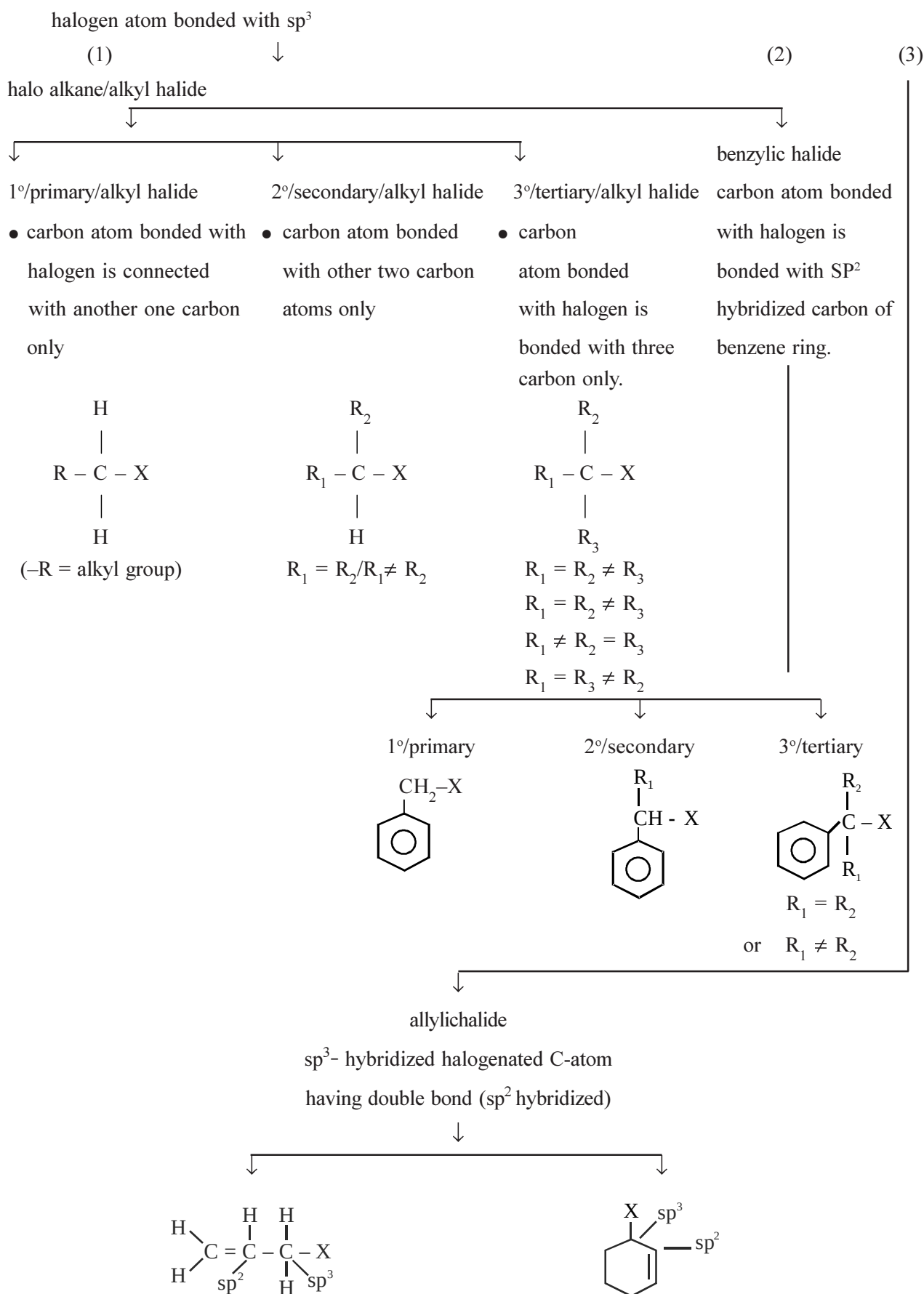
● **Importance :**

- These compounds are useful to introduce alkyl or aryl group in other organic compounds. Hence they are important raw material.
- Good solvents.
- For physical growth and immunity.
- As enzyme in biochemical process.
- As hormones (iodine in thyroxene).
- As anesthetic during surgery of body (chloroform).
- As a drug for the treatment of diseases like malaria and typhoid.

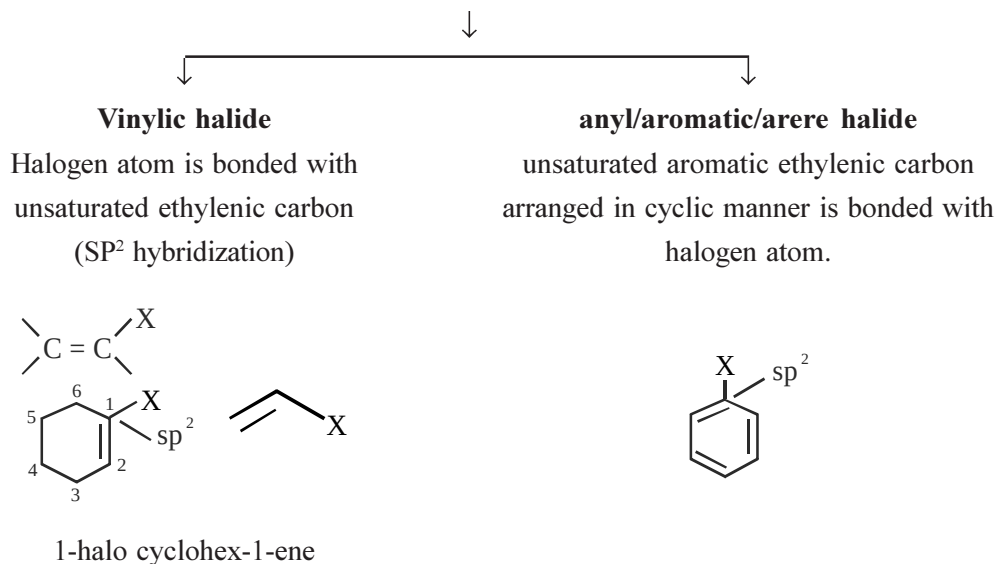
Classification of halogenated compounds

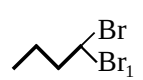
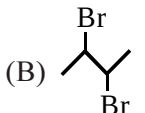
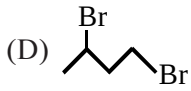
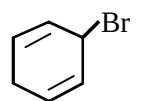
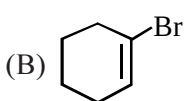
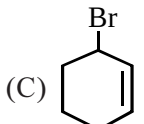
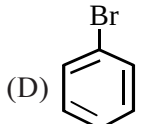
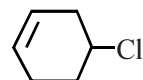
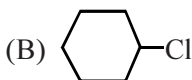
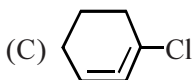
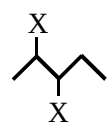
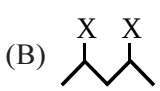


● **Classification of halogen hybridization of carbon**

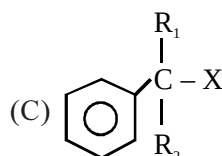
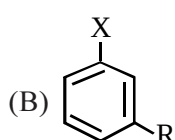
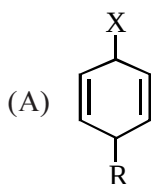


Halogenated compounds in which halogen atom is bonded with sp^2 hybridized carbon.



- What is the hybridization of carbon atom having halogen atom in halo arene compounds ?
 (A) sp^3 (B) sp (C) sp^2 (D) both (B) and (C)
- Which structure represents vicinal dihalide ?
 (A) 
 (B) 
 (C) 
 (D) 
- Which structure represents vinyl halide ?
 (A) 
 (B) 
 (C) 
 (D) 
- Which compound represents allylic halide ?
 (A) $CH_2 - CH = CHCH_2Cl$ (B) $CH_3CH_2 - CH_2Cl$
 (C) $CH_3 - CH_2 - CH = CH_2Cl$ (D) $Cl \cdot CH_2 - CH_2 - CH = CH_2$
- How many structural isomers are possible for $C_5H_{11}Br$?
 (A) 5 (B) 8 (C) 6 (D) 11
- Which structure represents allyl halide ?
 (A) 
 (B) 
 (C) 
 (D) 
- Which structure represents geminal dihalides ?
 (A) 
 (B) 
 (C) 
 (D) 

8. Which sentence indicates alkylidene compounds ?
 (A) All carbon atoms in alkane are bonded with halogen atoms.
 (B) Alternate carbon present in alkane are bonded with halogen atoms.
 (C) Carbon atoms at the end of the alkane series are bonded with halogen atoms.
 (D) Two halogen atoms are bonded with the same carbon atom of alkane.
9. Which of the following is used to prepare poly vinyl chloride ?
 (A) CH_2Cl_2 (B) $\text{HC} \equiv \text{C} \cdot \text{Cl}$ (C) $\text{CH}_2 = \text{CHCl}$ (D) $\text{Cl} \cdot \text{CH}_2 - \text{CH}_2 \cdot \text{Cl}$
10. Compound $\text{C}_3\text{H}_7\text{Cl}$ has how many structural isomers ?
 (A) 3 (B) 5 (C) 7 (D) 2
11. Formula of geminal dihalide is :
 (A) $\text{CH}(\text{Br}) \cdot \text{OH} - \text{CH}_2\text{Br}$ (B) $\text{CH}_2\text{Br} \cdot \text{CH}_2 - \text{CH}_2\text{Br}$
 (C) $\text{CH}_3 - \text{C}(\text{Br})_2 - \text{CH}_3$ (D) $\text{CH}_2 = \text{CBr}_2$
12. Identify ethylidene di chloride :
 (A) $\text{CH}_3 \cdot \text{CH}_2 \cdot \text{Br}$ (B) $\text{Br} \cdot \text{CH}_2 - \text{CH}_2\text{Br}$
 (C) $\text{CH}_3 - \text{CHBr}_2$ (D) $\text{CH}_2 = \text{CCl}_2$
13. From which substance trihalogen halo form compound is obtained ?
 (A) propane (B) ethane (C) benzene (D) methane
14. which compound represents secondary halide ?
 (A) iso propyl chloride (B) isobutyl chloride
 (C) n-propyl chloride (D) n-butyl chloride
15. Which substance is primary halide ?
 (A) iso propyl iodide (B) secondary butyl iodide
 (C) tertiary butyl bromide (D) new hexyl chloride
16. Which compound has 1° , 2° , 3° and 4° carbon atoms ?
 (A) 2, 3, 5-dimethyl pentane (B) 3-Chloro, 2, 3-dimethyl pentane
 (C) 3, 3-di methyl pentane (D) 2, 3, 4-tri methyl pentane
17. How many π - bonds are present in benzene hexa chloride (B.H.C.) ?
 (A) 6 (B) 3 (C) 12 (D) zero
18. Which molecular formula represents alkene halide ?
 (A) $\text{C}_6\text{H}_{11}\text{CH}_2\text{Cl}$ (B) $\text{C}_6\text{H}_5\text{C}_2\text{H}_2\text{Cl}$ (C) $\text{C}_6\text{H}_5\text{C}_2 - \text{Cl}$ (D) $\text{C}_6\text{H}_5\text{C}_2\text{H}_5 \cdot \text{Cl}$
19. Identify structure of benzylic halide :



Answers : 1. (C), 2. (B), 3. (B), 4. (A), 5. (B), 6. (D), 7. (C), 8. (D), 9. (C), 10. (D), 11. (C), 12. (C), 13. (D), 14. (A), 15. (D), 16. (B), 17. (D), 18. (B), 19. (C)

● Nomenclature of halo alkane and halo arene compounds

● Common nomenclature :

After writing the name of hydro carbon suffix halide is added :

F → Fluoride

Cl → Chloride

Br → Bromide

I → Iodide

If more than one halogen atoms of identical type are present then prefix di, tri, tetra etc. are used.

If same type of two halogen atoms are bonded on the same carbon then such dihalo alkanes are called geminal dihalide or **alkilidine** halide.

If same type of two halogen atoms are bonded on the successive carbon atoms then such compounds are called vicinal dihalide or **alkylene** dihalide.

In di halo arene compounds position of halogen is indicated by O-ortho, M-meta or P-para before name of aromatic nucleus and then suffix dihalide is written.

● IUPAC nomenclature

Select the longest chain of hydrocarbon which is bonded with halogen and then place prefix halo-before root name.

F → Fluoro

Cl → Chloro

Br → Bromo

I → Iodo

If more than one halogen atoms of same type are present then it is indicated by numeric prefix di, tri, tetra, penta etc.

In halo arene compounds prefix halo is placed before the name of aromatic nucleus.

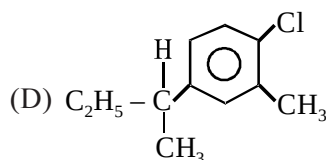
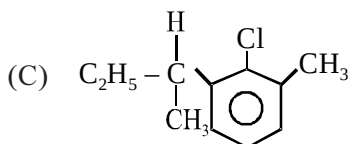
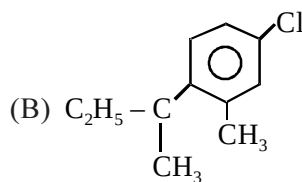
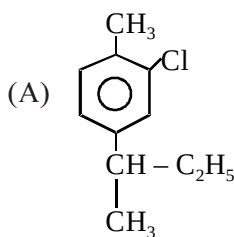
In dihalo alkane having two identical halogen group prefix di is placed before the least possible locant of halogen atoms.

In case of di halo arene position of halogen atom is indicated by (1, 2), (1, 3) or (1, 4) along with dihalo prefix before the name of aromatic nucleus.

20. Which of the following is the structure of alkylene dihalide ?

(A) $\text{Cl}\cdot\text{CH}_2 - \text{CH}_2\cdot\text{Cl}$ (B) $\text{Cl}\cdot\text{CH} = \text{CH}\cdot\text{Cl}$ (C) $\text{CH}_3 - \text{CHCl}_2$ (D) $\text{CH}_2 = \text{CCl}_2$

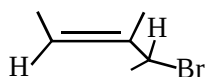
21. Indicate the structural Formula of 1-chloro-4-secbutyl-2-methyl benzene.



22. Give the complete name of D. D. T.

- (A) 1, 1, 1-tri chloro, 2, 2-bis (para chloro phenyl)
 (B) 1, 1-dichloro, 2, 2-diphenyl trimethyl ethane
 (C) 1, 1-di chloro, 2, 2-diphenyl trichloro ethane
 (D) None.

23. Give the IUPAC name of



- (A) 2-bromo, 3-methyl pent 2-ene
 (B) 1-bromo, 2-methyl Pent 2-ene
 (C) 4-bromo, 3-methyl pent 2-ene
 (D) 3-bromo, 2-methyl 2-ene

24. Give IUPAC name of $\text{CH}_3 - \text{C}(\text{C}_2\text{H}_5)_2\text{CH}_2\text{Cl}$.

- (A) 2, 2-di ethyl, 1-chloro propane
 (B) 2, ethyl, 2-methyl, chloro propane
 (C) 4-bromo, 3-methyl pent-2-ene
 (D) 3-bromo 2-methyl pent-2-ene

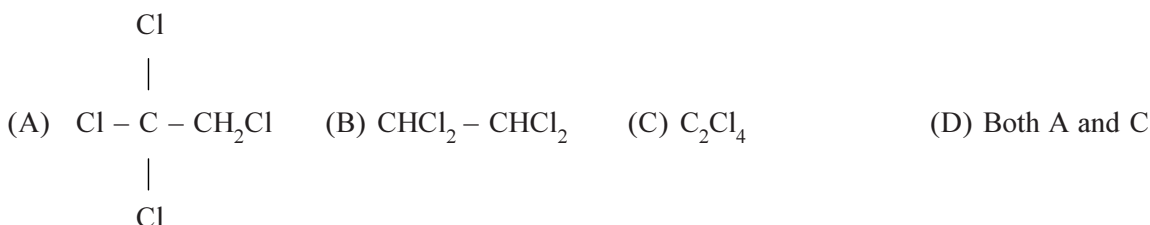
25. Which substance is inflammable ?

- (A) Freon (B) CHI_3 (C) CHCl_3 (D) D. D. T

26. What is the IUPAC name of $(\text{CH}_3)_3\text{C} - \text{CH}_2 - \text{CH}(\text{Br}) - \text{C}_6\text{H}_5$?

- (A) 2, 2-dimethyl 4-bromo, 4-phenyl butane
 (B) 3, 3 di methyl 2-phenyl 1-bromo butane
 (C) 1-bromo 3, 3 dimethyl 1-phenyl butane
 (D) 3, 3-dimethyl 1-phenyl 1-bromo butane

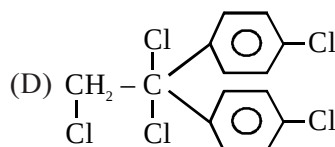
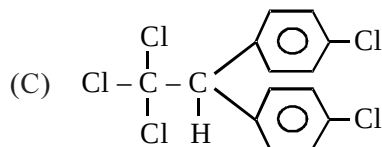
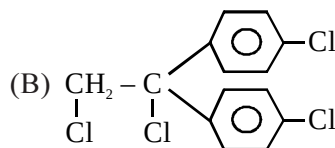
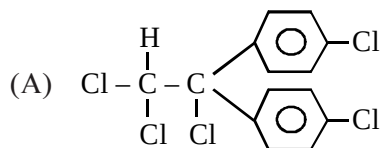
27. Indicate structural formula of acetyl tetra chloride.



28. Give IUPAC name of $\text{Br} - \text{CH}_2 - \text{C} \equiv \text{C} - \text{CH}_2\text{Br}$.

- (A) 2-butyl 1, 4 dibromide
 (B) 1, 4-dibromo propyne
 (C) 1, 3-di bromo, 2-butene
 (D) 1, 4-di bromo, but-2-ene

29. Indicate structural formula of D. D. T. :



Answers : 20. (A), 21. (D), 22. (A), 23. (C), 24. (B), 25. (C), 26. (C), 27. (B), 28. (D), 29. (C)

● Nature of C-X bond

As electro negativity of halogen atom is more than carbon atom in C - X bond compounds ($\text{>C}^{\delta+} - \text{X}^{\delta-}$) carbon atom is partially positively charged ($+\delta$) while halogen atom is partially negatively charged ($-\delta$) hence $\text{>C} - \text{X}$ bond is polar.

In halo alkane as atomic no. of hologen increases, atomic volume ... $\text{>C} - \text{X}$ also increase hence bond length increases.

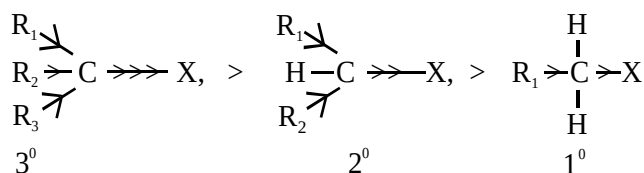


$\text{>C} - \text{X}$ bond enthalpies, reactivity of reaction and bond polarity gradually decreases :

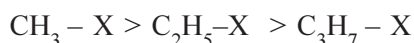


In aryl halide carbon atom having $\text{>C} - \text{X}$ bond is bonded with ehtynilic carbon (SP^2) of aromatic nucleus and halogen ($:\ddot{\text{X}}:$) atom has non-bonding electron pair hence due to resonance C-X bond becomes shorter, more stronger and more polar and as a result its nucleophilic substitution reaction takes place in severe conditions.

1°, 2° and 3° in halo alkane as no. of alkyl group bonded with halogenated carbon increases +I effect increases hence polarity and reactivity of $\text{>C} - \text{X}$ bond increases.

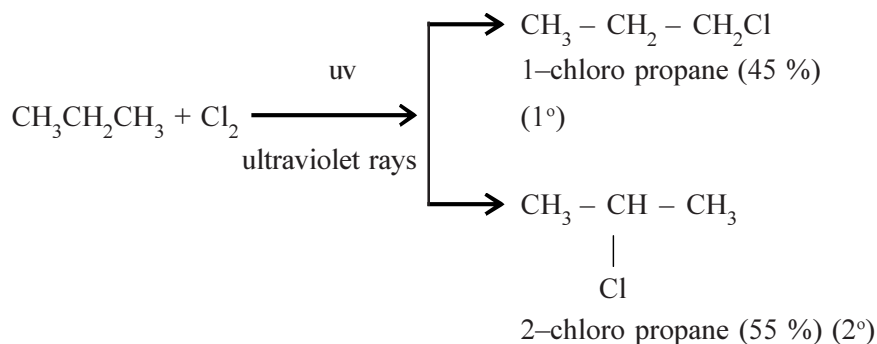
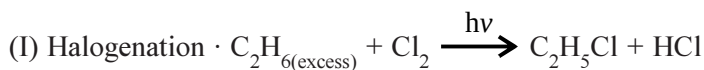


Primary alkyl halide gives reaction by SN^2 or E_2 mechanism through transition state. As number of carbon increases, chemical reactivity of alkyl halide decreases.

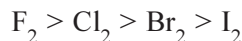


● **Preparation of haloalkane :**

(A) From alkane :



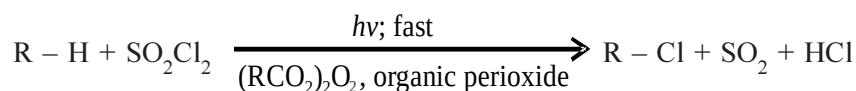
- Reaction takes place by free radical mechanism reactivity of halogen atoms with alkane is



- Reactivity order of alkane



(II) Reaction of alkane with Sulphuryl chloride (SO_2Cl_2).

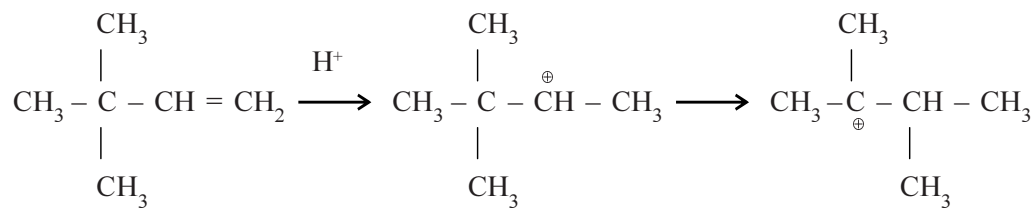


(B) From alkene :

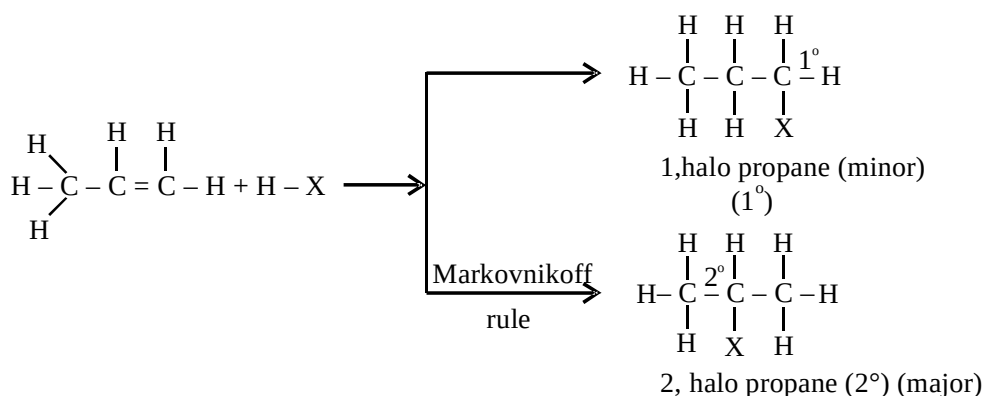
- Reactivity order of halogenation in hydrohalogenation $\text{HI} > \text{HBr} > \text{HCl}$

- 1, 2-hydride or 1,2-methyl shift have greater stability.

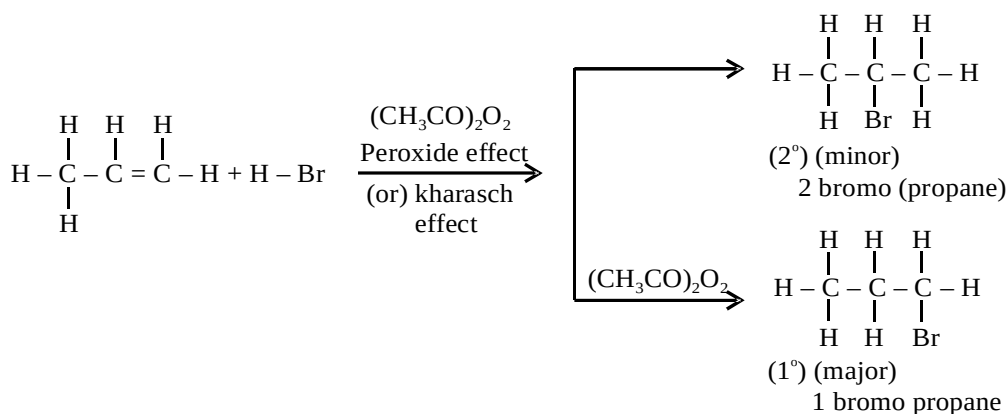
- Stability order of carbocation is : $3^\circ > 2^\circ > 1^\circ > (^+\text{CH}_3)$



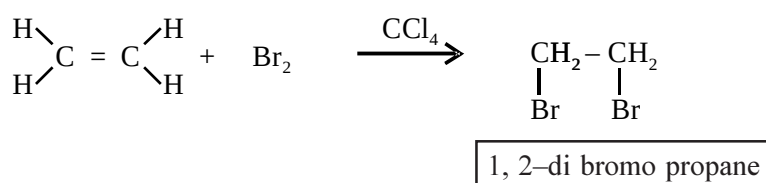
- As per Markonokoff rule :



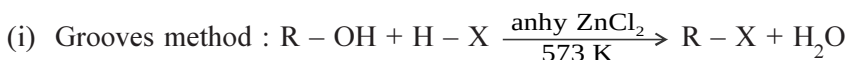
- Anti Markovnikoff rule :



- By addition reaction with Br_2 in presence of dihalogen Br_2 dihalo alkane is obtained.



(C) Alkyl halide from alcohol :

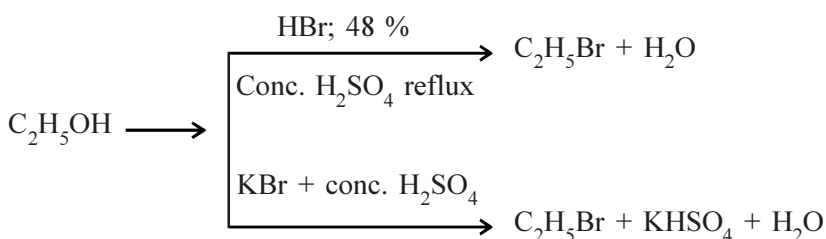


Chemical reactivity : $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$

Reactivity on the basis of alcohol :

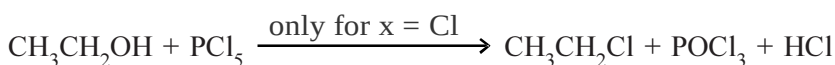
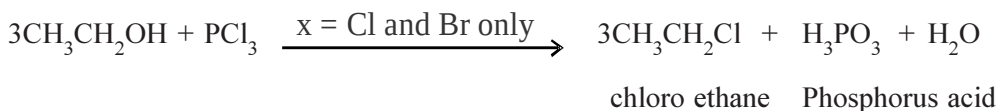
3°	$>$	2°	$>$	1°	$>$	CH_3OH
$\uparrow$		$\uparrow$		$\uparrow$		$\uparrow$ (MeOH)
gives SN^1 reaction				gives SN^2 reaction		

Reaction with anhy. ZnCl_2 and Conc. HCl is called Lucas test.



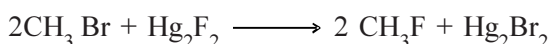
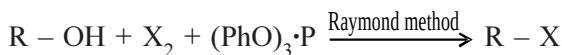
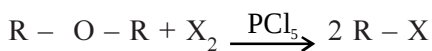
For 2° and 3° alcohol above reaction is not possible.

(ii) Reaction of alcohol with PCl_3 and PCl_5 .



As PBr_5 and PI_5 are unstable, bromide and iodide can not be obtained.

3° and 2° alcohol on heating get converted into alkene so this method is only known for 1° alcohol.

$$\text{CH}_3\text{CH}_2\text{OH} + \text{SOCl}_2 \xrightarrow[\text{SN}^2 \text{ reaction}]{\text{Pyridine}} \text{CH}_3\text{CH}_2\text{Cl} + \text{SO}_{2(\text{g})} \uparrow + \text{HCl}_{(\text{g})} \uparrow$$
$$\text{R} - \underset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{OAg} + \text{Br} - \text{Br} \xrightarrow[\text{decarboxylation}]{\text{CCl}_4} \text{R} - \text{Br} + \text{CO}_{2(\text{g})} \uparrow + \text{AgBr}_{(\text{s})} \uparrow$$
$$\text{R-X} + \text{NaI} \xrightarrow{\text{Dry acetone}} \text{R-I} + \text{NaX}$$
$$\text{CH}_3 - \text{Cl} \xrightarrow{\text{AgF}} \text{CH}_3\text{F} + \text{AgCl}$$

$$\text{R} - \text{OH} \xrightarrow{\text{KI; H}_3\text{PO}_4} \text{R} - \text{I}$$

$$\text{dihalide} \xrightarrow[\text{HCl}]{\text{Zn - Cu}} \text{R - X}$$

$$\text{C}_2\text{H}_5\text{OH} + \text{SOCl}_2 \xrightarrow{\text{Pyridine}} \text{C}_2\text{H}_5\text{Cl} + \text{SO}_{2(\text{g})} + \text{HCl}$$

(D) 2-bromo 2-methyl propane

32. Mention the main product obtained by reaction between silver acetate and bromine water in presence of carbon disulphide.
- (A) CH_3OI (B) CH_3Br
(C) CH_3COOH (D) None
33. Which products are obtained by reaction between ethanol and thionyl chloride in presence of catalyst pyridine?
- (A) $\text{CH}_3\text{COCl} + \text{HCl} + \text{SO}_2$ (B) $\text{CH}_3\text{CH}_2\text{Cl} + \text{H}_2\text{O} + \text{SO}_2$
(C) $\text{C}_2\text{H}_5\text{Cl} + \text{HCl} + \text{SO}_2$ (D) $\text{CH}_3\text{CH}_2\text{Cl} + \text{HCl}$
34. Which reaction gives the product 2,2 di bromo propane ?
- (A) $\text{CH}_3 - \text{C} \equiv \text{CBr} + \text{HBr} \rightarrow$ (B) $\text{CH} \equiv \text{CH} + 2 \text{H} \cdot \text{Br} \rightarrow$
(C) $\text{CH}_3 - \text{CH} = \text{CH}_2 + \text{HBr} \rightarrow$ (D) $\text{CH}_3 - \text{C} \equiv \text{CH} + 2 \text{HBr} \rightarrow$
35. Indicate decreasing order of reactivity of HX for reaction $\text{R-OH} + \text{HX} \rightarrow \text{R-X} + \text{H}_2\text{O}$.
- (A) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ (B) $\text{HBr} > \text{HCl} > \text{HI} > \text{HF}$
(C) $\text{HCl} > \text{HBr} > \text{HI} > \text{HF}$ (D) $\text{HF} > \text{HBr} > \text{HCl} > \text{HI}$
36. $\text{CH}_2 = \text{CH} - \text{C} \cdot \text{Cl}_3 + \text{HBr} \rightarrow \dots\dots$ product is obtained.
- (A) $\text{CH}_2(\text{Br}) \text{CH}_2\text{CCl}_3$ (B) $\text{CH}_3\text{CH}_2 \text{CCl}_3$
(C) $\text{BrCH}_2 \text{CH Cl CHCl}_2$ (D) $\text{CH}_3 \text{CH Br CCl}_3$
37. Mention the type of reaction for reaction between propane and chlorine gas in presence of sunlight.
- (A) substitution (B) addition (C) rearrangement (D) elimination
38. Mention the product of the reaction between acetylene and HCl.
- (A) $\text{CH}_3\text{CH}_2\text{Cl}$ (B) CH_3CHCl_2 (C) $\text{CH}_2 = \text{CHCl}$ (D) $\text{CHCl} = \text{CHCl}$
39. Which product is obtained by purification reaction between ethyl alcohol and excess chlorine and $\text{Ca}(\text{OH})_2$?
- (A) $\text{CH}_3\text{CH}_2\text{O}$ (B) CCl_3CHO (C) CHCl_3 (D) $(\text{CH}_3)_2\text{O}$
40. Whose yellow precipitate are obtained by reaction between ethyl alcohol and Na_2CO_3 in presence of KI ?
- (A) CHI_3 (B) CH_3I (C) CH_2I_2 (D) $\text{C}_2\text{H}_5\text{I}$
41. Which is required to prepare chloroform from ethanol and bleaching powder ?
- (A) $\text{Ca}(\text{OH})_2$ (B) Cl_2
(C) Both A and B . (D) None
42. Which reaction is not observed when chloroform is formed by reaction between ethanol and bleaching powder ?
- (A) oxidation (B) hydrolysis (C) reduction (D) chlorination
43. From which substance chloroform can be obtained ?
- (A) Methanol (B) Methanal (C) Propane-1-ol (D) Propan-2-ol
44. Which product is obtained by reaction between chloroform and chlorine gas ?
- (A) Chloroform (B) Chloral (C) Ethyl chloride (D) Acetaldehyde
45. Which product is obtained on heating di ethyl ether with conc HI ?
- (A) iodoform (B) ethyl iodide (C) ethanol (D) methyl iodide
46. Mention correct method to prepare methyl fluoride ?
- (A) $\text{CH}_4 + \text{HF} \rightarrow \dots\dots$ (B) $\text{CH}_3\text{OH} + \text{HF} \rightarrow \dots\dots$
(C) $\text{CH}_3\text{Br} + \text{AgF} \rightarrow \dots\dots$ (D) $\text{CH}_4 + \text{F}_2 \rightarrow \dots\dots$

47. Grignard reagent is obtained by reaction with which substance and magnesium method ?
 (A) methyl amine (B) ethyl iodide (C) diethyl ether (D) ethyl alcohol
48. Which product is obtained by electrolysis of ethanolic solution of NaCl ?
 (A) ethanol (B) chloral (C) chloroform (D) acetaldehyde
49. Which reagent is not appropriate to prepare alkyl halide from alcohol ?
 (A) NaCl (B) SOCl_2 (C) PCl_5 (D) $\text{HCl} + \text{ZnCl}_2$
50. Identify industrial method to prepare ethyl bromide.
 (A) ethanol + Br_2 (B) ethanol + HBr (C) alcohol + $\text{H}\cdot\text{Br}$ (D) None
51. $\text{X} \xrightarrow{\text{PCl}_5} \text{C}_2\text{H}_5\text{Cl}$; $\text{Y} \xrightarrow{\text{PCl}_3} \text{CH}_3\text{COCl}$ identify X and Y.
 (A) $\text{C}_2\text{H}_5\text{I}$ and $\text{C}_2\text{H}_5\text{CHO}$ (B) $\text{C}_2\text{H}_5\text{OH}$ and $\text{CH}_3\text{CO}_2\text{H}$
 (C) $(\text{C}_2\text{H}_5)_2\text{O}$ and $\text{CH}_3\text{CO}_2\text{H}$ (D) $\text{C}_2\text{H}_5\text{OH}$ and $\text{C}_2\text{H}_5\text{CHO}$
52. By which of the following substance iodo form cannot be prepared ?
 (A) ethyl methyl ketone (B) 3-methyl 2-butanone
 (C) iso propyl alcohol (D) iso butyl alcohol

Answers : 30. (B), 31. (D), 32. (B), 33. (C), 34. (D), 35. (A), 36. (D), 37. (A), 38. (B), 39. (C), 40. (A), 41. (C), 42. (C), 43. (D), 44. (B), 45. (B), 46. (C), 47. (B), 48. (C), 49. (C), 49. (A), 50. (B), 51. (B), 52. (D),

● Physical Properties :

● Pure halo alkane compounds are colourless, in presence of sunlight bromide and iodide compounds turn coloured.

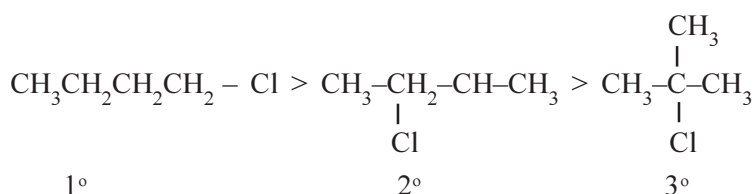
$\text{C}^{\delta+} - \text{X}^{\delta-}$ bond is polar hence boiling point of halo alkane are more than corresponding alkane.

eg., $\text{CH}_3\text{Cl} > \text{CH}_4$

● As no. of carbon atom increases boiling point increases.

$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} > \text{CH}_3\text{CH}_2\text{Cl} > \text{CH}_3\text{Cl}$

● From $1^\circ \rightarrow 2^\circ \rightarrow 3^\circ$ boiling point decreases.



● In alkyl halide having same no of C-atom as atomic number of halogen increases boiling point increases.

$\text{CH}_3\text{I} > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl} > \text{CH}_3\text{F}$ OR $\text{CH}_3\text{F} < \text{CH}_3\text{Cl} < \text{CH}_3\text{Br} < \text{CH}_3\text{I}$

● Boiling point of halo arene are higher because in halo arene C-X bond is shorter and polar due to resonance.

● In halo arene compounds difference between boiling point of 1, 2 ortho, (1, 3 (meta)) and (1, 4 (para)) is very less.

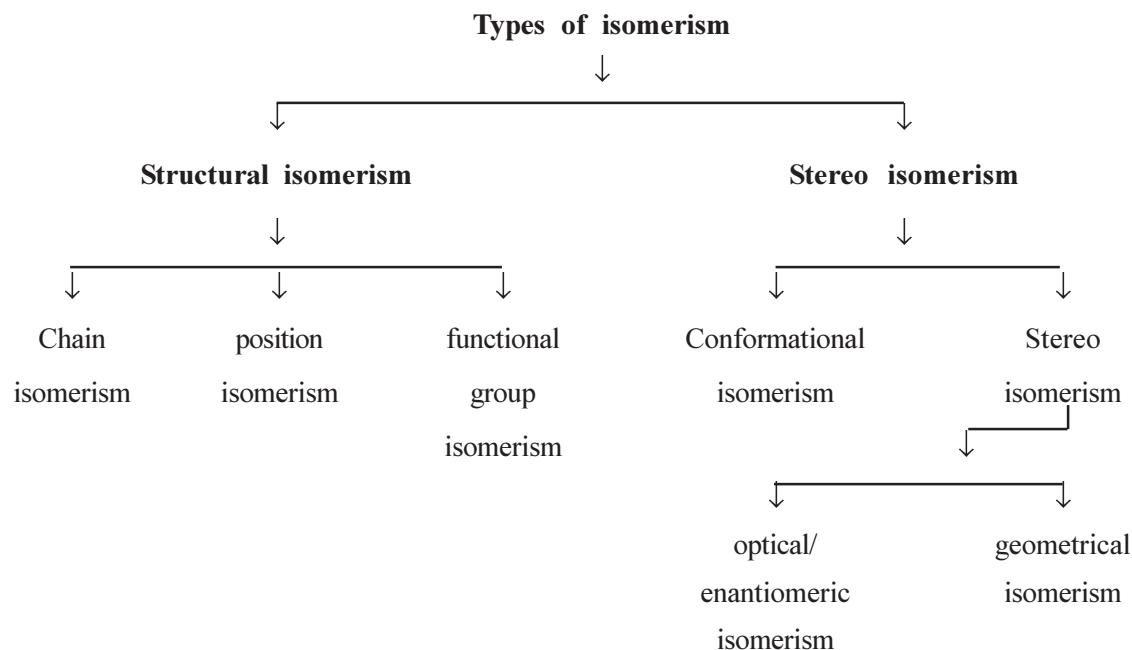
● Density of poly chloro alkane, bromo alkane and iodo alkane is more than that of water. As number of carbon atom increase or atomic no or atomic mass of halogen increases density increases.



● Halo alkane is partially soluble in alkane while it is soluble in organic solvents like acetone and ethanol.

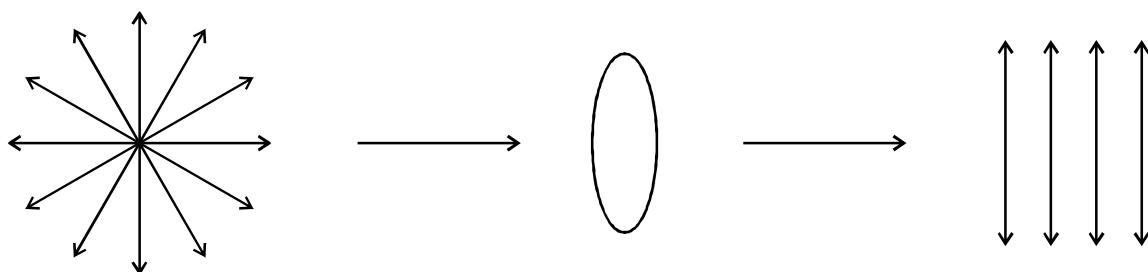
● Absolute D, L Configuration and R, S configuration nomenclature

Stereo chemistry : Branch of chemical science in which study of three dimensional structure of organic compound is done is called stereo chemistry. Its basic property is isomerism.



● Optical isomerism

Plane polarised light : In white light seven colour lights of different wave lengths are vibrating in all possible planes. When such light is passed through nicol prism or polarizer the transmitted light have vibrations only in one plane. Such light is called plane polarised light.



Vibrations of lights in palnes source
white light rays

nicol prism/
polariser

Plane polarised
light

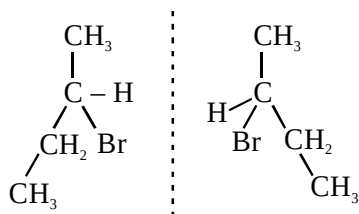
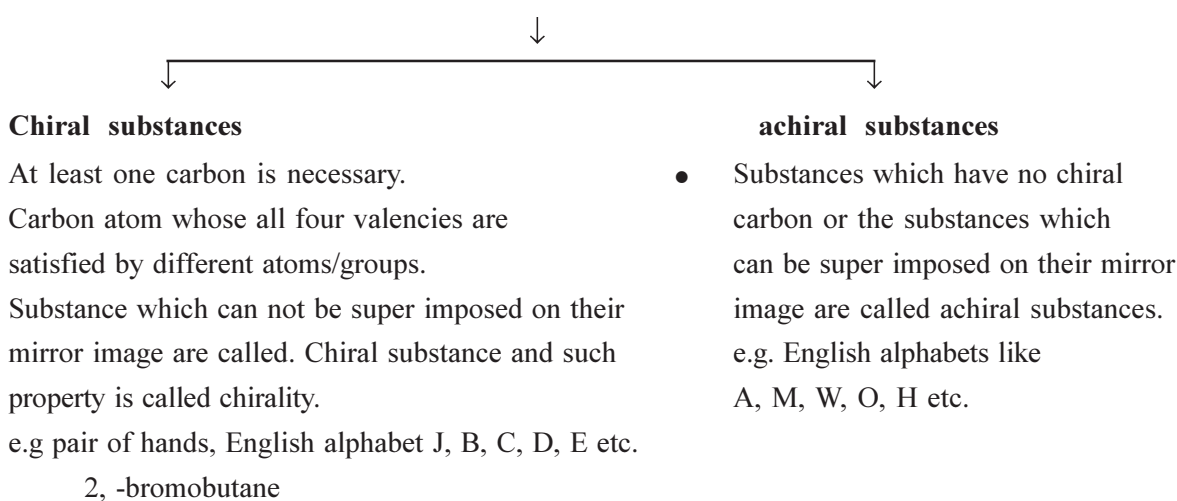
● Optical activity

- Substance having molecular asymmetry has capacity to rotate plane of plane polarised light, such substances are called optically active compounds.
- If it rotate plane of plane polarised light towards left side it is called leavo rotatory substance which is denoted by *l* or (–) sign.
- If it rotate plane of plane polarised light towards right side it is called dextro rotatory substance which is denoted by *d* or (+) sign.

● Chirality :

Due to molecular asymmetry in optically active compounds at least one asymmetric carbon is present whose all four valencies are satisfied by different atoms or groups.

Classification on the basis of Molecular asymmetry



D and L configuration : It is also known as relative configuration.

Useful to explain configuration of carbohydrate and amino acids.

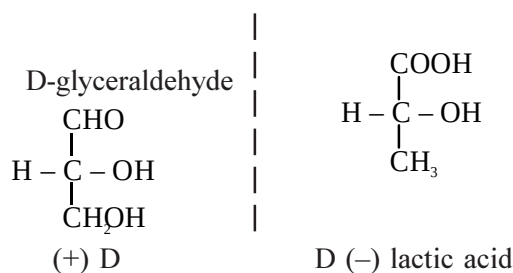
Difference between

D, L

- Determined theoretically.
- Enantiomeric isomers
- Compound with D configuration can be d or l type.
- Compound with L Configuration can be d or l type.

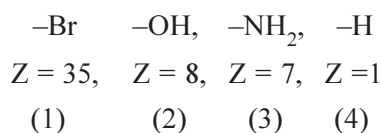
d (+)/ l (-)

- Determined by polarimeter.



● Absolute R and S configuration

- R, S nomenclature method for chiral substances or enantiomeric isomers is given by Cahn, Ingold and Prelog.
- Step-I To determine priority order of groups bonded with chiral carbon.
- The atom which has greater atomic number/mass is more given the first priority.
- If, - H, - NH₂, - OH, - Br are bonded with chiral carbon then priority order is



If two isotopes are bonded with asymmetric carbon then the isotope having greater atomic mass should get the priority.

eg., Priority order for H, Cl, C, D (Deuterium)

Cl	C	D (${}_1\text{H}^2$)	H (${}_1\text{H}^1$)
Z = 17,	Z = 6,	Z = 1,	Z = 1
(1)	(2)	(3)	(4)

If the groups bonded with chiral carbon are connected through same atom i.e. having same atomic number. Hence second number atom's atomic mass is compared and even if second atom has same atomic number then third number atom's atomic number are compared and the atom which has greater atomic no get the priority.

eg., $-\text{CH}_2\text{OH}$, $-\text{CH}_2-\text{CH}_3$, $-\text{CH}_3$, $-\text{CH}_2-\text{NH}_2$...
 $Z = 6 \quad 8 \quad 6 \quad 6 \quad 6 \quad 6 \quad 7$

Correct Priority order :

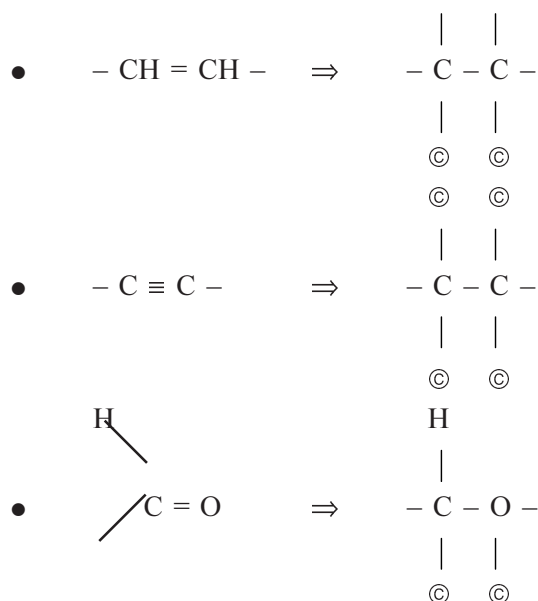
$-\text{CH}_2\text{OH}$; $-\text{CH}_2\text{NH}_2$; $-\text{CH}_2\text{CH}_3$; $-\text{CH}_3$
 (1) (2) (3) (4)

eg.,

$-\text{CH}_2\text{OH}$, $-\text{NH}_2$, $-\text{CH}_2\text{Cl}$, $-\text{I} \Rightarrow -\text{I}$, $-\text{NH}_2$, CH_2Cl , CH_2OH
 $Z = 6 \quad 8 \quad 7 \quad 6 \quad 17 \quad 53 \quad (1) \quad (2) \quad (3) \quad (4)$

In the groups having double or triple bond, their all π - bonds are broken and it is believed that imaginary atoms are bonded their.

Example,



On the basis of above rules priority order for some of the groups are as follows :

$-\text{I} > -\text{Br} > -\text{Cl} > -\text{SO}_3\text{H} > -\text{SH} > -\text{F} > -\text{OCOR} > -\text{O}-\text{R} >$

$-\text{OH} > -\text{NO}_2 > -\text{N} \begin{array}{l} \nearrow \text{R}_1 \\ \searrow \text{R}_2 \end{array} > \text{N} \begin{array}{l} \nearrow \text{H} \\ \searrow \text{R} \end{array} > -\text{COOR} > -\text{COOH}$

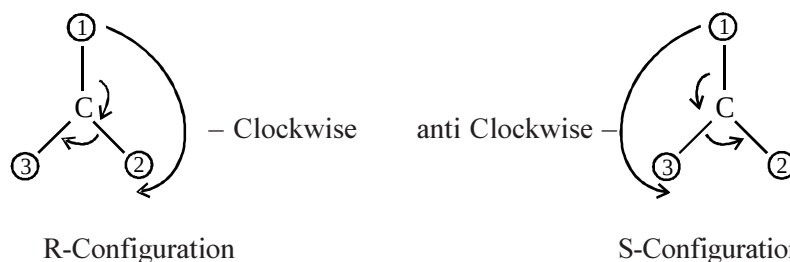
$> -\text{COR} > -\text{CHO} > -\text{CH}_2\text{OH} > \text{CN} > -\text{CH}_3 > \text{D} > -\text{H}$

• To determine R-S configuration

After determining the priority order of groups in three dimensional structure atoms present with 4 priority i.e. Cost priority is kept at vertical line i.e. away from viewer. Then on observing from opposite side of group with priority 4, if other three priority positions 1, 2 and 3 are determined absolute stereo configuration R and S as follows.

If increasing order of $1 \rightarrow 2 \rightarrow 3$ is clock wise it is called R configuration.

But if it is in anticlock wise/left side then such configuration is called S-configuration.

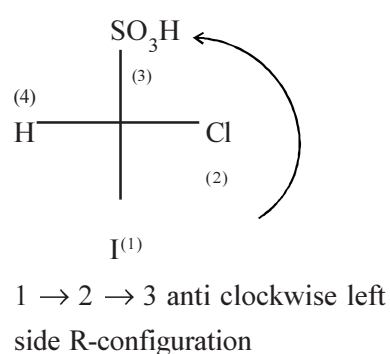
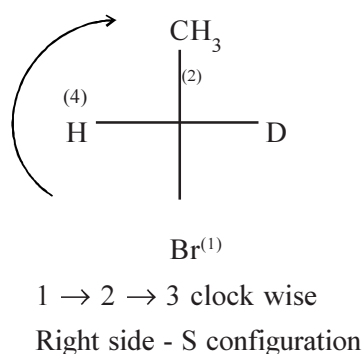
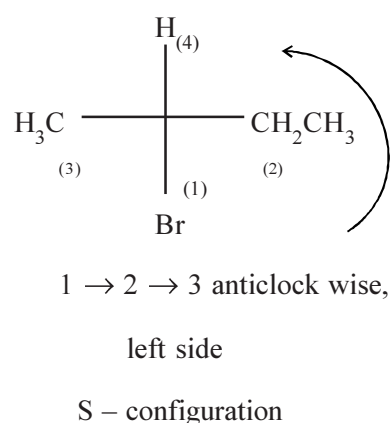
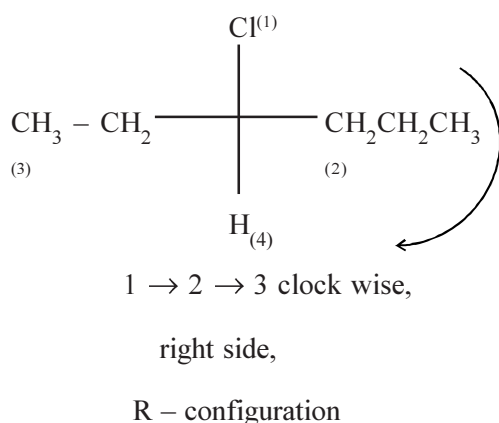


It is difficult to represent chiral compounds in three dimension hence normally chiral compounds are written in two dimensional Fischer projection. Therefore, in 1982 Epling suggested the rule vertical is very good for least priority order.

If compounds in Fischer projection then lowest priority group kept at vertical line and for $1 \rightarrow 2 \rightarrow 3$ clock wise groups configuration is R while for $1 \rightarrow 2 \rightarrow 3$ anticlockwise groups configuration is S.

If lowest priority group is on horizontal line of Fischer projection then in such compound configuration is inverse than the obtained configuration.

For $1 \rightarrow 2 \rightarrow 3$ clockwise direction **configuration is S** and for $1 \rightarrow 2 \rightarrow 3$ anticlockwise direction **configuration is R**.

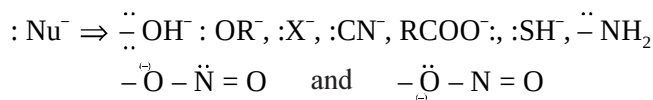
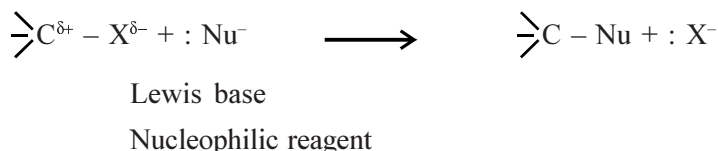


● Chemical properties of Halo alkane (Reactions)

● Nucleophilic substitution reaction :

In halo alkane compound ($\text{>C}^{\delta+} - \text{X}^{\delta-}$) bond is polar : Hence : Nu^- which is a Lewis base and has tendency to donate electron pair. (all anion and some neutral molecule)

Attract the partially positively charged carbon atom and combine with it by displacing halogen atom. Therefore such reactions are called nucleophilic substitution reaction or SN reaction.



Cyanide ($-\text{CN}^-$) and nitrite ($-\text{O}-\ddot{\text{N}}=\text{O}$) have two nucleophilic sites.

● Reactions by Cyanide group

- If carbon of $-\text{C} \equiv \text{N}$ act as nucleophile then, product alkyl cyanide is obtained
 $-\text{C}^{\delta+} \equiv \text{N}^{\delta-}$
- If nitrogen of $-\text{C} \equiv \text{N}$ act as nucleophile then product iso cyanide is obtained.
 $(-\text{N}^{\delta+} \equiv \text{C}^{\delta-})$

- In nitrite ($^{\delta-}\text{O}-\text{N}^{\delta+}=\text{O}$) if carbon atom of alkyl group combine with nucleophilic oxygen then product alkyl nitrite is obtained
 $\text{R}-\text{O}-\text{N}=\text{O}$
- In nitrite ($-\text{O}^{\delta+}-\text{N}^{\delta-}=\text{O}$) if carbon atom of alkyl group is combined with N then it gives nitro alkane product.

Mechanism of Nucleophilic substitution can be explained by two methods.

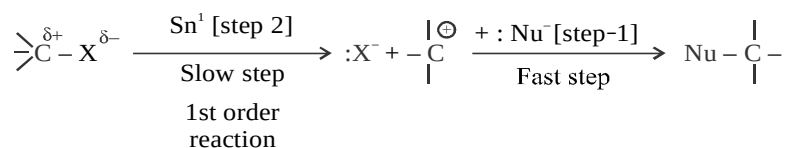
● SN¹ Reactions

Uni molecular nucleophilic substitution reaction.

First step is slow hence it is rate determining step.

In the first step, carbocation (carbonium ion) is formed by heterolytic fission of ($\text{>C} \text{---} \text{X}$). To break ($\text{>C}-\text{X}$) bond necessary energy is obtained by polar solvents such as water, alcohol and acetic acid etc.

In second step nucleophilic reagent combine with carbocation and it is a fast step.



Rate of reaction do not depend on concentration of nucleophilic reagent. But rate of reaction depends on concentration of substrate i.e. original reactant, ease of formation of carbocation and stability of carbocation.

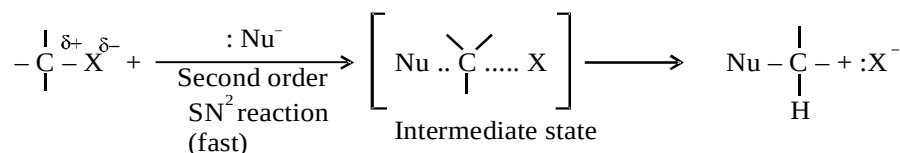
Stability of carbocation depends on +I effect of electron donating group and on resonance.

Thus Rate of reaction = $K \cdot [\text{S}]^1$

Order of Rate of reaction for SN¹ reaction : $\text{CH}_3\text{X} < 1^\circ < 2^\circ < 3^\circ$ gradually increases.

● SN² Reactions

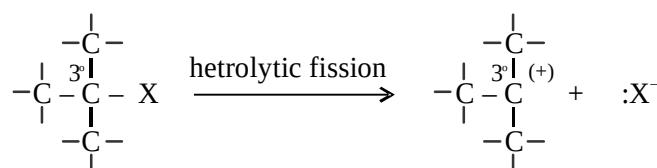
- Bimolecular nucleophilic substitution reaction.
- Follows principle of chemical kinetics.
- Fast second order reaction.
- Order of reaction depends on concentration of both reactants.
- Without intermediate product, final product is obtained.
- Heterolytic fission of substrate does not take place, but the sp³ hybridization at carbon atom taking part in reaction changes to sp² at transition state, due to bond breaking and formation. At transition state substrate and nucleophilic reagent combine with each other.
- Nucleophilic reagent and leaving group both are negatively charged hence nucleophilic reagent always combine from opposite side of leaving group.
- Rate of reaction = K [S]¹ [:Nu]¹ hence second order reaction.
- The reaction in which in a rate determining step nucleophilic reagent reacts with carbon atom with less electron density and at transition state rate of reaction depends on concentration of both substrate as well as nucleophile then such substitution reactions are called second order nucleophilic substitution reaction SN².



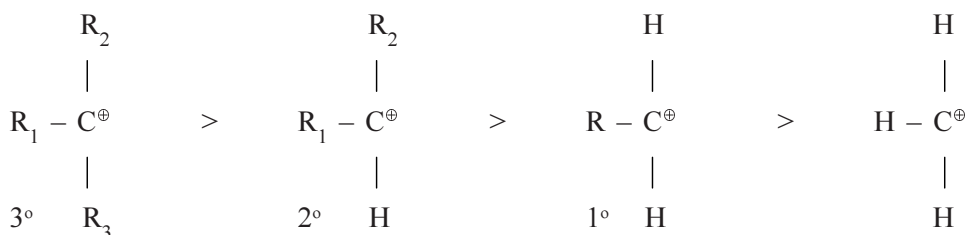
- Order of rate of reaction for SN² : CH₃X > 1° > 2° > 3°

Racemic mixture : Equal proportion mixture of dextro rotatory and leavo rotatory isomer is called **racemic mixture**.

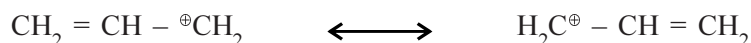
● Stability of Carbocation



- If electron donor group (o/p) are bonded with carbocation, then its stability increases.
- If electron attracting group (m) are bonded with carbocation then its stability decreases.
- As no of alkyl group with carbocation increases, its stability increases.

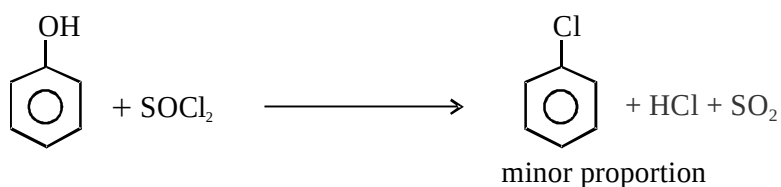
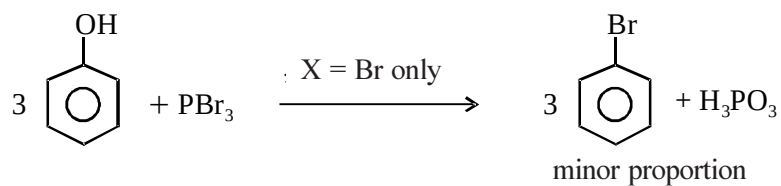


- Stability of carbocation increases with resonance.

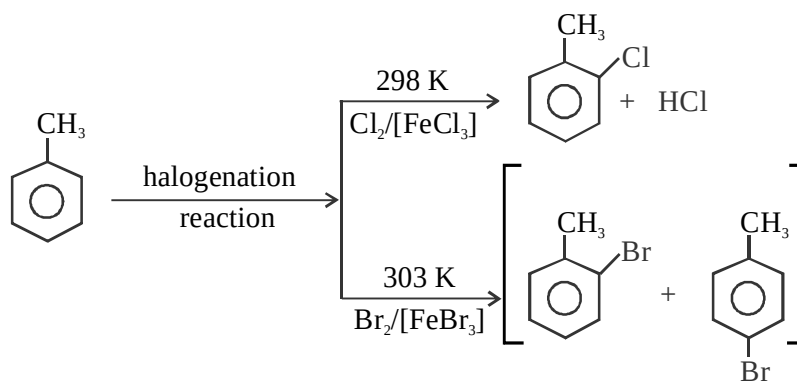
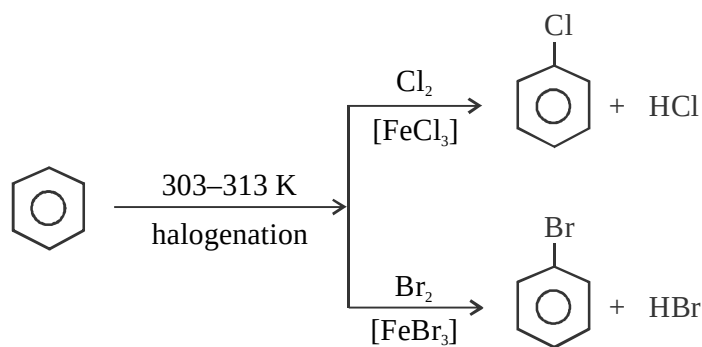


- Preparation of haloarene compounds

- From phenol :



- By Electrophilic substitution reaction of hydrocarbon

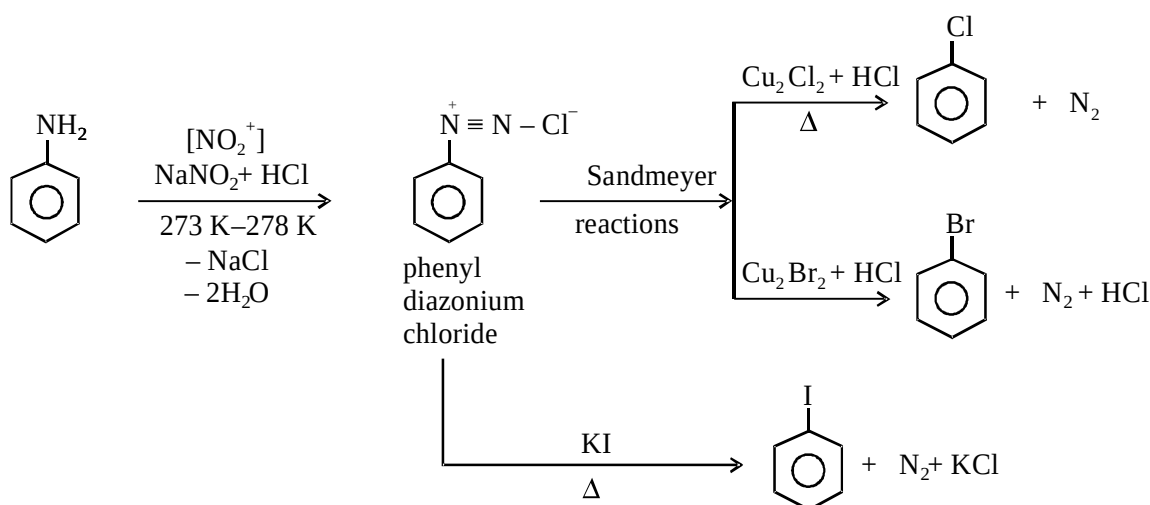


Note : Though electronegativity of F_2 is high, proper products are not obtained at boiling point.

Difference in boiling point between ortho/para is very small.

- **By Sandmeyer reaction**

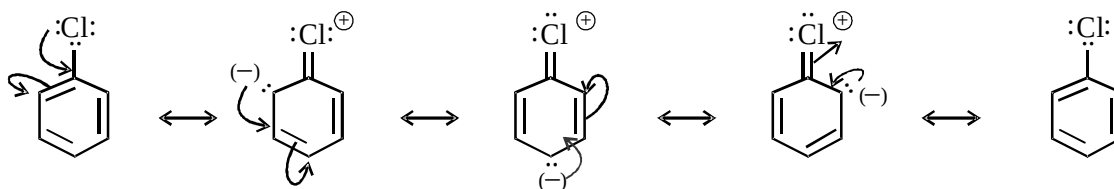
From aniline/phenyl diazonium chloride haloarene compounds.



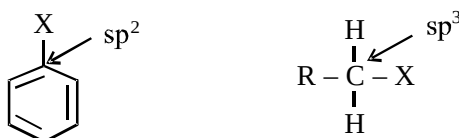
- **Chemical reactions of haloarene compounds**

Nucleophilic substitution reactions : Due to non bonding electron pairs on halogen ($:\ddot{X}:$) in haloarene compounds, resonance and formation of halo cation, $\text{C} - \text{X}$ bond is shorter and stronger. Therefore severe reaction conditions are required so nucleophilic substitution reaction of haloarene compounds are difficult.

Resonating structures



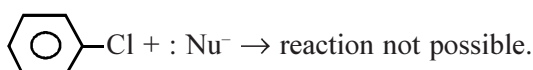
C – X Due to difference in hybridization of carbon atom in hybridization



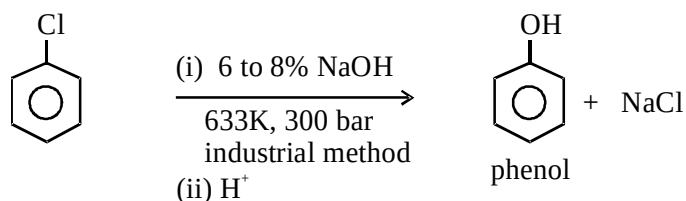
In halo arene sp^2 hybridized carbon is more electronegative hence it attracts electron pair of C–X bond towards itself so C–X bond becomes shorter, stronger and more polar as a result it requires more energy to break. Therefore nucleophilic substitution reactions of halo arene compounds are lesser as compared to alkyl halide.

- **Unstable phenyl cation**

In halo arene compounds as carbon atoms of phenyl nucleus forms cation hence its self ionization is not possible. In phenyl cation resonating structures decreases stability of selfionization so SN^1 reaction is not possible in them.



- Substitution by $\ddot{\text{O}}\text{H}^-$ (Dow's process for preparation of phenol.)



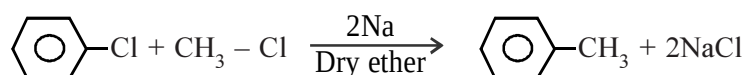
- Substitution of Cl atom by $\ddot{\text{O}}\text{H}^-$ in presence of electron attracting ($-\text{NO}_2$) group.
- As number of electron attracting groups are more in halo arene compounds proportion of product is more.
- **Substitution by CN^- group** : Chloro benzene on heating at 473 K and high pressure with NaCN in presence of catalyst $\text{Cu}_2(\text{CN})_2$ gives phenyl cyanide by Sandmeyer reaction.

• Electrophilic substitution reactions

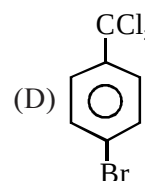
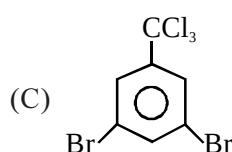
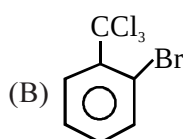
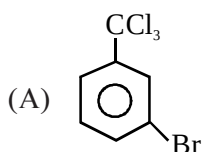
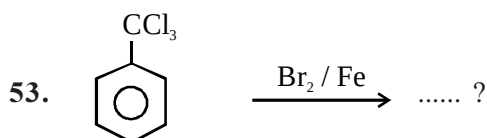
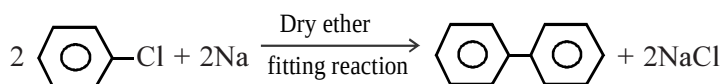
- In haloarene compounds halogen decreases reactivity of benzene. Thus they are different than other ortho para directing groups.
- In chlorobenzene Cl is more electro negative hence it has ($-\text{I}$) effect but due to nonbonding electron pair, possibility of resonating forms increases. Therefore at ortho (o) and para (p) position electron density increases than at meta (m) position. In haloarene compounds, due to negative inductive effect ($-\text{I}$) is more powerful than its resonating effect so reactivity of benzene decreases for electrophilic substitution reactions of benzene are slow.

• Reaction with metals

(i) **WurtzFittig reaction** : By reaction between chloro benzene and Methyl chloride or ethyl chloride with sodium metal in presence of dry ether gives alkyl benzene.

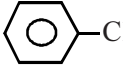
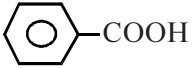
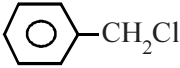
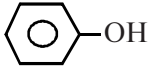


(ii) **Fittig reaction** : By reaction between two moles of alkyl or aryl halide with sodium metal in presence of dry ether gives hydrocarbon with double no of carbon.



54. Mention the reaction conditions to convert ethyl bromide into ethyl alcohol.
 (A) Zn and dil HCl on heating (B) On heating with alcoholic KOH
 (C) On heating with aqueous NaOH (D) none
55. Mention common name of phosgene.
 (A) Phosphonyl chloride (B) Carbon tetra chloride
 (C) CO_2 and PH_3 (D) Carbonyl chloride
56. Which two alkyl chloride on heating with Na metal in presence of dry ether gives isobutane ?
 (A) CH_3Cl and $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ (B) $\text{CH}_3 - \underset{\text{Cl}}{\underset{|}{\text{CH}}} - \text{CH}_3$ and CH_3Cl
 (C) $\text{CH}_3\text{CH}_2\text{Cl}$ and CH_3Cl (D) $\text{CH}_3\text{CHClCH}_3$ and $\text{CH}_3\text{CH}_2\text{Cl}$
57. Which substance gives SN^2 reaction ?
 (A) CH_3Cl (B) $(\text{C}_2\text{H}_5)_2\text{CHCl}$ (C) $(\text{CH}_3)_3\text{C}\cdot\text{Cl}$ (D) $(\text{CH}_3)_2\text{CH}\cdot\text{Cl}$
58. What is correct for reactivity of ethyl chloride ?
 (A) more or equal to benzyl chloride
 (B) more than benzyl chloride
 (C) more or equal than chlorobenzene
 (D) less than chloro benzene
59. What is correct for chloro benzen ?
 (A) more than $\text{C}_2\text{H}_5\text{Cl}$ (B) equal to CH_3Cl
 (C) less reactive than benzyl chloride (D) more than isopropyl chloride
60. Which substance immediately gives precipitate with AgNO_3 ?
 (A) CHCl_3 (B) $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$ (C) CHI_3 (D) CCl_3CHO
61. Which substance in one step gives ethylene and acetylene ?
 (A) $\text{CH}_3\text{CH}_2\text{OH}$ (B) $\text{CH}_2\text{BrCH}_2\text{Br}$ (C) CH_3COOH (D) $\text{CH}_2\text{Br}-\text{CH}_2\text{OH}$
62. What is obtained by reaction between tertiary butyl bromide and CH_3ONa ?
 (A) iso butane (B) iso butene
 (C) sodium t-butoxide (D) t-butyl methyl ether
63. Mention the product obtained by reaction of mixture aniline chloroform and alcoholic KOH.
 (A) Phenyl cyanide (B) phenyl isocyanate
 (C) Phenyl isocyanide (D) nitro benzene
64. What is obtained on reaction between ethylidene dichloride with aqueous KOH ?
 (A) ethylene glycol (B) acetaldehyde (C) formaldehyde (D) none
65. What is obtained by hydrolysis of ethylene difluoride ?
 (A) dichloro ethanol (B) fluoro methane (C) glycol (D) Freon
66. What is obtained by oxidation of benzyl chloride by $\text{Pb}(\text{NO}_3)_2$?
 (A) benzene (B) benzoic acid
 (C) benzaldehyde (D) none

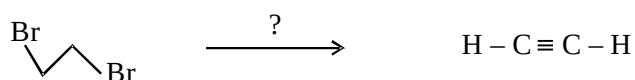
Answers : 53. (A), 54. (C), 55. (D), 56. (B), 57. (A), 58. (B), 59. (C), 60. (C), 61. (B), 62. (B), 63. (C), 64. (B), 65. (C), 66. (C)

67. CCl_4 do not give precipitate with AgNO_3 because ...
 (A) it forms compound with AgNO_3 . (B) release Cl_2 gas.
 (C) chloride ion do not forms. (D) AgNO_3 do not give Ag^+ ion.
68. $\text{CH}_3\text{CH}_2\cdot\text{Br} \xrightarrow[\text{alloy}]{\text{Pb - Na}} ?$
 (A) tetra ethyl lead (B) tetra methyl bromide
 (C) both A and B (D) none
69. What is obtained by reacting ethyl bromide with silver nitrite ?
 (A) nitro ethane (B) ethyl nitrite
 (C) nitro ethane and ethyl nitrite (D) ethane
70. By which reaction $\text{CH}_2 = \text{C} = \text{C} = \text{CH}_2$ is obtained ?
 (A) $\text{CH}_2\text{Br} - \text{CBr} = \text{CH}_2 \xrightarrow{\text{Zn}/\text{CH}_3\text{OH}}$ (B) $\text{CH} \equiv \text{C} - \text{CH}_2\text{COOH} \xrightarrow[40^\circ\text{C}]{\text{K}_2\text{CO}_3(\text{qq})}$
 (C) $\text{CH}_2\text{Br} - \text{C} \equiv \text{C} - \text{CH}_2\text{Br} \xrightarrow[\Delta]{\text{Zn}}$ (D) $2\text{CH}_2 = \text{CHCH}_2\text{I} \rightarrow$
71.  $\xrightarrow[\Delta]{\text{solid NaOH}} ?$
 (A)  (B)  (C)  (D) 
72. $\text{CH}_3\text{CH}_2\text{Cl} + \text{AgCN} \xrightarrow{\Delta} ?$
 (A) $\text{C}_2\text{H}_5\text{CN}$ (B) $\text{CH}_3\text{NH}\cdot\text{CH}_3$ (C) $\text{C}_2\text{H}_5\text{NH}_2$ (D) $\text{C}_2\text{H}_5\text{NC}$
73. Which organic halide on stirring with dilute HNO_3 and AgNO_3 aqueous solution with dilute NaOH gives white precipitate ?
 (A) $\text{C}_6\text{H}_4(\text{CH}_3)\cdot\text{Br}$ (B) $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$ (C) $\text{C}_6\text{H}_5\text{Cl}$ (D) none
74. What is the type of following reaction ?

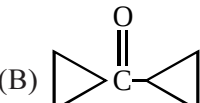
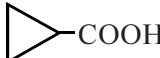
$$\text{C}_6\text{H}_5\text{Cl} + 2\text{NaOH} \xrightarrow[200\text{ bar}]{200 - 250^\circ\text{C}} \text{C}_6\text{H}_5\text{ONa} + \text{NaCl} + \text{H}_2\text{O}$$

 (A) Dow process (B) Kolbe reaction
 (C) Carbyl amine test (D) haloform test
75. $\text{C}_6\text{H}_5\text{Cl} + \text{KCN} \xrightarrow{\text{hydrolysis}} \text{X} \xrightarrow{\text{hydrolysis}} \text{Y}$ then X and Y are respectively ?
 (A) C_2H_6 and $\text{C}_2\text{H}_5\text{CN}$; (B) CH_3CN and C_2H_6
 (C) $\text{C}_2\text{H}_5\text{CN}$ and $\text{C}_2\text{H}_5\text{CH}_2\text{NH}_2$ (D) $\text{C}_2\text{H}_5\text{CN}$ and $\text{C}_2\text{H}_5\text{COOH}$
76. Which substance on heating with NaOH and I_2 gives iodoform ?
 (A) methanol (B) benzene (C) ethanol (D) formic acid
77. The compound with which type of bond gives monohalo alkane product by hydro halogenation ?
 (A) single bond (B) double bond
 (C) tripple bond (D) none

78. What is obtained by mixing chloroform with concentrated HNO_3 ?
 (A) CHCl_2NO_2 (B) $\text{CHCl}_2\text{HNO}_3$
 (C) CCl_3NO_2 (D) none
79. Mention the type of dehydro halogenation reactions of alkyl halide.
 (A) addition (B) Substitution reaction (C) elimination (D) oxidation
80. $\text{CH}_3\text{CH}_2\text{Br}$ on reaction with LiAlH_4 gives ethane gas while $(\text{CH}_3)_3\text{C-Br}$ on reaction with LiAlH_4 gives H_2 gas because
 (A) 1st SN^2 and then E_2 reaction. (B) 1st E_2 and then SN^2 reaction.
 (C) 1st SN^1 and then E_2 reaction. (D) 1st E_2 and then SN^1 reaction.
81. 2, bromo pentane on heating with KOH in presence of ethanol gives
 (A) cis pentene-2 (B) trans pentene-2 (C) pentene-1 (D) 2-ethoxy pentene
82. Identify the reaction taking place when chloroform is mixed with excess oxygen.
 (A) $\text{COCl}_2 + \text{HCl}$ (B) $\text{COCl}_2 + \text{Cl}_2 + \text{H}_2$
 (C) $\text{COCl}_2 + \text{Cl}_2 + \text{H}_2\text{O}$ (D) none
83. Which isomer of cyclohexane hexachloride is strong insecticide ?
 (A) α (B) β (C) δ (D) γ
84. What is obtained when alkyl halide is heated with alcoholic NH_3 in a closed tube ?
 (A) 2^o-amine (B) 1^o amine (C) 3^o amine (D) all
85. What is obtained when alkyl halide is heated with Mg metal in presence of dry ether ?
 (A) Magnesium halide (B) Grignard reagent (C) alkene (D) alkyne
86. $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{NaNH}_2 \rightarrow ?$
 (A) $\text{CH}_3\text{CH} = \text{CH}_2$ (B) $\text{CH}_3 - \text{C} \equiv \text{CH}$
 (C) $\text{CH}_3\text{CH}_2\text{CH}(\text{NH}_2)$ (D) $\text{CH}_3\text{CH}_2\text{C}(\text{Cl}_2)\text{NH}_2$
87. What is obtained by debromination of meso dibromobutane ?
 (A) trans-2-butene (B) cis-2-butene (C) 1-butene (D) 2-butene
88. How many products are obtained by monochlorination of 2, 6 dimethyl heptane ?
 (A) 6 (B) 5 (C) 4 (D) 3
89. Why reactivity of Cl is less than $\text{CH}_2 = \text{CH}\cdot\text{Cl}$?
 (A) resonance (B) electromeric effect
 (C) electronegativity (D) none.
90. $\text{CH}_3\text{CH}_2\text{Br} \xrightarrow{\text{KCN}} \text{CH}_3\text{CH}_2\text{CN} \xrightarrow{\text{H}_2\text{O}} \text{X}; \text{X} = ?$
 (A) acetic acid (B) butyric acid (C) propanoic acid (D) Formic acid
91. Identify reaction condition for given reaction ?



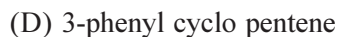
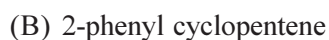
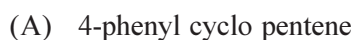
- (A) alcoholic KOH (B) alcoholic $\text{KOH} + \text{NaNH}_2$
 (C) aqueous $\text{KOH} + \text{NaNH}_2$ (D) $\text{Zn}/\text{CH}_3\text{OH}$

92. In the reaction -Br $\xrightarrow[\text{(iii) H}_3\text{O}^+]{\text{(i) Mg, Et}_2\text{O; (ii) CO}_2}$ $\xrightarrow{?}$ product.
- (A)  (B)  (C)  (D) 
93. $\text{C}_2\text{H}_5\text{Cl} + \text{AgCN} \xrightarrow{\text{Et-OH/H}_2\text{O}}$ X which is correct for X ?
- (A) On hydrolysis it gives propionic acid. (B) It has ester group.
(C) "N" is bonded with ethyl carbon. (D) It has cyanide group.
94. What is obtained by reaction between vinyl chloride and HCl ?
- (A) 1, 2 dichloro ethane (B) 1,1-dichloro ethane
(C) tetra chloro ethylene (D) mixture of 1, 2 and 1, 1 dichloro ethane
95. Which product is obtained on reduction of acetyl chloride by H_2 in presence of Pd ?
- (A) CH_3COCH_3 (B) CH_3CHO (C) CH_3COOH (D) $\text{C}_2\text{H}_5\text{OH}$
96. What is obtained on heating methyl bromide with zinc dust ?
- (A) CH_4 (B) CH_3OH (C) C_2H_6 (D) C_2H_4
97. Iodoform + KOH $\xrightarrow{\Delta}$?
- (A) HCOOK (B) HCHO (C) CH_3CHO (D) CH_3COOK
98. Which of the following gas is poisonous ?
- (A) CO_2 (B) CHCl_3
(C) CO (D) None
99. Which substance is used as methylating agent ?
- (A) $\text{C}_2\text{H}_5\text{Br}$ (B) $\text{C}_2\text{H}_5\text{Cl}$ (C) $\text{C}_6\text{H}_5\text{Cl}$ (D) CH_3I
100. $\text{C}_2\text{H}_5\text{I} + \text{AgNO}_3 \xrightarrow{\Delta}$?
- (A) $\text{C}_2\text{H}_5\text{O}\cdot\text{NO}_2$ (B) $\text{C}_2\text{H}_5\text{Ag}$ (C) $\text{Ag}\cdot\text{O}\cdot\text{NO}_2$ (D) $\text{C}_2\text{H}_5\text{I}\cdot\text{NO}_2$
101. $\text{C}_6\text{H}_6\text{Cl}_6 + \text{alcoholic KOH} \xrightarrow{\Delta}$?
- (A) C_6H_6 (B) $\text{C}_6\text{H}_6\cdot\text{OH}$ (C) $\text{C}_6\text{H}_3\text{Cl}_3$ (D) $\text{C}_6\text{H}_6\text{Cl}_4$
102. $\text{CHCl}_3 + \text{Zn} \xrightarrow{\Delta}$?
- (A) CH_2Cl_2 (B) CCl_4 (C) CH_4 (D) chloropicrin
103. Which catalyst is used to prepare Grignard reagent ?
- (A) iodine powder (B) iron powder (C) active charcoal (D) MnO_2
104. By which reaction butane nitrile can be obtained ?
- (A) $\text{C}_3\text{H}_7\text{Br} + \text{KCN} \rightarrow$ (B) $\text{C}_4\text{H}_9\text{Br} + \text{KCN} \rightarrow$
(C) $\text{C}_3\text{H}_7\text{OH} + \text{KCN} \rightarrow$ (D) $\text{C}_4\text{H}_9\text{OH} + \text{KCN} \rightarrow$

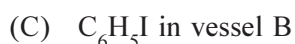
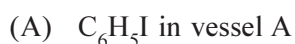
105. Which substance has highest boiling point ?



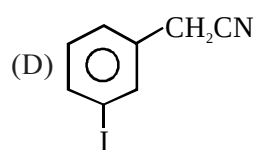
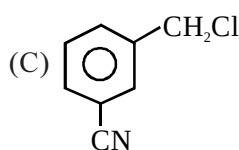
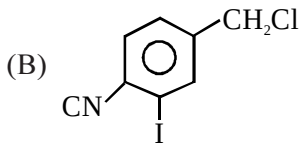
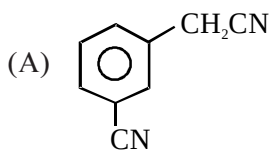
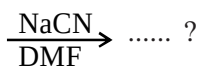
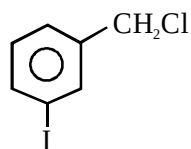
106. The product of trans-2-phenyl, 1-bromo cyclopentane with alcoholic KOH is



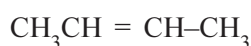
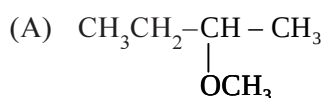
107. Two bottles are filled with $\text{C}_6\text{H}_5\text{I}$ and $\text{C}_6\text{H}_5\text{CH}_2\text{I}$. If labels of both the bottles are lost then solution of vessel A and B taken in different test tube and heated with NaOH and solution obtained are acidified with dilute HNO_3 . Afterwards on adding AgNO_3 solutions, only vessel-B gives yellow precipitate. Then which sentence is correct for this experiment ?



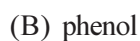
108. Identify structural formula of major product in the following reaction.



109. $\text{CH}_3\text{CH}_2\text{CH}(\text{F})\text{CH}_3 \xrightarrow{\text{CH}_3\text{O}^- / \text{CH}_3\text{OH}}$



110. + $\text{CH}_3-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3$ (t-butanol) $\rightarrow$



111. Alkylhalide + di alkyl copper lithium



112. Which substance is liquid at normal temperature ?



113. Identify most reactive halo alkane.

- (A) 1, chloro propane (B) 1, bromo propane (C) 2, chloro propane (D) 2, bromo propane

114. In which compound grignard reagent can be added ?

- (A) >C=O (B) $\text{--C}\equiv\text{N}$ (C) >C=S (D) all.

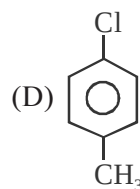
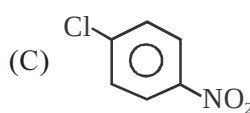
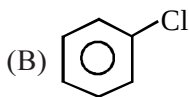
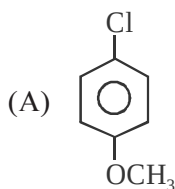
115. Identify increasing order for $\text{S}_\text{N}1$ reaction of alkyl halide.

- (A) $\text{CH}_3\text{CH}_2\text{--X} < (\text{CH}_3)_3\text{C--X} < \text{CH}_2=\text{CH--CH}_2\text{--X} < \text{PhCH}_2\text{--X}$
 (B) $(\text{CH}_3)_2\text{CH}\cdot\text{X} < \text{CH}_3\text{CH}_2\text{--X}, < \text{PhCH}_2\text{--X} < \text{CH}_2=\text{CH--CH}_2\text{--X}$
 (C) $\text{PhCH}_2\cdot\text{X} < (\text{CH}_3)_2\text{C--X}; < \text{CH}_3\text{CH}_2\text{--X} < \text{CH}_2=\text{CH--CH}_2\text{--X}$
 (D) $\text{CH}_2=\text{CH--CH}_2\cdot\text{X} < \text{PhCH}_2\text{X} < (\text{CH}_3)_2\text{CH--X} < \text{CH}_3\text{CH}_2\text{--X}$

116. In which substance hydrolysis does not take place by $\text{S}_\text{N}1$ reaction ?

- (A) $\text{CH}_2=\text{CHCH}_2\text{Cl}$ (B) $\text{C}_6\text{H}_5\text{Cl}$ (C) $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$ (D) $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\cdot\text{Cl}$

117. Which substance gives nucleophilic substitution easily ?



118. $\text{CHCl}_3 \xrightarrow{\text{aqueous KOH}}$?

- (A) ethanol (B) methanol (C) acetic acid (D) formic acid

119. 1, 3-di bromopropane $\xrightarrow{\text{Zn} + \text{NaI}}$?

- (A) propane (B) cyclopropane (C) hexane (D) propene

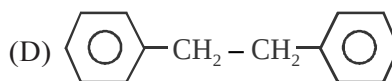
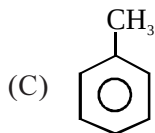
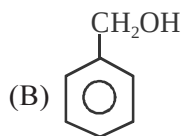
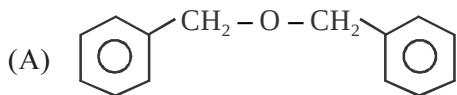
120. Correct order for rate of reaction of hydrolysis reaction of 1° , 2° , 3° and CH_3X for $\text{S}_\text{N}2$ mechanism ?

- (A) $1^\circ > 2^\circ > 3^\circ > \text{CH}_3\cdot\text{X}$ (B) $\text{CH}_3\text{X} > 3^\circ > 2^\circ > 1^\circ$
 (C) $\text{CH}_3\text{X} > 1^\circ > 2^\circ > 3^\circ$ (D) $3^\circ > 2^\circ > 1^\circ > \text{CH}_3\text{X}$

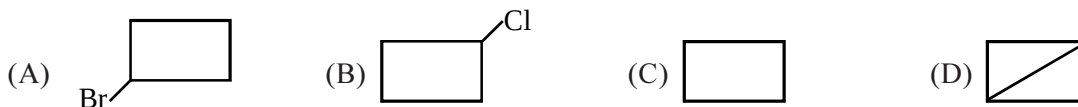
121. Which substance is most reactive in $\text{S}_\text{N}1$ mechanism ?

- (A) $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ (B) $\text{C}_6\text{H}_5\cdot\text{CH}\cdot(\text{C}_6\text{H}_5)\text{Br}$
 (C) $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$ (D) $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\cdot\text{C}_6\text{H}_5\text{Br}$

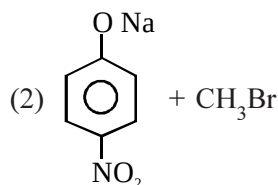
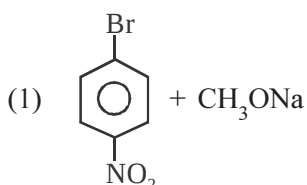
122. $\text{C}_6\text{H}_5\text{CH}_2\text{Br} \xrightarrow[\text{H}_3\text{O}^+]{\text{Mg ether}}$?



123. $\text{CH}_3\cdot\text{Br} \xrightarrow{\text{KCN}} \text{A} \xrightarrow{\text{H}_3\text{O}^+} \text{B} \xrightarrow{\text{LiAlH}_4} \text{C}$ then what is C ?
 (A) acetone (B) ethyl alcohol (C) acetaldehyde (D) methane
124. Which substance damages the layer of ozone gas ?
 (A) alkane (B) Freon (C) Grignard reagent (D) all.
125. How many chlorine atoms are present in D.D.T. ?
 (A) 3 (B) 4 (C) 2 (D) 5
126. Which substance has highest dipole moment ?
 (A) CH_3Cl (B) CH_2Cl_2 (C) CHCl_3 (D) CCl_4
127. 1, bromo, 3-chloro cyclobutane $\xrightarrow[\text{Dry ether}]{2 \text{ Na}}$

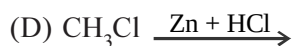
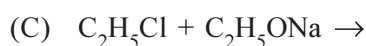
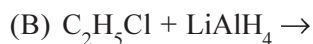


128. Which substance does not give nucleophilic substitution reaction.
 (A) vinyl chloride (B) ethyl bromide
 (C) benzyl chloride (D) isopropyl chloride
129. In which substance proportion of chlorine is highest ?
 (A) chloral (B) PVC (C) pyrene (D) gamaxene
130. In which substance mainly SN^2 reaction is observed ?
 (A) CH_3Cl (B) $\text{CH}_3\text{CH}_2\text{Cl}$ (C) $(\text{CH}_3)_2\text{CH}\cdot\text{Cl}$ (D) $(\text{CH}_3)_3\text{C}\cdot\text{Cl}$
131. Which reagents are appropriate to obtain, methoxy, 4-nitro benzene ?

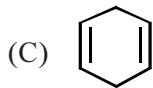
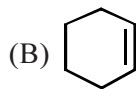
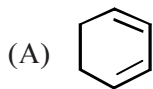


- (A) 1 (B) 2
 (C) 1 and 2 both (D) These reagents are not useful
132. Which reaction shows SN^2 reaction ?
 (A) $\text{CH}_3\cdot\text{Br} + \text{OH}^- \rightarrow \text{CH}_3\text{OH} + \text{Br}^-$
 (B) $\text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_3 + \text{OH}^- \rightarrow \text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_3$
 (C) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{-H}_2\text{O}]{\text{H}_3\text{O}^+, \Delta} \text{CH}_2 = \text{CH}_2$
 (D) $\text{CH}_3 - \underset{\text{Br}}{\underset{\text{CH}_3}{\text{C}}} - \text{CH}_3 + \text{OH}^- \rightarrow \text{CH}_3 - \underset{\text{H}}{\underset{\text{CH}_3}{\text{C}}} - \text{OCH}_3 + \text{Br}^-$

133. By Wurtz reaction of CH_3I product X is obtained. Then which of the following reaction gives product X ?

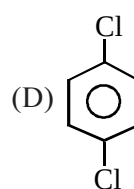
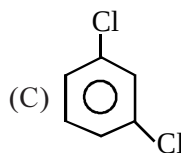
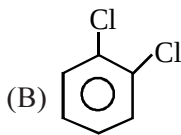
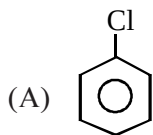


134. What is obtained by dehydro halogenation of 1, 2, dibromo benzene ?

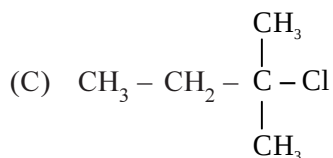
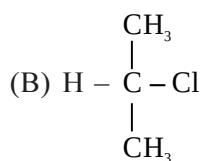


(D) None

135. Which substance has highest melting point ?



136. In which of the following substance chlorine is most electro negative ?

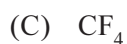


● Questions with one or more than one correct answer :

137. Reactivity for nucleophilic substitution reaction at aryl halide is less than alkyl halide because,

- (A) less stable carboniumion.
- (B) resonance stability.
- (C) Shorter C-X bond length.
- (D) inductive effect sp^2 hybridized cerson is attached with hologen.

138. Which substance is used as refrigerant ?



139. Identify the product of reaction between ethyl bromide and alcoholic silver nitrite.

(A) ethane

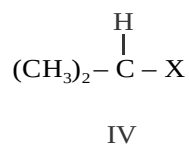
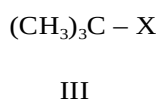
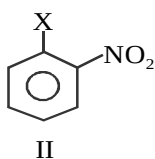
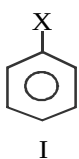
(B) ethene

(C) nitro ethane

(D) ethyl alcohol

(e) ethylnitrite

140. In which reaction possibility of formation of new C-C bond ?
 (A) Cannizaro (B) Fridel Craft (C) Clemmenson (D) Rimer-Tiemann
141. In which reaction PCl_5 used as reagent ?
 (A) $\text{CH}_2 = \text{CH}_2 \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$; (B) $\text{CH}_3\text{-O-CH}_3 \rightarrow \text{CH}_3\text{Cl}$
 (C) $\text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{CH}_2\text{Cl}$; (D) $\text{CH} \equiv \text{CH} \rightarrow \text{CH}_2 = \text{CH.Cl}$
142. Characteristic of reaction between methyl bromide and aqueous KOH is
 (A) racemisation (B) SN^1 mechanism
 (C) Inversion of configuration (D) SN^2 mechanism
143. Which of the following reaction is correct ?
 (A) $\text{C}_2\text{H}_5\text{Br} \xrightarrow[\text{KOH}]{\text{alcohol}} \text{C}_2\text{H}_5\text{OH}$
 (B) $\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{Na}} \text{C}_2\text{H}_6$
 (C) $\text{C}_2\text{H}_5\text{Br} + \text{C}_2\text{H}_5\text{ONa} \rightarrow \text{CH}_3\text{CH}_2\text{O-CH}_2\text{CH}_3$
 (D) $\text{C}_2\text{H}_5\text{Br} + \text{AgCN} \rightarrow \text{CH}_3\text{CH}_2\text{NC}$
144. Identify the testing method for chloroform which is used as anesthetic is
 (A) fehling solution
 (B) AgNO_3 solution
 (C) ammoniacal Cu_2Cl_2
 (D) on heating with alcoholic KOH addition of AgNO_3 solution
145. Identify incorrect sentences.
 (A) chloroform is heavier than water (B) CCl_4 is not inflammable
 (C) vinyl chloride is more reactive than alkyl chloride.
 (D) $\text{Br}^- > \text{I}^-$ nucleophilic reagent
146. Identify increasing order in the given compounds for reactivity of nucleophilic part in C-X bond.



- (A) $\text{III} < \text{II} < \text{I} < \text{IV}$ (B) $\text{I} < \text{II} < \text{IV} < \text{III}$
 (C) $\text{II} < \text{III} < \text{I} < \text{IV}$ (D) $\text{IV} < \text{III} < \text{I} < \text{II}$

147.

Column-A	Column-B
(1) goiter	(p) anesthetic
(2) malaria	(q) for micro growth of blood
(3) typhoid fever	(r) chloroamin
(4) halo ethane	(s) chloramphenicol
(5) fluorinated compounds	(t) thyroxene
(A) (1)-(t), (2)-(q), (3)-(p), (4)-(r), (5)-(s)	(B) (1)-(t), (2)-(s), (3)-(p), (4)-(q), (5)-(r)
(C) (1)-(t), (2)-(q), (3)-(s), (4)-(r), (5)-(p)	(D) (1)-(t), (2)-(r), (3)-(s), (4)-(p), (5)-(q)

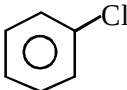
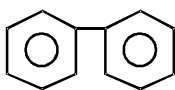
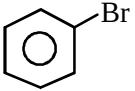
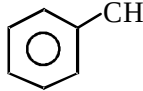
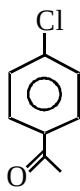
148.

Column-A	Column-B
(1) D.D.T.	(p) bleaching
(2) iodo form	(q) as coolant in refrigerator
(3) carbontetra chloride	(r) in air condition
(4) freon R - 22	(s) as anesthetic
(5) chloroform	(t) as insecticide
(A) (1)-(t), (2)-(s), (3)-(p), (4)-(r), (5)-(q)	(B) (1)-(q), (2)-(p), (3)-(t), (4)-(r), (5)-(s)
(C) (1)-(s), (2)-(t), (3)-(p), (4)-(r), (5)-(z)	(D) (1)-(q), (2)-(s), (3)-(t), (4)-(p), (5)-(r)

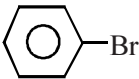
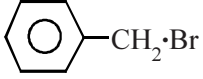
149.

Column-A	Column-B
(1) $\text{CH}_3\text{CH}_2\text{MgCl} + \text{H}_2\text{O} \rightarrow \text{ethane} + \text{Mg(OH)Cl}$	(p) Elimination reaction
(2) $2\text{CH}_3\text{CH}_2\text{Br} + 2\text{Na} \rightarrow \text{CH}_3 - (\text{CH}_2)_2\text{CH}_3 + 2\text{NaBr}$	(q) Substitution reaction
(3) $\text{CH}_3\text{CH}_2\text{Cl} + \xrightarrow[\Delta]{\text{KOH} + \text{Ethenol}}$ ethene	(r) Wurtz reaction
(4)  + $\text{OH}^- \rightarrow \text{tert butyl alcohol}$	(s) Grignard reaction
(A) (1)-(r), (2)-(q) (3)-(s), (4)-(p)	(B) (1)-(s) (2)-(r) (3)-(p), (4)-(q)
(C) (1)-(s) (2)-(p) (3)-(r), (4)-(q)	(D) (1)-(s) (2)-(r) (3)-(p), (4)-(q)

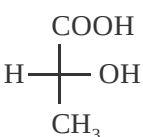
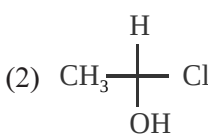
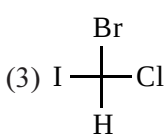
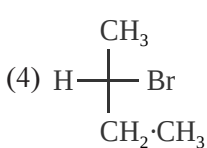
150.

Column-A	Column-B
(1)  + 2Na $\xrightarrow{\text{ether}}$  + 2NaCl	(p) Fridel craft reaction
(2)  + 2Na + $\text{CH}_3\text{Br} \xrightarrow[\text{anhy.}]{\text{ether}}$  + 2NaBr	(q) Fittig reaction
(3) $\text{C}_6\text{H}_5\text{Cl} + \text{CH}_3 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{Cl} \xrightarrow[\text{AlCl}_3]{\text{anhy.}}$ 	(r) Wurtz-Fittig reaction
	(s) Alkylation reaction
(A) (1)-(r), (2)-(q) (3)-(s)	(B) (1)-(s), (2)-(q) (3)-(r)
(C) (1)-(q), (2)-(s) (3)-(r)	(D) (1)-(q), (2)-(r) (3)-(p)

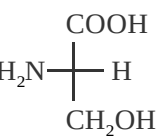
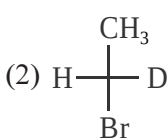
151.

Column-A	Column-B
(1) benzyl bromide	(M) : 
(2) ethylidene bromide	(N) : $\text{CH}_3\text{CH}\cdot\text{Br}_2$
(3) phenyl bromide	(O) : $\text{CH}_2 = \text{CHCH}_2\cdot\text{Br}$
(4) allyl bromide	(P) : 
(A) (1)-(M), (2)-(N), (3)-(O), (4)-(P)	(B) (1)-(P), (2)-(N), (3)-(M), (4)-(O)
(C) (1)-(P), (2)-(N), (3)-(O), (4)-(M)	(D) (1)-(N), (2)-(O), (3)-(M), (4)-(P)

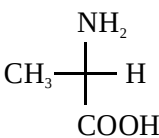
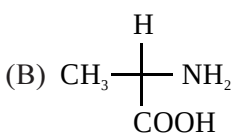
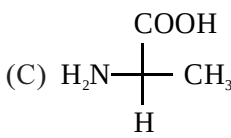
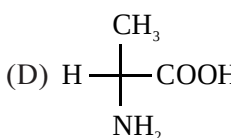
152. Identify R and S structure for given structures :

(1) 	(2) 	(3) 	(4) 
(A) 1-S, 2-R, 3-R, 4-S	(B) 1-R, 2-S, 3-R, 4-R	(C) 1-R, 2-R, 3-R, 4-S	(D) 1-R, 2-S, 3-S, 4-S

153. What is the configuration of given structures respectively ?

(1) 	(2) 	(A) R and R	(B) R and S	(C) S and S	(D) S and R
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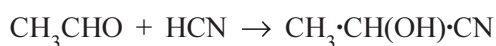
154. Identify D configuration of alanine.

(A) 	(B) 	(C) 	(D) 
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155. Which substance has chiral atom and possess optical isomerism ?

(A) 2, chloro propane	(B) 2, Methyl butane	(C) 2, bromo butane	(D) 2, 2 dichloro butane
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156. In the given reaction product has chiral centre what is the type of this product ?



(A) leavo rotatory	(B) meso isomer	(C) dextro rotatory	(D) racemic mixture
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157. In  which configuration is observed ?

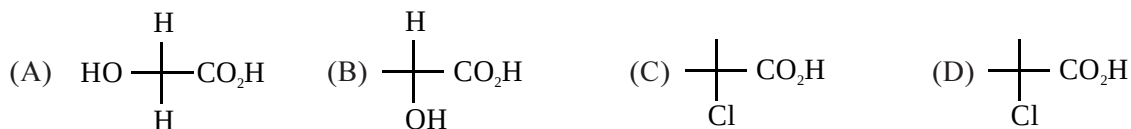
(A) S	(B) R	(C) L	(D) D
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158. Which compound possess optical activity ?

(A) 2, 2 di methyl pentene	(B) 3-methyl pentene
(C) 2,-methyl pentene	(D) butene

159. Optically active isomer *d* and *l* differ in which manner ?
- (A) On the basis reactivity with achiral substance.
- (B) On the basis of melting point.
- (C) On the basis of angle of rotation of plane of plane polarised light.
- (D) On the basis of solubility in achiral reagent.

160. Which compound is optically active ?



- In the following questions two sentences are given out of which one is assertion (A) and other is reason (R) is correct explanation of assertion :

161. **Assertion (A)** : On adding bromine to trans 2-butene, meso 2,3 di bromo butane is obtained.
- Reason (R)** : Reaction of addition of bromine into alkene is electrophilic addition reaction.
- (A) Assertion (A) and reason (R) is correct and reason (R) is correct explanation of assertion (A).
- (B) Assertion (A) and reason (R) is correct but reason (R) is not correct explanation of assertion (A).
- (C) Assertion (A) is correct, Reason (R) is incorrect.
- (D) Assertion (A) is incorrect, Reason (R) is correct.

Answers : 67. (C), 68. (A), 69. (A), 70. (C), 71. (C), 72. (D), 73. (B), 74. (A), 75. (D), 76. (C), 77. (B), 78. (C), 79. (C), 80. (A), 81. (B), 82. (B), 83. (C), 84. (D), 85. (B), 86. (A), 87. (C), 88. (B), 89. (C), 90. (C), 91. (B), 92. (B), 93. (B), 94. (A), 95. (C), 96. (D), 97. (C), 98. (C), 99. (C), 100. (C), 101. (A), 102. (B), 103. (B), 104. (D), 105. (B), 106. (D), 107. (B), 108. (A), 109. (C), 110. (A), 111. (D), 112. (D), 113. (A), 114. (B), 115. (C), 116. (D), 117. (B), 118. (C), 119. (D), 120. (C), 121. (B), 122. (B), 123. (D), 124. (A), 125. (D), 126. (A), 127. (C), 128. (A), 129. (C), 130. (A), 131. (B), 132. (A), 133. (D), 134. (B), 135. (B), 136. (D), 137. (C), (D), 138. (B), (D), 139. (B), (C), 140. (B), (C), 141. (C), 142. (C), (D), 143. (C), (D), 144. (B), 145. (D), 146. (B), 147. (D), 148. (D), 149. (B), 150. (C), 151. (C), 152. (C), 153. (C), 154. (D), 155. (A), 156. (B), 157. (C), 158. (B), 159. (B).

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