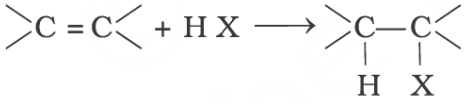
NEET Important Questions with Solutions from Haloalkanes and Haloarenes

Q.1. Which of the following is halogen exchange reaction?

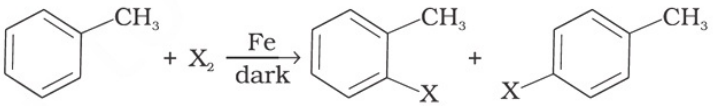
A)

B)



C)

D)



Answer:

Solution:

Alkyl Iodides are often prepared by the reaction of alkyl chlorides/bromides with NaI in dry acetone. This reaction is known as Finkelstein reaction.

$NaCl$ or $NaBr$ thus formed is precipitated in dry acetone. It facilitates the forward reaction according to Le Chatelier's Principle.

In the given reaction, there happens to be an exchange of halogens between reacting species, hence the reaction is very often termed as Halogen exchange reaction.

Q.2. Which reagent will you use for the following reaction?

$$CH_3CH_2CH_2CH_3 \rightarrow CH_3CH_2CH_2CH_2Cl + CH_3CH_2CHClCH_3$$

A) Cl_2 / UV light

B) $NaCl + H_2SO_4$

C) Cl_2 gas in dark

D) Cl_2 gas in the presence of iron in dark

Answer: Cl_2 / UV light

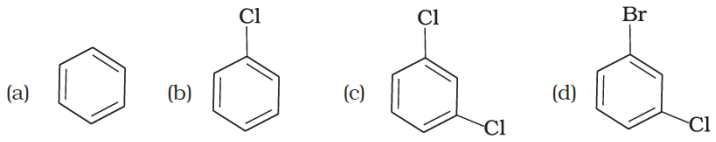
Solution:

Free radical chlorination or bromination of alkanes gives a complex mixture of isomeric mono and polyhaloalkanes, which is difficult to separate as pure compounds.

In this case, a mixture of the two isomeric forms of butane is obtained by reacting butane with Cl_2 / UV light.

$$CH_3CH_2CH_2CH_3 \xrightarrow[\text{or heat}]{Cl_2/\text{UV light}} CH_3CH_2CH_2CH_2Cl + CH_3CH_2CHClCH_3$$

Q.3. Arrange the following compounds in the increasing order of their densities.



A) $(a) < (b) < (c) < (d)$

B) $(a) < (c) < (d) < (b)$

C) $(d) < (c) < (b) < (a)$

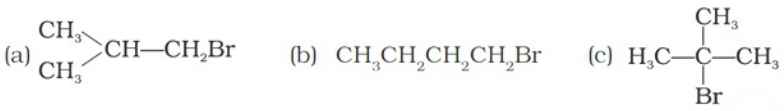
D) $(b) < (d) < (c) < (a)$

Answer: $(a) < (b) < (c) < (d)$

Solution: The density increases with increase in number of carbon atoms, halogen atoms and atomic masses of the halogen atoms bonded with the alkyl or aryl groups.

In other words, density is related to molecular mass of the compound. Higher the molecular mass, greater will be the density of the compound.

Q.4. Arrange the following compounds in increasing order of their boiling points.



A) $(b) < (a) < (c)$

B) $(a) < (b) < (c)$

C) $(c) < (a) < (b)$

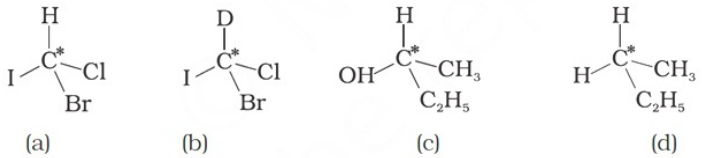
D) $(c) < (b) < (a)$

Answer: $(c) < (a) < (b)$

Solution: Molecular forces of attraction get stronger as molecules get bigger in size. Further, as the branching increases, the surface area of the molecule decreases. Because of this, the Van der Waal's force of attraction between the molecule decreases and consequently boiling point decreases.

In the above three isomers given Structure (b) is a straight-chain with no branching, structure (c) is branched but has less surface area compared to the structure (a). Hence, the increasing order of their boiling points is, $(c) < (a) < (b)$

Q.5. In which of the following molecules carbon atom marked with asterisk $(*)$ is asymmetric?



A) $(a), (b), (c), (d)$

B) (a), (b), (c)

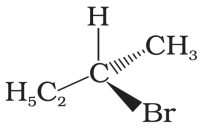
C) (b), (c), (d)

D) (a), (c), (d)

Answer: (a), (b), (c)

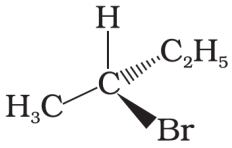
Solution: Carbon atom attached with four different groups or atoms is known as asymmetric carbon atom. This condition is satisfied by the compounds (a), (b) and (c) which contain chiral carbon. The compound (d) contains carbon atom which is linked to two similar atoms (H), hence it is not asymmetric carbon atom.

Q.6. Which of the following structures is enantiomeric with the molecule (A) given below:

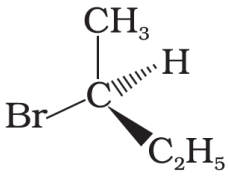


(A)

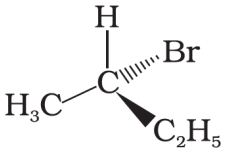
A)



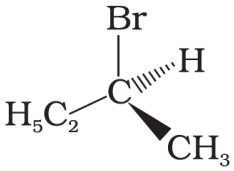
B)



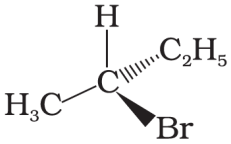
C)



D)



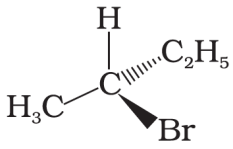
Answer:



Solution: The stereo isomers of a compound which are non-superimposable on each other are known as enantiomers.

The molecule (A) has an asymmetric carbon atom.

The mirror image of the molecule



is not superimposable on (A).

The other molecules are superimposable on (A).

Q.7. Which of the following is an example of vic-dihalide?

A) Dichloromethane

B) $1,2-$dichloroethane

C) Ethylidene chloride

D) Allyl chloride

Answer: $1,2-$dichloroethane

Solution: Vic-dihalides or vicinal dihalides are those dihaloalkanes where the halogen atoms are present on two adjacent carbon atoms.

In $1,\ 2$ dichloroethane, the two chlorine atoms are attached to two adjacent carbon atoms, therefore, it is a vic-dihalide.

In Dichloromethane two halogen atoms are attached to the same carbon atom.

Ethylidene chloride is geminal dihalide as both the halogen atom are attached to the same carbon atom, while Allyl chloride consists of only one chlorine atom.

Q.8. The position of $-\mathrm{Br}$ in the compound in $\mathrm{CH_3\ CH=CHC(Br)(CH_3)_2}$ can be classified as _____.

A) Allyl

B) Aryl

C) Vinyl

D) Secondary

Answer: Allyl

Solution: The compounds in which the halogen atom is bonded to an $\mathrm{sp^3-}$ hybridised carbon atom next to carbon-carbon double bond $(\mathrm{C=C})$ i.e., to an allylic carbon are classified as allylic halides.

Therefore, $\mathrm{CH_3\ CH=CHC(Br)(CH_3)_2}$ can be considered as allyl halide.

Aryl halides are formed when the halogen atom is bonded directly to the $\mathrm{sp^2}$ hybridised carbon atom of an aromatic ring.

Vinylic bonds are formed when the halogen atom is bonded to a $\mathrm{sp^2}$ hybridised carbon atom of a carbon-carbon double bond.

In Secondary haloalkanes, the halogen is bonded to a secondary carbon atom of the molecule.

Q.9. A primary alkyl halide would prefer to undergo _____.

A) $\mathrm{S_N1}$ reaction

B) S_N2 reaction

C) $\alpha-$Elimination

D) Racemisation

Answer: S_N2 reaction

Solution: S_N2 type reactions (i.e.bimolecular nucleophilic substitution) proceed in one step and the rate of reaction depends on the steric hindrance in the substrate, lesser is the hindrance, more is the probability of S_N2 reaction. Primary halides being least hindered almost exclusively undergo S_N2 reaction.

Q.10. Which of the following alkyl halides will undergo S_N1 reaction most readily?

A) $(CH_3)_3C—F$

B) $(CH_3)_3C—Cl$

C) $(CH_3)_3C—Br$

D) $(CH_3)_3C—I$

Answer: $(CH_3)_3C—I$

Solution: S_N1 type (unimolecular nucleophilic substitution) reactions proceed in two steps. If $C-X$ bond length is greater, then the bond breaking and S_N1 will take place easily. Further, RX bond length in case of RI is longest, it has lowest bond dissociation enthalpy. Therefore, it will react most readily.

Q.11. Which of the following is known as freon and is used as a refrigerant?

A) CCl_2F_2

B) $CHCl_3$

C) CH_2F_2

D) CF_4

Answer: CCl_2F_2

Solution: CCl_2F_2 is known as freon and is used as a refrigerant.

Dichlorodifluoromethane is a colorless, non-flammable gas that can affect you when breathed in. Acute (short-term) exposure to dichlorodifluoromethane can cause dizziness, lightheadedness, and trouble with concentration.

Q.12. Use of chlorofluorocarbons is NOT encouraged because _____.

A) they are harmful to the eyes of people that use it

B) they damage the refrigerators and air conditioners

C) they deplete away the ozone in the atmosphere

D) they destroy the oxygen layer

Answer: they deplete away the ozone in the atmosphere

Solution: Chlorofluorocarbons are the cause depletion of the ozone layer in the atmosphere because they react with ozone molecule by releasing chlorine radicals through a chain reaction. Chlorofluorocarbons are broken up by ultraviolet radiations.

Q.13. In the compound 'X', all the bond angles are exactly $109°28'$. 'X' may be _____.

A) Chloroform

B) Iodoform

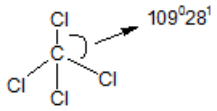
C) Chloromethane

D) Carbon tetrachloride

Answer: Carbon tetrachloride

Solution: When all the atoms are attached to carbon atom are same then all the angles between atom-carbon-atom are the same.

In carbon tetrachloride, chlorine atom is attached



to carbon is same then all the angles between

$Cl - C - Cl$ are the same.

Q.14. Isobutyl bromide may be obtained from isobutylene and HBr in the presence of _____.

A) peroxide

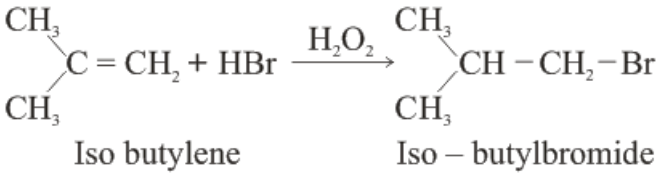
B) hydroquinone

C) diffused sunlight

D) Pyridine

Answer: peroxide

Solution: Isobutyl bromide may be obtained from isobutylene and HBr in the presence of peroxide $(Anti - Markovnikov\ rule)$.



Q.15. Heterolysis of carbon-chlorine bond produces _____.

A) carbocation and chloride ion

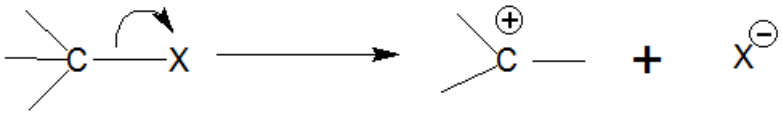
B) two free radicals

C) carbanion and chloronium ion

D) two carbocations

Answer: carbocation and chloride ion

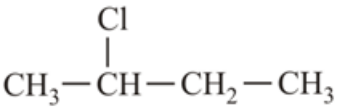
Solution: Heterolysis of carbon-chlorine bond produces carbocation and chloride ion. Heterolysis means that the sharing of the bonding electron takes towards the more electronegative atom when the cleavage of carbon-halogen atom.



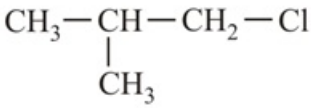
Q.16. Which of the following is isobutyl chloride?

A)

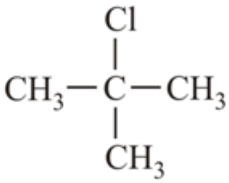
B)



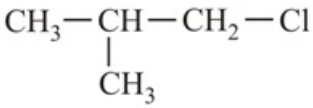
C)



D)



Answer:

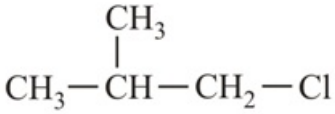


Solution: 'Iso' term is used when, methyl is attached to the second carbon from terminal carbon in the main chain.

Isobutyl chloride is a chlorinated derivative of isobutane.

Isobutane is the simplest alkane with one tertiary carbon.

Its IUPAC name is $1-$chloro$-2-$methylpropane and its structure is given below:



Isobutyl chloride

Q.17. Arenes, when treated with chlorine or bromine in the presence of Lewis acid as a catalyst, undergo _____ reaction.

A) nucleophilic substitution

B) electrophilic substitution

C) rearrangement

D) dehydrohalogenation

Answer: electrophilic substitution

Solution: Electrophilic substitution reactions are chemical reactions in which an electrophile displaces a functional group in a compound, which is mostly hydrogen atom. Arenes, when treated with chlorine or bromine in the presence of Lewis acid as a catalyst, undergo electrophilic substitution reaction.

Q.18. State the product formed during the reaction between sodium phenoxide and ethyl iodide on heating:

A) benzyl alcohol

B) phenol

C) phenetol

D) None of these

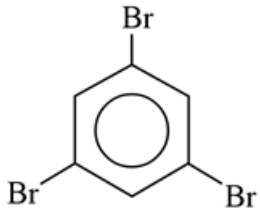
Answer: phenetol

Solution: The reaction between sodium phenoxide and ethyl iodide on heating gives phenetol. This is SN^2 reaction, as the strong nucleophile sodium phenoxide attacks on the less crowded ethyl iodide. Reaction is shown below.

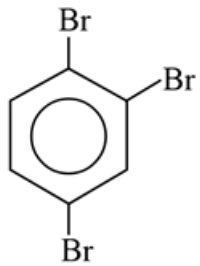
$$PhO^- + C_2H_5I \rightarrow \underset{\text{phenetol}}{C_2H_5OPh}$$

Q.19. A particular form of tribromobenzene forms three possible mono nitro tribromobenzenes. The structure of the compound is

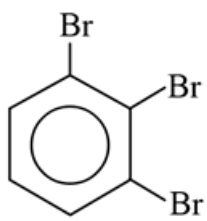
A)



B)

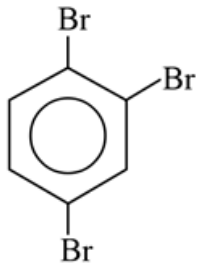


C)



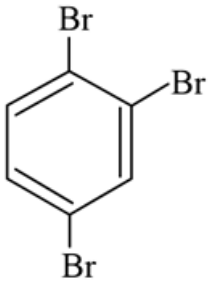
D) Both B and C

Answer:

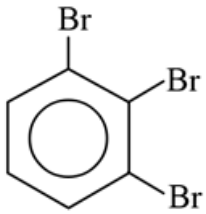


Solution:

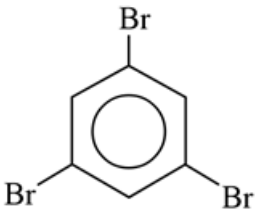
The structure of the compound is,



because it has three positions available to attack $\overset{\oplus}{N}O_2$ group in the given reaction conditions to form three possible mono nitro tribromobenzene and others form only one type of product.

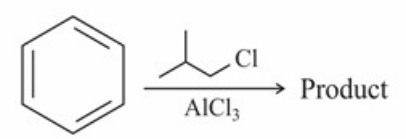


The above molecule is having two different position to attack electrophile.

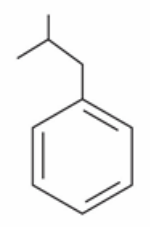


The above structure forms single nitro product on nitration.

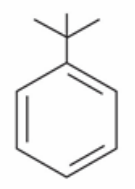
Q.20. Predict the product formed in the following reaction:



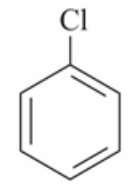
A)



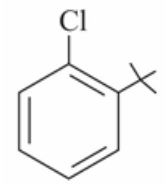
B)



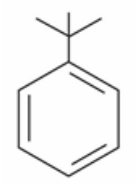
C)



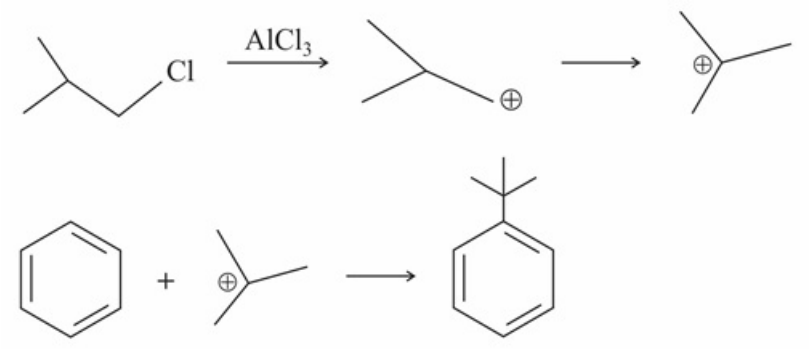
D)



Answer:



Solution: First of all Lewis acid reacts with the alkyl chloride and forms the carbocation. Then carbocation will go for rearrangement from less stable form to more stable form. After that benzene will give the electrophilic aromatic substitution reaction and gives the Friedel-Craft Alkylation reaction.



Q.21. Which would be obtained by boiling $CHCl_3$ with caustic soda?

A) CH_3COON

B) $HCOONa$

C) $Na_2C_2O_4$

D) CH_3OH

Answer: $HCOONa$

Solution: Chloroform when boiled with the aqueous solution of caustic soda, first it forms formic acid which reacts further and sodium formate forms.

Hydrolysis in basic medium chloroform converts into sodium formate.

$$CHCl_3 \xrightarrow{4NaOH} HCOONa + 3\ NaCl + 2H_2O$$

Q.22. Which of the following statement is FALSE for alkyl halides?

A) They are less reactive by nature.

B) They give nucleophilic substitution reactions.

C) The halide group is easily replaced by different functional groups.

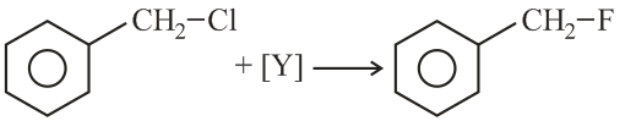
D) All of these

Answer: They are less reactive by nature.

Solution: The $C-X$ bond is a covalent bond, but, the electronegativity of carbon atom is less than halogen atom. Therefore, due to the difference in electronegativity, the $C-X$ bond is polar in nature. In this way, the partial negative charge appears on the halogen atom and a partial positive charge on the carbon atom.

Due to this, alkyl halide gives nucleophilic substitution reaction.

Q.23.



Reagent [Y] can be:

A) AgF

B) Hg_2F_2

C) SbF_3

D) All

Answer: All

Solution: The given reaction is the halide exchange reaction in which alkyl fluoride is formed.

This is Swart's reaction.

Swarts' reaction is generally used to get alkyl fluorides from alkyl chlorides or alkyl bromides. This is done by heating of the alkyl chloride/bromide in the presence of the fluoride of some heavy metals like $AgF,\ Hg_2F_2,\ SbF_5$ etc.

The reaction will proceed if sodium fluoride or potassium fluoride is used, but the resulting yield will be significantly lower.

Q.24. The best leaving group (nucleofuge) is:

A) $(CH_3)_2S$

B) $(CH_3)_2NH$

C) $(CH_3)_2O$

D) CH_3OH

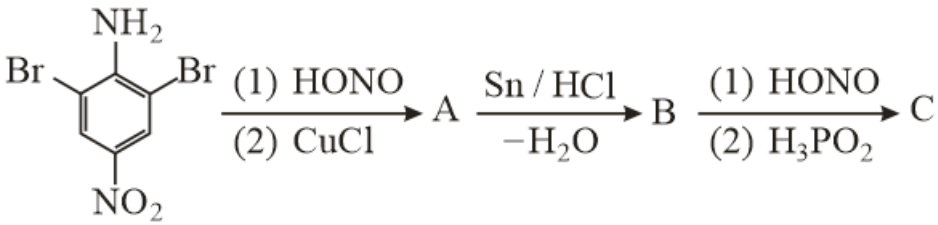
Answer: $(CH_3)_2S$

Solution: According to the question, leaving group is an atom or group of atoms which breaks away from the rest of the molecule, taking with it the electron pair which used to be the bond between the leaving group and the rest of the molecule. The bond dissociation occurs through heterolytic bond fission.

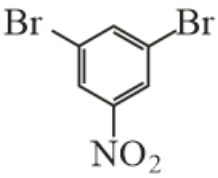
The leaving power of the group is indirectly proportional to the basicity of group. As electronegativity of centre atom of nucleophile decreases then its leaving ability increases.

For example- order of increasing of basicity: or decreasing in leaving ability. $I^- > Br^- > Cl^- > F^-$. So di-methyl sulphide is better leaving group among these options.

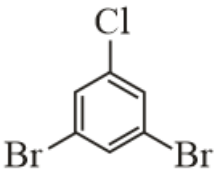
Q.25. What is the product C obtained in the following sequence of reactions?



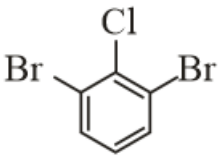
A)



B)

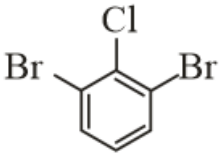


C)



D) None of these

Answer:

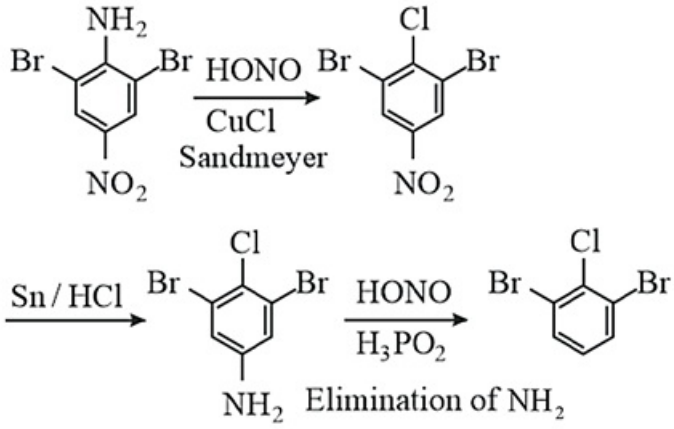


Solution:

The first reaction is the Sandmeyer reaction which is used to synthesise aryl halide (A) from aryl diazonium salt using copper salt as a reagent or a catalyst. It is an example of radical-nucleophilic aromatic substitution.

The next step is the reduction of $-\mathrm{NO_2}$ group of A by tin and HCl to $-\mathrm{NH_2}$ to form the product B.

B reacts with $\mathrm{HNO_2}$ to give diazonium salt and $\mathrm{H_3PO_2}$ replaces it by H.



Practice more on Haloalkanes and Haloarenes