

# CHEMISTRY STUDY MATERIALS FOR CLASS 12

## (NCERT Exemplar Problems of Chapter - 10)

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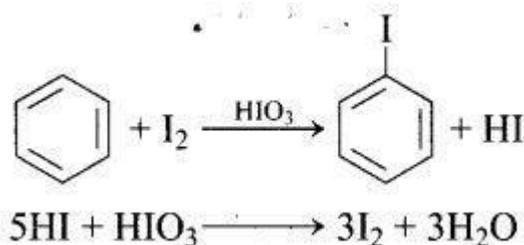
DATE:- 12/09/2021

### Haloalkanes and Haloarenes

#### Short Answer Type Questions

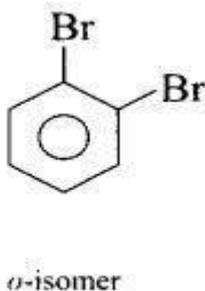
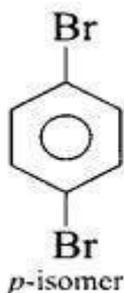
**Question 44.** Aryl chlorides and bromides can be easily prepared by electrophilic substitution of arenes with chlorine and bromine respectively in the presence of Lewis acid catalysts. But why does preparation of aryl iodides require presence of an oxidizing agent?

**Solution:** Iodination reactions are reversible in nature. To carry out the reaction in forward direction, HI formed during the reaction is removed by oxidation.  $\text{HIO}_3$  is used as an oxidising agent.



**Question 45.** Out of o- and p-dibromobenzene, which one has higher melting point and why?

**Solution:** p-Dibromobenzene has higher melting point than its o-isomer. It is due to symmetry of p-isomer which fits in crystal lattice better than the o-isomer.



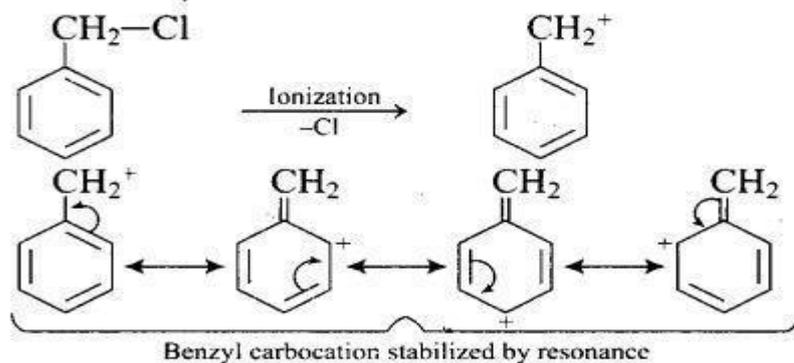
**Question 46.** Which of the compounds will react faster in  $\text{S}_\text{N}1$  reaction with the  $\text{OH}^-$  ion?  $\text{CH}_3 - \text{CH}_2 - \text{Cl}$  or  $\text{C}_6\text{H}_5 - \text{CH}_2 - \text{Cl}$

## Solution:



$\text{S}_{\text{N}}1$  reaction proceeds through the formation of carbocation intermediate.

$\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  readily undergoes ionization to give  $\text{C}_6\text{H}_5\text{CH}_2^+$  carbocation, which is stabilized by resonance.



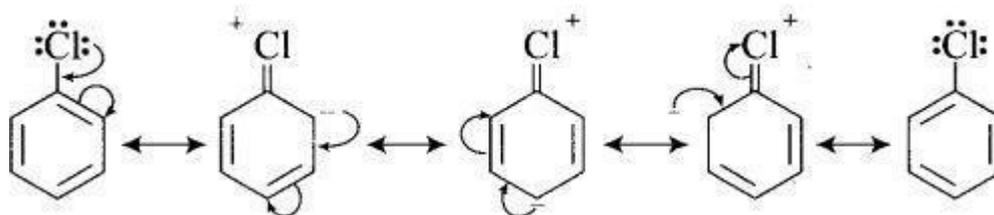
On the other hand,  $\text{CH}_3\text{CH}_2\text{Cl}$  does not undergo ionization to give  $\text{CH}_3\text{CH}_2^+$  carbocation. Therefore,  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$  reacts faster than  $\text{CH}_3\text{CH}_2\text{Cl}$  with  $\text{OH}^-$  ion.

## Question 47. Why has iodoform appreciable antiseptic property?

**Solution:** Antiseptic properties of iodoform are due to liberation of free iodine.

## Q 48. Haloarenes are less reactive than haloalkanes and halo alkenes. Explain.

**Solution:** In haloarenes, the electron pairs on halogen atom are in conjugation with  $\pi$ -electrons of the ring.

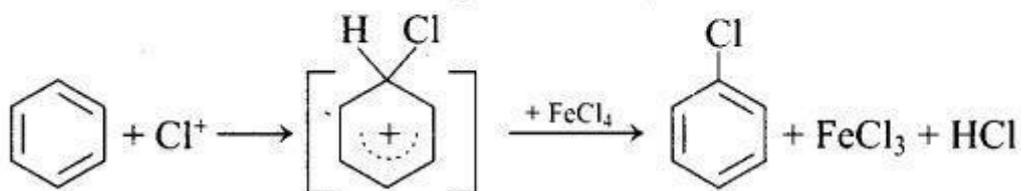
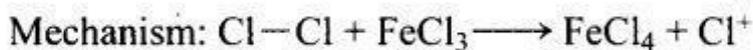
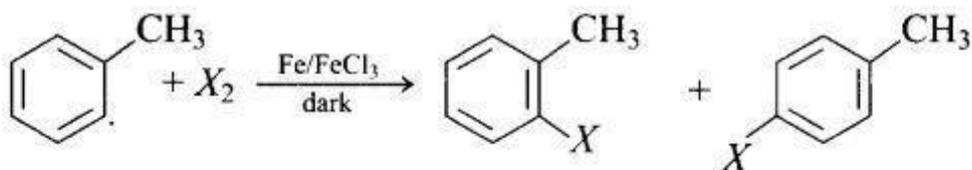


C – Cl bond acquires a partial double bond character due to resonance. As a result, the bond cleavage in haloarene is difficult than haloalkane and therefore they are less reactive towards nucleophilic substitution reaction.

## Question 49. Discuss the role of Lewis acids in the preparation of aryl bromides and chlorides in the dark.

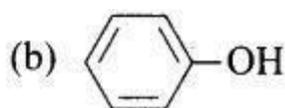
**Solution:** Aryl chlorides and bromides can be easily prepared by electrophilic substitution of arenes with chlorine and bromine respectively, in the presence of Lewis acid catalysts like iron or iron chloride.

Lewis acid generates the electrophile required for the substitution.



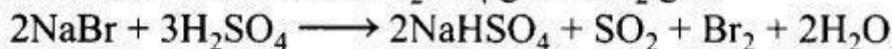
Lewis acid generates the electrophile required for the substitution.

**Question 50.** Which of the following compounds (a) and (b) will not react with a mixture of NaBr and  $\text{H}_2\text{SO}_4$  Explain why?

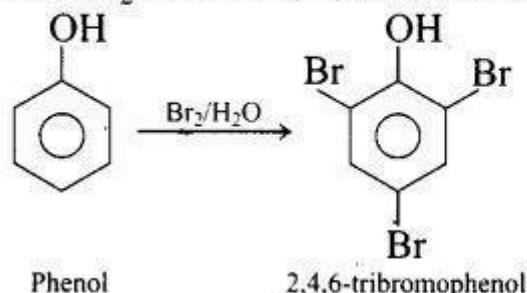


**Solution:**

(b) As mixture of NaBr and  $\text{H}_2\text{SO}_4$  gives  $\text{Br}_2$  gas.

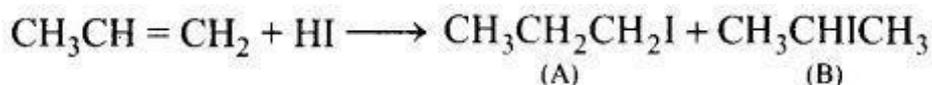


Phenol (b) reacts with  $\text{Br}_2$  to form 2, 4, 6-tribromophenol.



But  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  (a) does not react with  $\text{Br}_2$  water.

**Question 51.** Which of the products will be major product in the reaction given



**Solution:** In the given reaction, (B) is the major product of the reactions.

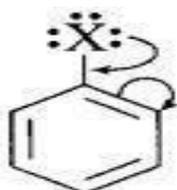
According to Markovnikov's rule, H is added to the C atom with higher number of hydrogen atoms.

**Question 52.** Why is the solubility of haloalkanes in water very low?

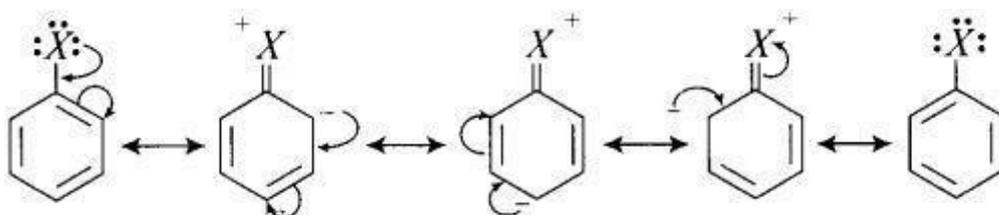
**Solution:** The haloalkanes are only slightly soluble in water. In order to dissolve a haloalkane in water, energy is required to overcome the attractions between the haloalkane molecules and break the hydrogen bonds between water molecules.

Since less energy is released in the formation of new attractions between haloalkane and water molecules and these are not very strong as the original hydrogen bonds present in water and hence the solubility of haloalkanes is low.

**Question 53. Draw other resonance structures related to the following structure and find out whether the functional group present in the molecule is ortho, para directing or meta directing.**



**Solution:**

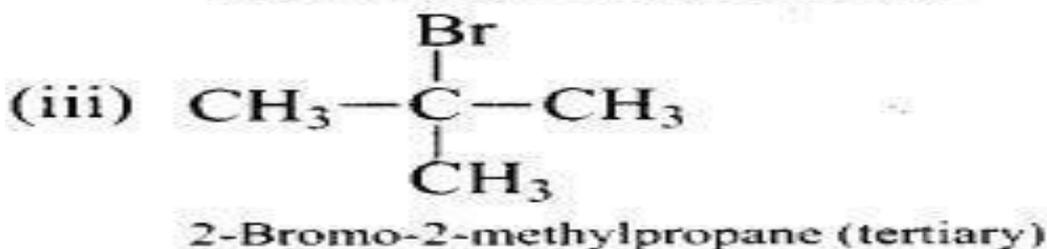
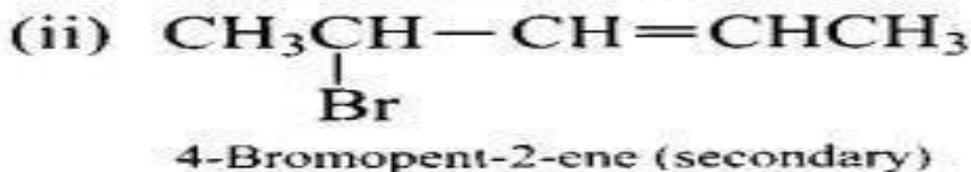
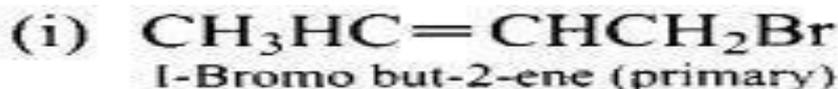


Since the electron density is more at ortho and para positions, the functional group present in the ring is ortho-para directing.

**Question 54. Classify the following compounds as primary, secondary and tertiary halides. (i) 1-Bromobut-2-ene**

**(ii) 4-Bromobut-2-ene**

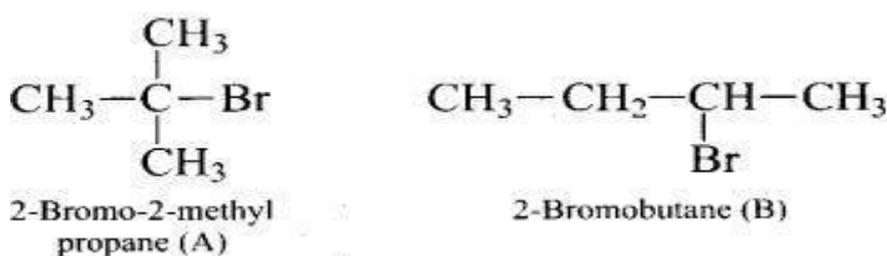
**(iii) 2-Bromo-2-methylpropane** **Solution:**



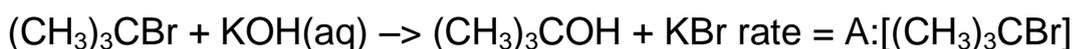
**Question 55.** Compound (A) with molecular formula  $C_4H_9Br$  is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.

- (i) Write down the structural formula of both compounds 'A' and 'B'.  
 (ii) Out of these two compounds, which one will be converted to the product with inverted configuration?

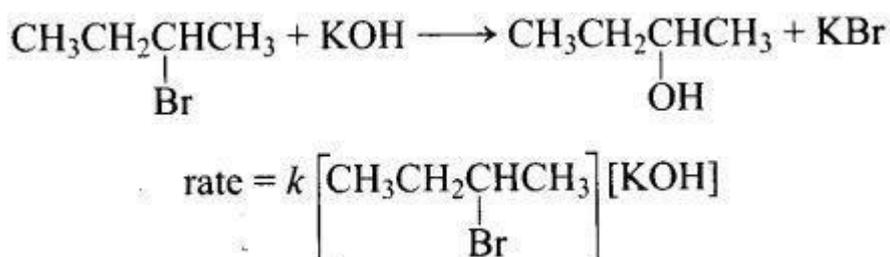
**Solution:** (i) The molecular formulae of isomers of  $C_4H_9Br$  are  $CH_3$



Since the rate of reaction of compound 'A' ( $C_4H_9Br$ ) with aqueous KOH depends upon the concentration of compound 'A' only, therefore, the reaction occurs by  $S_N^1$  mechanism and compound 'A' is tertiary bromide i.e., 2-Bromo-2-methyl propane.



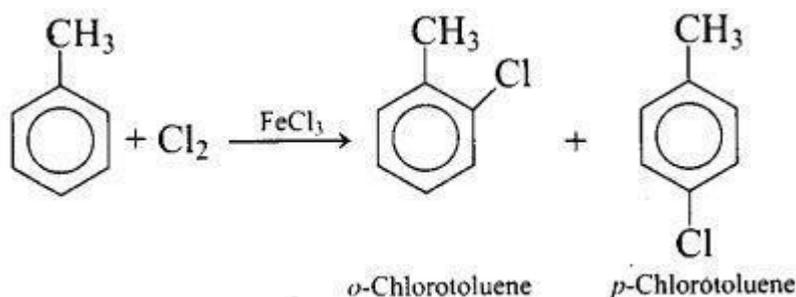
Since compound 'B' is optically active and is an isomer of compound 'A' ( $C_4H_9Br$ ), therefore, compound 'B' must be 2-Bromobutane. Since the rate of reaction of compound 'B' with aqueous KOH depends upon the concentration of compound 'B' and KOH, therefore, the reaction occurs by  $S^2$  mechanism and product of hydrolysis will have inverted configuration.



**Question 56.** Write the structures and names of the compounds formed when compound 'A' with molecular formula,  $C_7H_8$  is treated with  $Cl_2$  in the presence of  $FeCl_3$ .

**Solution:** The compound with molecular formula  $C_7H_8$  is toluene,  $C_6H_5CH_3$ .

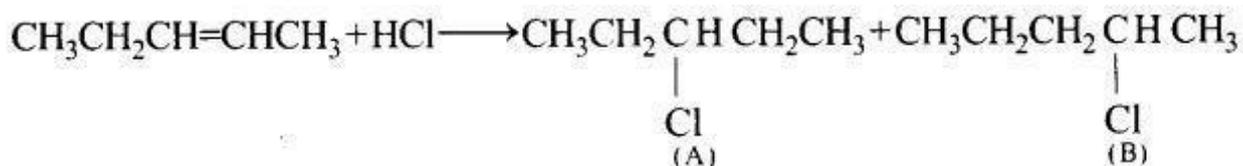
Since  $-CH_3$  group is o-, p-directing, therefore, chlorination of toluene gives o-chlorotoluene and p-chlorotoluene, in which the p-isomer predominates.



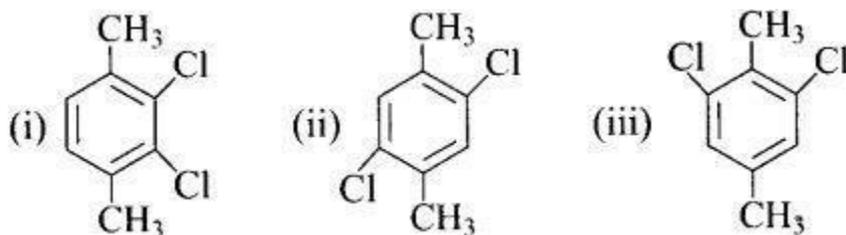
**Question 57. Identify the products A and B formed in the following reaction:**



**Solution:**



**Question 58. Which of the following compounds will have the highest melting point and why?**



**Solution:** Structure II has a symmetrical structure hence, it will have the highest melting point.

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