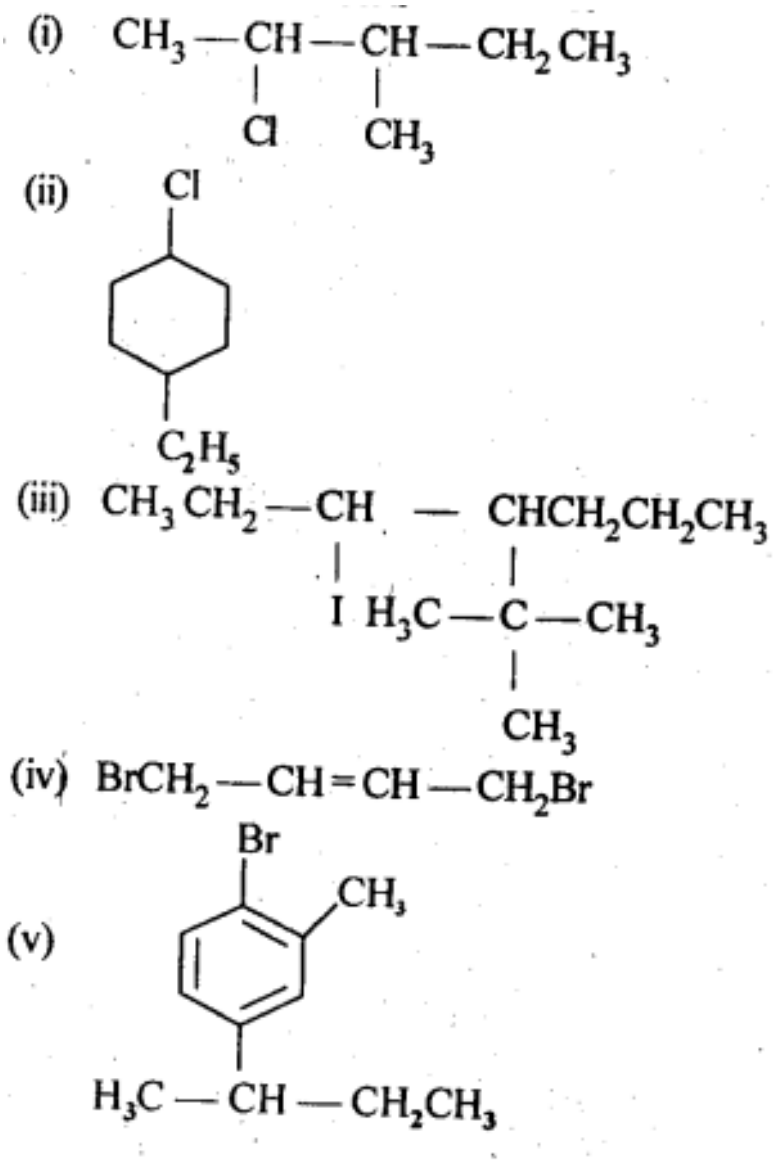
NCERT IN TEXT QUESTIONS

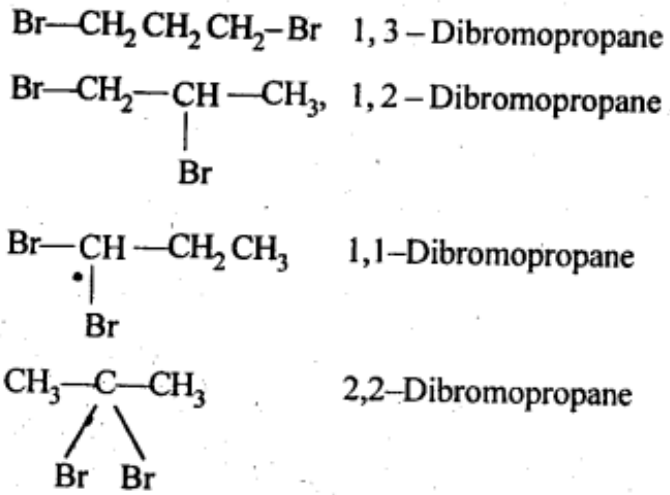
10.1. Write structures of the following compounds:
(i) 2-Chloro-3-methylpentane
(ii) 1-Chloro-4-ethylcydohexane
(iii) 4-tert. Butyl-3-iodoheptane
(iv) 1,4-Dibromobut-2-ene
(v) 1-Bromo-4-sec. butyl-2-methylbenzene.
Ans:



10.2. Why is sulphuric acid not used during the reaction of alcohols with KI?
Ans. H_2SO_4 is an oxidising agent. It oxidises HI produced during the reaction to I_2 and thus prevents the reaction between an alcohol and HI to form alkyl iodide. To prevent this, a non¬oxidising acid like H_3PO_3 is used.

$$2KI + H_2SO_4 \rightarrow 2KHSO_4 + 2HI;$$
$$2HI + H_2SO_4 \rightarrow H_2O + I_2 + SO_2$$
$$CH_3CH_2OH + KI + H_3PO_4 \xrightarrow{\Delta} CH_3CH_2 - I + KH_2PO_4 + H_2O$$

10.3. Write structures of different dihalogen derivatives of propane.
Ans: Four isomers are possible. These are :



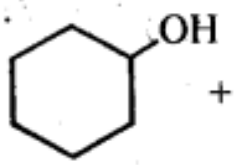
10.4. Among the isomeric alkanes of mdlecular formula C_5H_{12}, identify the one that on photochemical chlorination yields
(i) A single monochloride.
(ii) Three isomeric monochlorides.
(iii) Four isomeric monochlorides.
Ans:

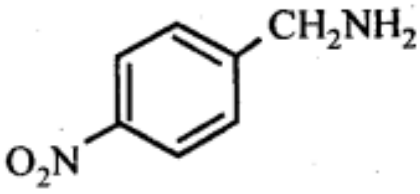
(i) Neopentane $H_3C - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH_3$. As all the H-atoms are equivalent, the replacement of any one of them gives the same product.

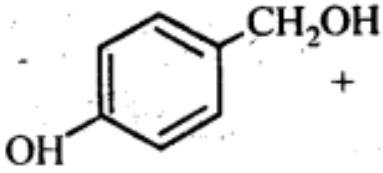
(ii) $\overset{a}{C}H_3\overset{b}{C}H_2\overset{c}{C}H_2\overset{b}{C}H_2\overset{a}{C}H_3$ *n*-pentane. *a*, *b*, *c* are the three sets of equivalent hydrogens. Therefore, three isomeric monochlorides are possible.

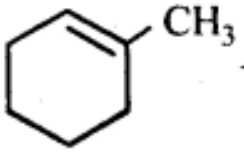
(ii) $\overset{a}{C}H_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle b}{\overset{|}{\underset{|}{C}}}}H - \overset{c}{C}H_2 - \overset{d}{C}H_3$ iso-pentane. there are four sets of equivalent hydrogens Designated as a, b, c, d. Thus, four isomeric monochlorides are possible.

10.5. Draw the structures of major monohalo products in each of the following reactions:

(i)  + $SOCl_2$ ⟶

(ii)  $\xrightarrow[\text{UV light}]{Br_2\text{heat or}}$

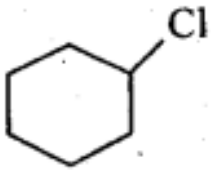
(iii)  + HCl $\xrightarrow{\text{heat}}$

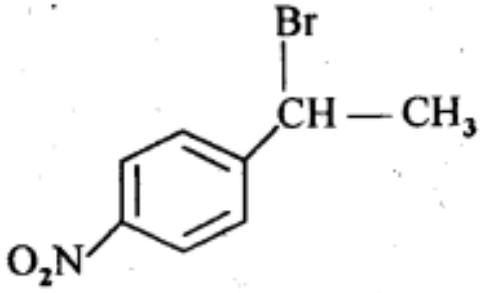
(iv)  + HI ⟶

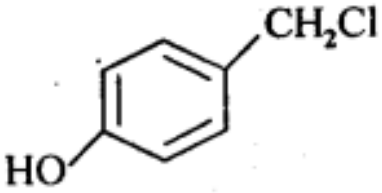
(v) $CH_3CH_2Br + NaI$ ⟶

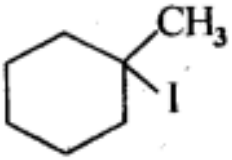
(vi)  + Br_2 $\xrightarrow[\text{UV light}]{\text{heat or}}$

Ans:

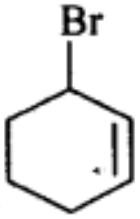
(i)  + SO_2 + HCl

(ii) 

(iii) 

(iv) 

(v) $CH_3CH_2I + NaBr$

(vi)  + HBr

10.6. Arrange each set of compounds in order of increasing boiling points.
(i) Bromomethane, Bromoform, Chloromethane, Dibromomethane.
(ii) 1-Chloropropane, Isopropyl chloride, 1-Chlorobutane.
Ans:
(i) Chloromethane < Bromomethane < Dibromomethane < Bromoform
The reason is:
(a) for same alkyl group, B.Pt increases with size of halogen atom.
(b) B.Pt increases as number of halogen atoms increase.
(ii) Isopropyl chloride < 1 - Chloropropane < 1 - Chlorobutane
Reason:
(a) For same halogen, B.Pt. increases as size of alkyl group increases.
(b) B.Pt. decreases as branching increases.

10.7. Which alkyl halide from the following pairs would you expect to react more rapidly by an S_N2 mechanism? Explain your answer.

(i) $CH_3CH_2CH_2CH_2Br$ or

$CH_3CH_2\underset{\displaystyle Br}{\underset{|}{C}}HCH_3$

(ii) $CH_3CH_2\underset{\underset{Br}{|}}{C}HCH_3$ or $H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-Br$

(iii) $CH_3\underset{\underset{CH_3}{|}}{C}HCH_2CH_2Br$ or $CH_3CH_2\underset{\underset{CH_3}{|}}{C}HCH_2Br$

Ans: In S_N2 mechanism, reactivity depends upon the steric hindrance around the C-atom carrying the halogen. Lesser the steric hindrance, faster the reaction.

(i) $CH_3CH_2CH_2CH_2Br$ 1° alkyl halide

$CH_3CH_2CH(Br)CH_3$ 2° alkyl halide

As steric hindrance in 2° alkyl halide is more, thus reactivity of $CH_3CH_2CH_2CH_2Br$ > $CH_3CH_2CH(Br)CH_3$

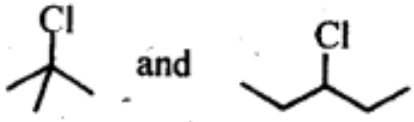
(ii) $CH_3CH_2CH(Br)CH_3$ 2° alkyl halide

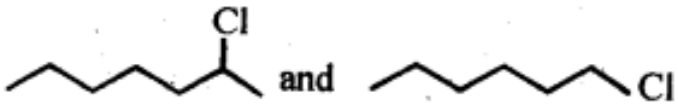
$(CH_3)_3CBr$ 3° alkyl halide

As steric hindrance in $(CH_3)_3CBr$ is more, thus it is less reactive than $CH_3CH_2CH(Br)CH_3$

(iii) Both are 2° alkyl halides but CH_3 group at C_2 is closer to Br atom than $-CH_3$ group at C_3. As a result $CH_3CH_2CH(CH_3)CH_2Br$ suffers greater steric hindrance than $CH_3CH(CH_3)CH_2CH_2Br$ and will thus be less reactive in S_N2.

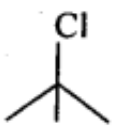
10.8. In the following pairs of halogen compounds, which compound undergoes faster S_N1 reaction?

(i) 

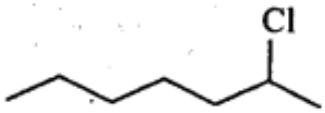
(ii) 

Ans:

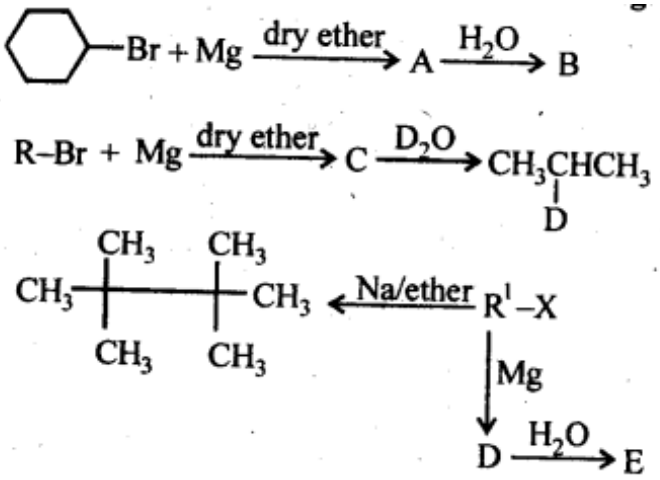
Reactivity in S_N1 is governed by stability of carbocations.

(i) 

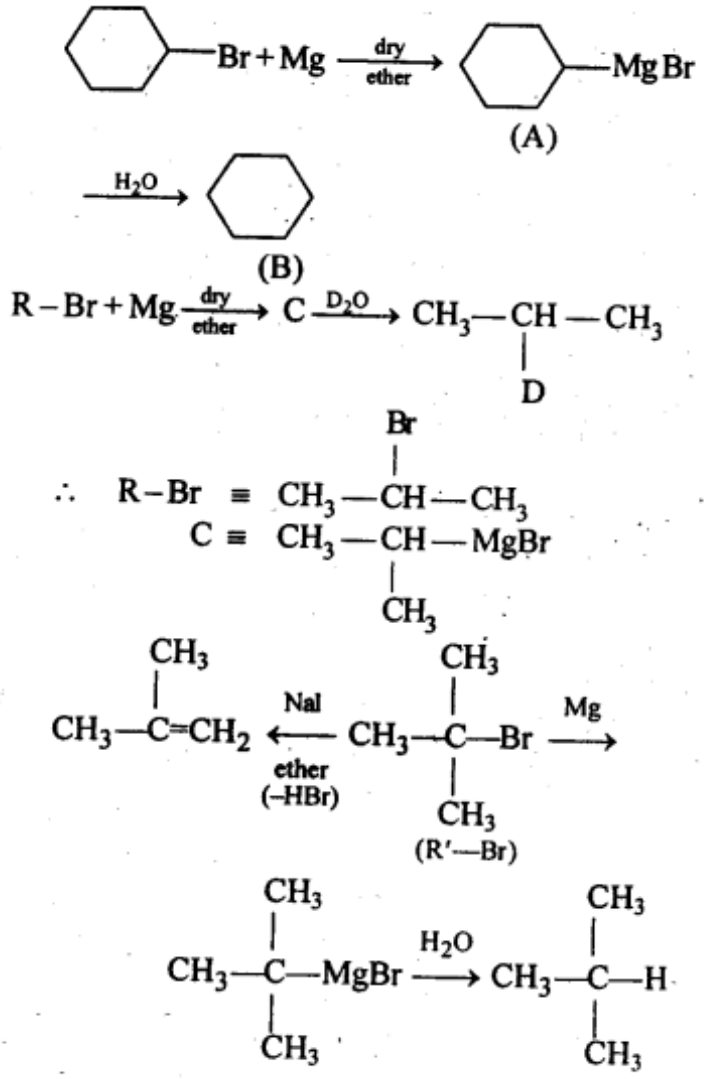
reacts faster due to greater stability of 3° carbocation.

(ii)  reacts faster due to greater stability of 2° carbocation over 1° carbocation.

10.9. Identify A, B, C, D, E, R and R^1 in the following:

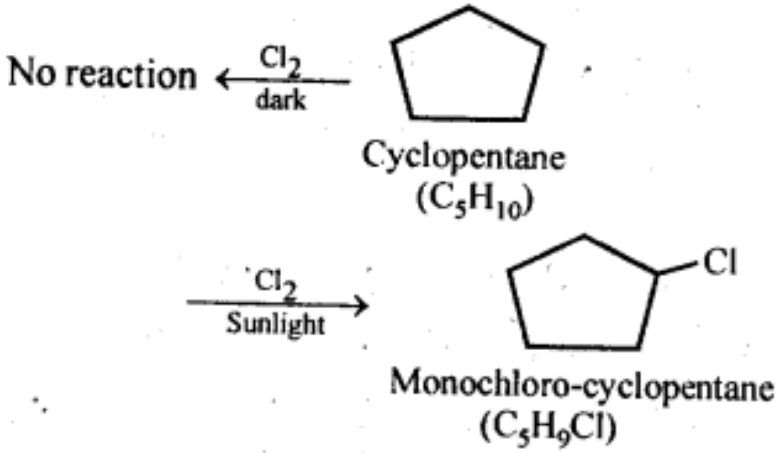


Ans:



10.10. A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound C_5H_9Cl in bright sunlight. Identify the hydrocarbon.

Ans: The hydrocarbon with molecular formula C_5H_{10} can either a cycloalkane or an alkene.Since the compound does not react with Cl_2 in the dark, therefore it cannot be an alkene but must be a cycloalkane. Since the cycloalkane reacts with Cl_2 in the presence of bright sunlight to give a single monochloro compound, C_5H_9Cl, therefore, all the ten hydrogen atoms of the cycloalkanes must be equivalent. Thus, the cycloalkane is cyclopentane.



********** END **********