(Chapter 11)(Alcohols Phenols and Ethers)

Intext Questions

Question 11.1:

Classify the following as primary, secondary and tertiary alcohols:



Tertiary alcohol \rightarrow (vi)

Question 11.2:

Identify allylic alcohols in the above examples.



Answer

The alcohols given in (ii) and (vi) are allylic alcohols.

Question 11.3:

Name the following compounds according to IUPAC system.

(i)



(i) 3-Chloromethyl-2-isopropylpentan-1-ol

(ii) 2, 5-Dimethylhexane-1, 3-diol

(iii) 3-Bromocyclohexanol

(iv) Hex-1-en-3-ol

(v) 2-Bromo-3-methylbut-2-en-1-ol



Question 11.4:

Show how are the following alcohols prepared by the reaction of a suitable Grignard reagent on methanal?



Question 11.5:

Write structures of the products of the following reactions:

(i)

$$CH_3 - CH = CH_2 \xrightarrow{H_2O/H^+}$$
(ii)



$$\bigcup_{CH_2-CH_2-CH-CHO}^{O} \xrightarrow{NaBH_4} \rightarrow$$
(iii)
$$CH_3-CH_2-CH-CHO \xrightarrow{NaBH_4} \rightarrow$$

Answer

(i)

$$CH_3 - CH = CH_2 \xrightarrow{H_2O/H^*} CH_3 - CH - CH_3$$
Propene
$$OH$$
Propene

(ii)

(iii)

$$\begin{array}{c} CH_3 - CH_2 - CH - CHO \xrightarrow{\text{NaBH}_4} CH_3 - CH_2 - CH - CH_2OH \\ l \\ CH_3 \\ 2 - Methylbutanal \\ 2 - Methylbutan - 1 - ol \end{array}$$

Question 11.6:

Give structures of the products you would expect when each of the following alcohol reacts with (a) HCl-ZnCl₂ (b) HBr and (c) SOCl₂.

(i) Butan-1-ol

(ii) 2-Methylbutan-2-ol

Answer

(a)

(i)

 $CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow{HCI - ZnCI_2} No reaction$ Butan - 1 - ol



Primary alcohols do not react appreciably with Lucas' reagent (HCI-ZnCl₂) at room temperature.

(ii)

$$CH_{3} - CH_{2} - \begin{pmatrix} OH \\ I \\ CH_{3} \end{pmatrix} \xrightarrow{HCI - ZnCI_{2}} CH_{3} - CH_{2} - \begin{pmatrix} CI \\ I \\ CH_{3} \end{pmatrix} \xrightarrow{HCI - ZnCI_{2}} CH_{3} - CH_{2} - \begin{pmatrix} CI \\ I \\ CH_{3} \end{pmatrix} \xrightarrow{H_{2}O} CH_{3} + H_{2}O$$

$$2 - Methylbutan - 2 - ol (3^{\circ}) \qquad 2 - Chloro - 2 - Methylbutane (White turbidity)$$

Tertiary alcohols react immediately with Lucas' reagent.

(b)

(i) $CH_3CH_2CH_2CH_2OH + HBr \xrightarrow{-H_2O} CH_3CH_2CH_2CH_2Br$ Butan - 1 - ol 1-Bromobutane

(ii)

$$\begin{array}{c} OH \\ CH_3 - CH_2 - \overset{OH}{c} - CH_3 + HBr \longrightarrow CH_3 - CH_2 - \overset{P}{c} - CH_3 + H_2O \\ \downarrow CH_3 \\ 2 - Methylbutan - 2 - ol (3^\circ) \\ 2 - Bromo - 2 - Methylbutane \\ \begin{array}{c} (c) \\ (i) \\ CH_3 CH_2 CH_2 CH_2 OH + SOCl_2 \longrightarrow CH_3 CH_2 CH_2 CH_2 CI + SO_2 + HCl \\ Butan - 1 - ol \\ 1 - chlorobutane \\ \begin{array}{c} (ii) \\ CH_3 - CH_2 - \overset{OH}{c} - CH_3 + SOCl_2 \longrightarrow CH_3 - CH_2 - \overset{Cl}{c} - CH_3 + SO_2 + HCl \\ \downarrow CH_3 \\ 2 - Methylbutan - 2 - ol \\ \end{array}$$

Question 11.7:

Predict the major product of acid catalysed dehydration of

(i) 1-methylcyclohexanol and



(ii) butan-1-ol

Answer



(ii)

 $\begin{array}{c} CH_{3}CH_{2}CH_{2}CH_{2}OH \xrightarrow{\text{Dehydration}} CH_{3}CH = CHCH_{3} + H_{2}O\\ Butan-1-ol & But-2-ene\\ (Major product) \end{array}$

Question 11.8:

Ortho and *para* nitrophenols are more acidic than phenol. Draw the resonance structures of the corresponding phenoxide ions.

Answer

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Resonance structure of the phenoxide ion





Resonance structures of *p*-nitrophenoxide ion



Resonance structures of *m*-nitrophenoxide ion

It can be observed that the presence of nitro groups increases the stability of phenoxide ion.

Question 11.9:

Write the equations involved in the following reactions:

- (i) Reimer-Tiemann reaction
- (ii) Kolbe's reaction

Answer





Question 11.10:

Write the reactions of Williamson synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol.

Answer

In Williamson synthesis, an alkyl halide reacts with an alkoxide ion. Also, it is an $S_N 2$ reaction. In the reaction, alkyl halides should be primary having the least steric hindrance. Hence, an alkyl halide is obtained from ethanol and alkoxide ion from 3methylpentan-2-ol.





2 - Ethoxy - 3 - methylpentane

Question 11.11:

Which of the following is an appropriate set of reactants for the preparation of 1methoxy-4-nitrobenzene and why?

(i) Br $+ CH_3ONa$ NO_2 (ii) ONa



Answer

Set (ii) is an appropriate set of reactants for the preparation of 1-methoxy-4nitrobenzene.



1 - Methoxy - 4 - nitrobenzene

In set (i), sodium methoxide (CH $_3$ ONa) is a strong nucleophile as well as a strong base. Hence, an elimination reaction predominates over a substitution reaction.

Question 11.12:

Predict the products of the following reactions:

(i)
$$CH_3 - CH_2 - CH_2 - O - CH_3 + HBr \rightarrow$$

(ii)





