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(Chapter 11)(Alcohols Phenols and Ethers)

Intext Questions

Question 11.1:

Classify the following as primary, secondary and tertiary alcohols:

(i)

(ii)
$$H_2C = CH - CH_2OH$$

$$(CH_3-CH_2-CH_2-OH_{iii})$$

(iv)

(v)

(vi)

$$CH = CH - C - OH$$

$$CH_3$$

$$CH_3$$

Answer

Primary alcohol → (i), (ii), (iii)

Secondary alcohol \rightarrow (iv), (v)

Tertiary alcohol → (vi)

Question 11.2:

Identify allylic alcohols in the above examples.

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Answer

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

Question 11.3:

Name the following compounds according to IUPAC system.

(i)

$$CH_2OH$$
 $CH_3-CH_2-CH-CH-CH-CH_3$
 $CH_3-CH_2-CH-CH-CH_3$
 $CH_3-CH_3-CH_3$

(ii)

(iii)

(iv)

$$H_2C = CH - CH - CH_2 - CH_2 - CH_3$$

OH

(v)

$$CH_3 - C = C - CH_2OH$$

$$CH_3 B_F$$

Answer

- (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

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Question 11.4:

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

Answer

(i)

(ii)

Question 11.5:

Write structures of the products of the following reactions:

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

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(iii)

Answer

(i)

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

Propene-2-ol

(ii)

$$\bigcup_{0}^{O} CH_{2} - C - OCH_{3} \xrightarrow{NaBH_{4}} \bigcup_{0}^{OH} CH_{2} - C - OCH_{3}$$

Methyl (2 – oxocyclohexyl) ethanoate Methyl (2 – hydroxycyclohexyl) ethanoate

(iii)

2 - Methylbutanal

2 - Methylbutan - 1 - ol

Question 11.6:

Give structures of the products you would expect when each of the following alcohol reacts with (a) $HCI-ZnCl_2$ (b) HBr and (c) $SOCl_2$.

- (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

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Primary alcohols do not react appreciably with Lucas' reagent ($HCI-ZnCl_2$) at room temperature.

(ii)

$$\begin{array}{c} OH \\ CH_{3}-CH_{2}-\overset{C}{\underset{C}{C}}-CH_{3} \\ CH_{3} \end{array} \xrightarrow{HCI-ZnCl_{2}} CH_{3}-CH_{2}-\overset{CI}{\underset{C}{\underset{C}{C}}}-CH_{3} \\ +H_{2}O \\ CH_{3} \end{array}$$

2 - Methylbutan - 2 - ol (3°)

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)

$$\begin{array}{c} OH & Br \\ | & | \\ CH_3 - CH_2 - C - CH_3 + HBr & \longrightarrow CH_3 - CH_2 - C - CH_3 + H_2O \\ | & | & | \\ CH_3 & | & | \\ \end{array}$$

2 - Methylbutan - 2 - ol (3°)

2 - Bromo - 2 - Methylbutane

(c)

(i)

$$CH_3CH_2CH_2CH_2OH + SOCl_2 \longrightarrow CH_3CH_2CH_2CI + SO_2 + HCI$$

Butan-1-ol l-chlorobutane

(ii)

$$CH_{3}-CH_{2}-\overset{OH}{\overset{1}{C}-}CH_{3}+SOCl_{2}\longrightarrow CH_{3}-CH_{2}-\overset{Cl}{\overset{1}{C}-}CH_{3}+SO_{2}+HCl_{3}$$

2 - Methylbutan - 2 - ol

2 - Chloro - 2 - Methylbutane

Question 11.7:

Predict the major product of acid catalysed dehydration of

(i) 1-methylcyclohexanol and

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(ii) butan-1-ol

Answer

(ii)

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

Question 11.8:

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

Answer

Resonance structure of the phenoxide ion

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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

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i. Reimer-Tiemann reaction

ii. Kolbe's reaction

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_N2 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.

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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)

(ii)

Answer

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

ONa OCH₃

$$+ CH_3Br \longrightarrow NO_2 + NaBr$$

1 - Methoxy - 4 - nitrobenzene

In set (i), sodium methoxide (CH_3ONa) 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)

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$$(iii)$$

$$CC_{2}H_{5} \xrightarrow{Conc.H_{2}O_{4}} \xrightarrow{Conc.H_{N}O_{3}}$$

$$(CH_{3})_{3}C - OC_{2}H_{5} \xrightarrow{III} \text{iv})$$
Answer
$$(i)$$

$$CH_{3} - CH_{2} - CH_{2} - O - CH_{3} + HBr \longrightarrow n\text{-propylmethyl ether}$$

$$CH_{3} - CH_{2} - CH_{2} - OH + CH_{3} - Br$$

$$Propanol \quad Bromomethane$$

$$(ii)$$

$$CC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OH} + C_{2}H_{5}Br$$

$$Ethoxybenzene \quad Phenol \quad Bromoethane$$

$$(iii)$$

$$CC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OC_{2}H_{5}} + C_{2}H_{5}Br$$

$$COC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OC_{2}H_{5}} + C_{2}H_{5}Br$$

$$COC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OC_{2}H_{5}} + C_{2}H_{5}Dr$$

$$COC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OC_{2}H_{5}} + C_{2}H_{5}Dr$$

$$COC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{OC_{2}H_{5}} + C_{2}H_{5}Dr$$

$$COC_{2}H_{5} \xrightarrow{Conc.H_{2}SO_{4}} \xrightarrow{$$