

Alcohol, Phenol & Ether (Assignment) ①

Solution

Q1 IUPAC Naming

- (i) 1-cyclohexylmethanol (ii) 3-Phenyl hexan-3-ol
 (iii) 2-Methyl-4-Phenoxy butane (iv) 1,2-Dimethoxy ethane
 (v) Phenoxybenzene (vi) 1-Phenoxy-1-phenyl methane
 (vii) 3-Methoxy butan-2-ol (viii) 1-Ethoxy-2,2-dimethyl cyclohexane
 (ix) $\begin{matrix} \text{CH}_3 & & \text{CH}_3 & & \text{CH}_3 \\ | & & | & & | \\ \text{C} & - & \text{C} & = & \text{C} \\ | & & | & & | \\ \text{CH}_3 & & \text{H} & & \text{H} \end{matrix}$ [6,6-Dimethyl hept-4-en-2-yn-1-ol]
 (x) 2,5-Dimethyl cyclohexan-1-ol

Q2 Name Rxn (Do this from class notes register)

Q3 Mechanism (Do this from photocopy notes of mechanism)

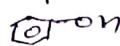
Q4 Distinguish Test

(i) Primary alcohol

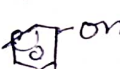
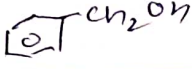
Test	1° Alcohol	2° Alcohol	3° Alcohol
Lucas Test	1° Alcohol + anhyd. ZnCl ₂ + conc. HCl ↓ No Rxn	2° Alcohol + anhyd. ZnCl ₂ + conc. HCl ↓ White fumes appears after 5min.	3° Alcohol + anhyd. ZnCl ₂ + HCl (conc.) ↓ White fumes appears immediately.

Test	Propan-1-ol CH ₃ CH ₂ CH ₂ OH (1° Alcohol)	Propan-2-ol CH ₃ -CH(OH)-CH ₃ (2° Alcohol)
Lucas Test	Propan-1-ol + anhyd. ZnCl ₂ + conc. HCl ↓ No change	Propan-2-ol + anhyd. ZnCl ₂ + conc. HCl ↓ White fumes appears after 5min.

(iii) Test	Ethanol $\text{CH}_3\text{CH}_2\text{OH}$ (1° Alcohol)	Propan-2-ol $\text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$ (2° Alcohol)
Lucas Test	Ethanol + anhyd. ZnCl_2 + conc. HCl ↓ No change	Propan-2-ol + anhyd. ZnCl_2 + conc. HCl ↓ white fumes appear after 5 min
(iv) Test	Ethanol $\text{CH}_3\text{CH}_2\text{OH}$ (1° Alcohol)	Propan-1-ol $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (1° Alcohol)
Iodoform Test	Ethanol + NaOH + I_2 ↓ Δ Yellow ppt of CHI_3	Propan-1-ol + NaOH + I_2 ↓ Δ No change
(v) Test	Propan-2-ol $\text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$ (2° Alcohol)	2-methyl Propan-2-ol $\text{CH}_3-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3$ (3° Alcohol)
Lucas Test	Propan-2-ol + Anhyd. ZnCl_2 + HCl (conc) ↓ white fumes appear after 5 min	2-methyl Propan-2-ol + anhyd. ZnCl_2 + HCl (conc) ↓ white fumes appear immediately,
(vi) Test	Ethanol $\text{CH}_3\text{CH}_2\text{OH}$ (1° Alcohol)	Methanol CH_3OH (1° Alcohol)
Iodoform Test	Ethanol + NaOH + I_2 ↓ Δ Yellow ppt (CHI_3)	Methanol + NaOH + I_2 ↓ Δ No change

(vii)	Test	Ethanol $\text{CH}_3\text{CH}_2\text{OH}$	Phenol 
	FeCl_3 Test	Ethanol + FeCl_3 ↓ No change	Phenol + FeCl_3 ↓ violet colouration

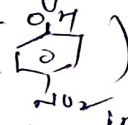
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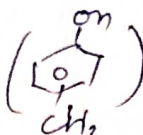
(viii)	Test	Phenol 	Benzyl alcohol 
	FeCl_3 Test	Phenol + FeCl_3 ↓ violet colouration	Benzyl alcohol + FeCl_3 ↓ No change

(ix)	Test	Propan-1-ol $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (1° alcohol)	2-methyl Propan-2-ol $\text{CH}_3\overset{\text{CH}_3}{\underset{\text{OH}}{\text{C}}}\text{CH}_3$ (3° alcohol)
	Lucas Test	Propan-1-ol + anhyd. ZnCl_2 + HCl (conc.) ↓ No Rxn	2-methyl Propan-2-ol + anhyd. ZnCl_2 + HCl (conc.) ↓ White fumes appear immediately

Q5 Reason

(i) Phenol is acidic in nature because the phenoxide ion thus form after removal of H^+ is more resonating stabilised than Phenol.

(ii) p-nitrophenol () is more acidic than Phenol because $-\text{NO}_2$ group in p-nitrophenol is electron withdrawing group (EWG), which help to stabilise the p-nitrophenoxide ion more stabilised than simply phenoxide ion after removal of H^+ .

(iii) cresol is less acidic () than phenol because ⁽¹⁾
-CH₃ gp. in cresol is electron donating group which destabilised ~~the~~ its conjugate base after removal of H⁺ than phenol.

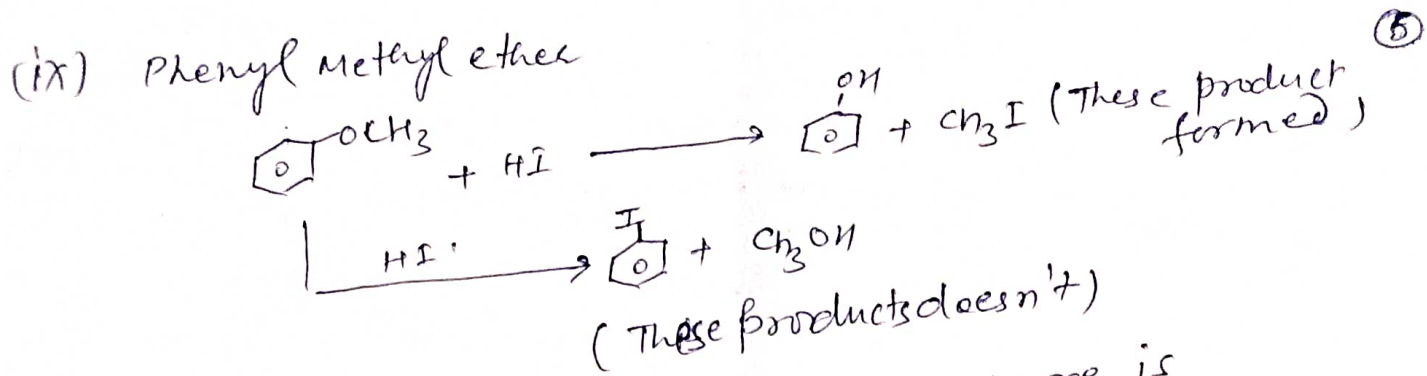
(iv) o-Nitrophenol is steam volatile because in o-nitrophenol there is weaker intermolecular H-bonding while p-nitrophenol is not steam volatile, in which there is stronger intermolecular H-bonding.

(v) Boiling point of isomeric alcohol are
 $1^\circ \text{Alcohol} > 2^\circ \text{Alcohol} > 3^\circ \text{Alcohol}$ because surface area of 1° alcohol is highest so strength of intermolecular H-bonding is largest.

(vi) Alcohols are more soluble in water than hydrocarbon because alcohol can easily form intermolecular H-bond with water.

(vii) Boiling point of ether are lower than its isomeric alcohol because in ether there is weaker vanderwaal's intermolecular forces while in alcohol there is stronger intermolecular H-bonding.

(viii) Symmetrical ethers are polar due to its structure similar to that of water according to VSEPR. So resultant dipole moment of ether is not zero.



Because in phenyl methyl ether there is double bond character between carbon of benzene and oxygen due to resonance which can't be split under the normal condition to form iodobenzene.

(x) Electrophilic substitution rxn like bromination, nitration is quicker in phenol than benzene because $-\text{OH}$ gp. in phenol is highly activating group.

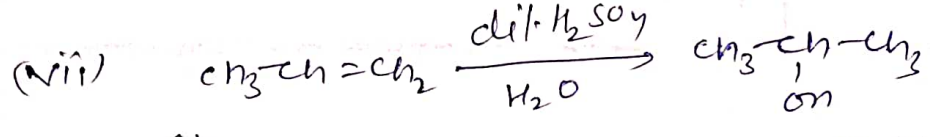
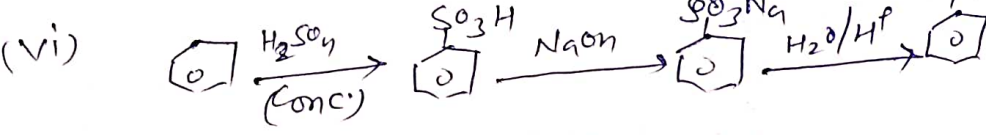
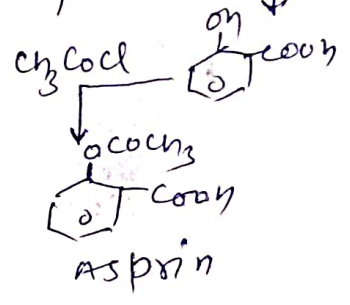
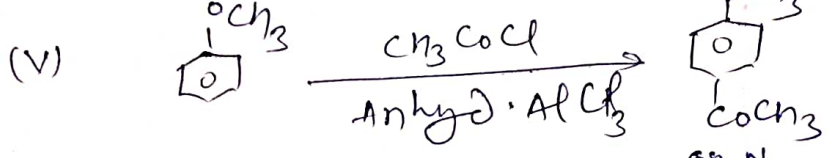
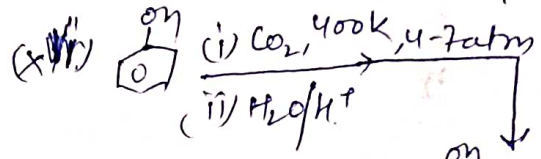
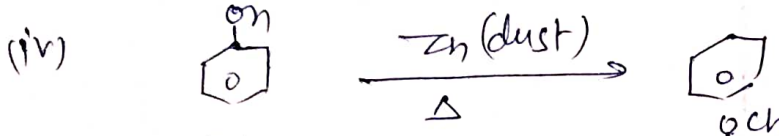
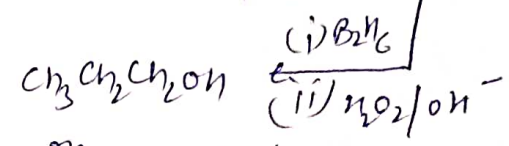
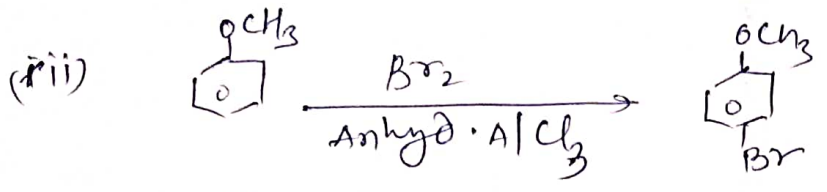
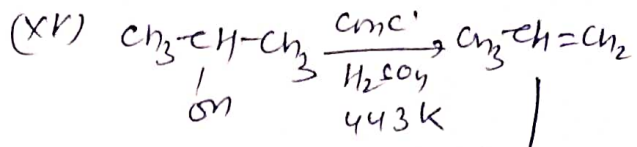
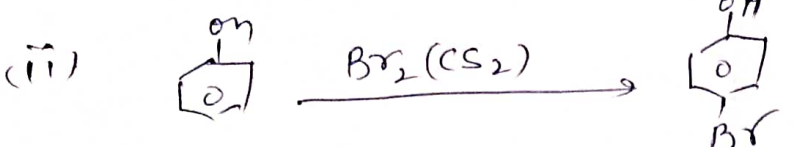
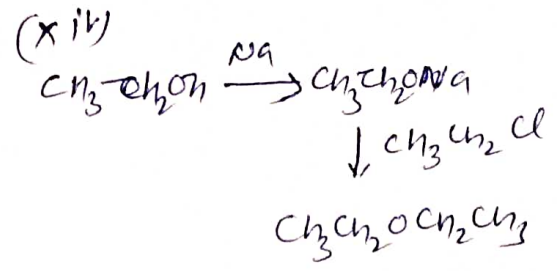
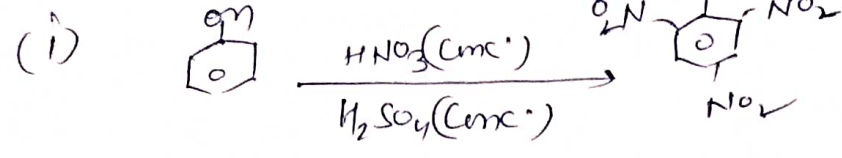
(xi) This is due to Williamson's synthesis reaction always carried out according with $\text{S}_\text{N}2$ mechanism.

(xii) ~~acid~~ In secondary and tertiary alcohols, the alkyl group create steric hindrance and the nucleophilic substitution rxn becomes difficult. Hence elimination to form alkene is favoured over substitution to form ether.

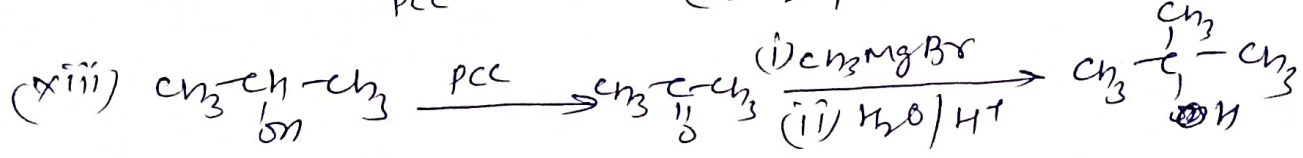
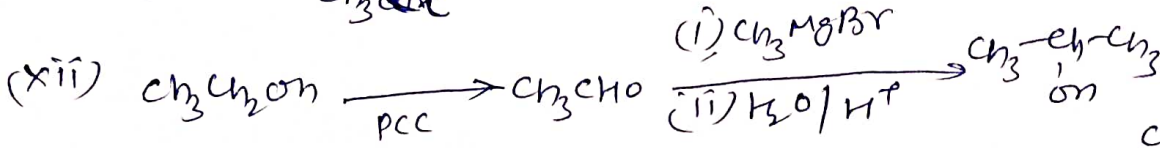
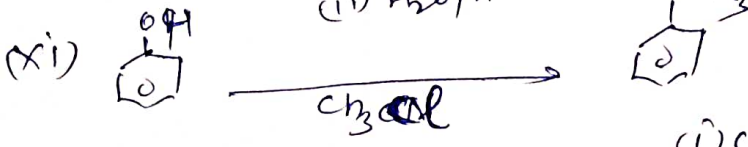
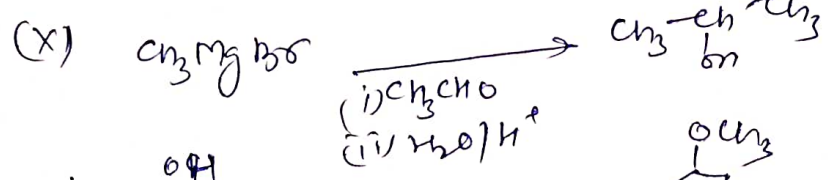
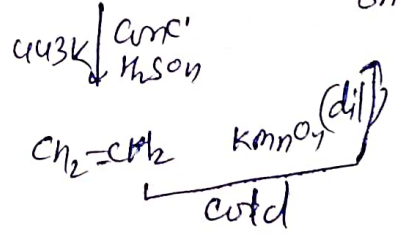
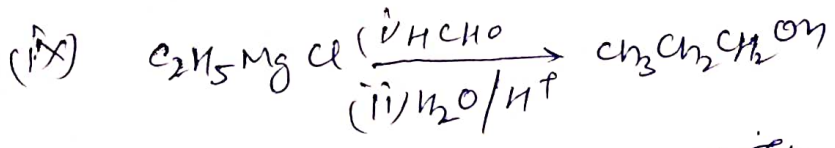
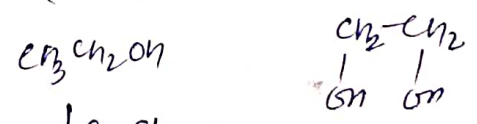
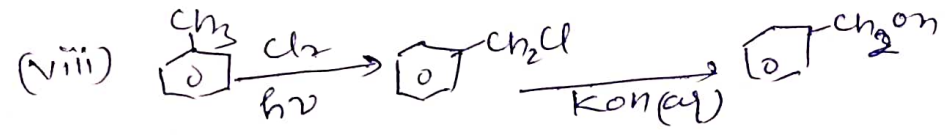
(xiii) order of reactivity of halogen acid

$\text{HCl} < \text{HBr} < \text{HI}$
 as bond length increases & bond strength decreases.

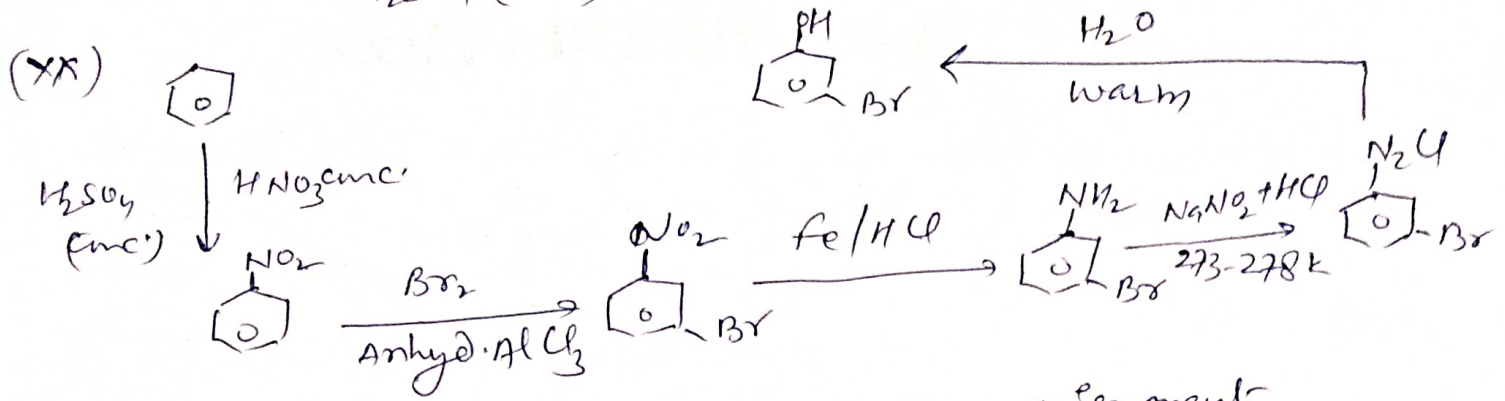
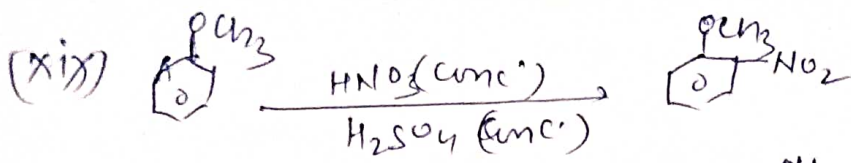
Q6 Conversion



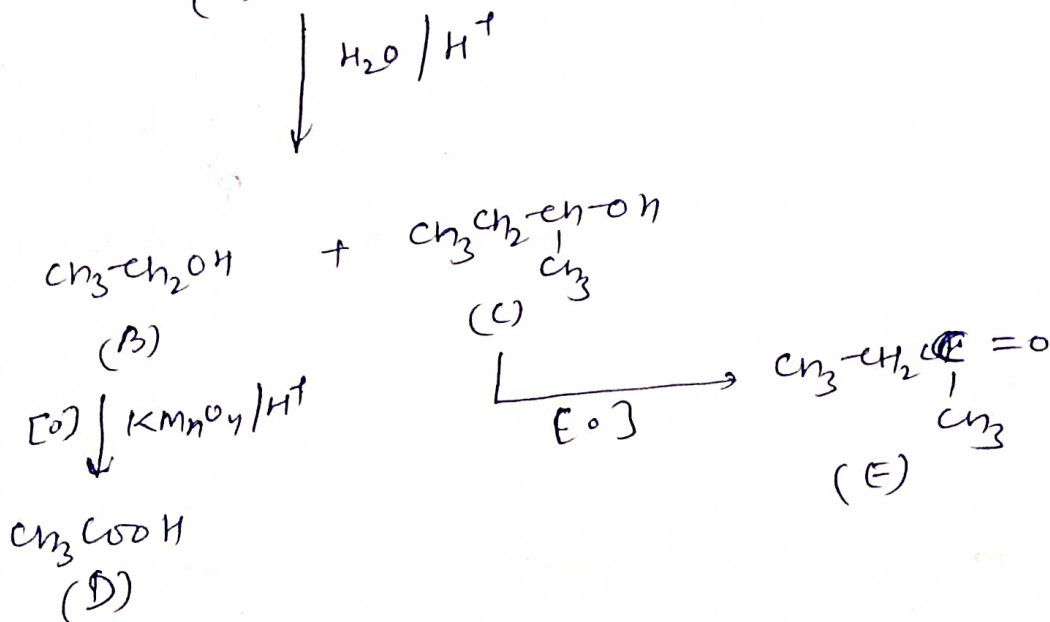
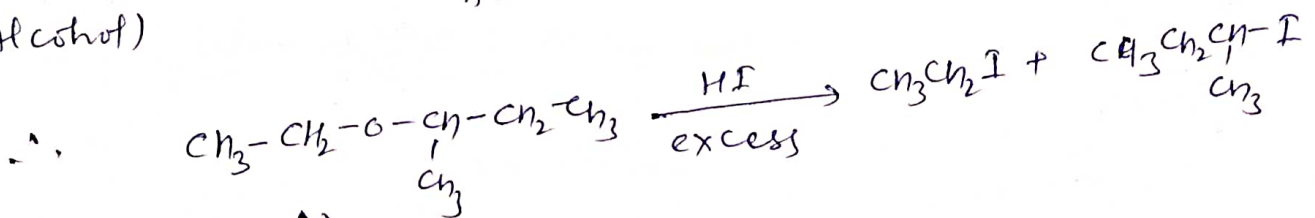
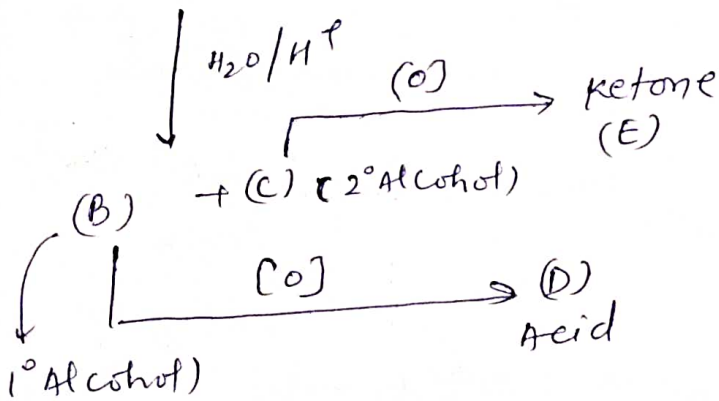
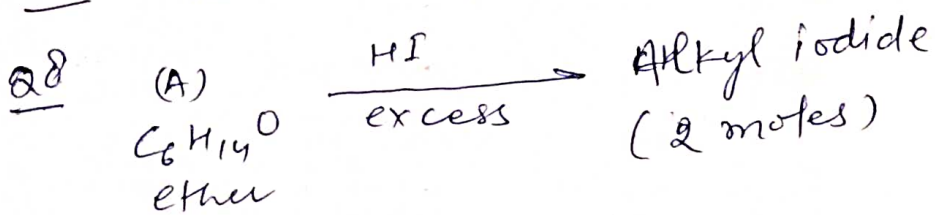
(xviii)

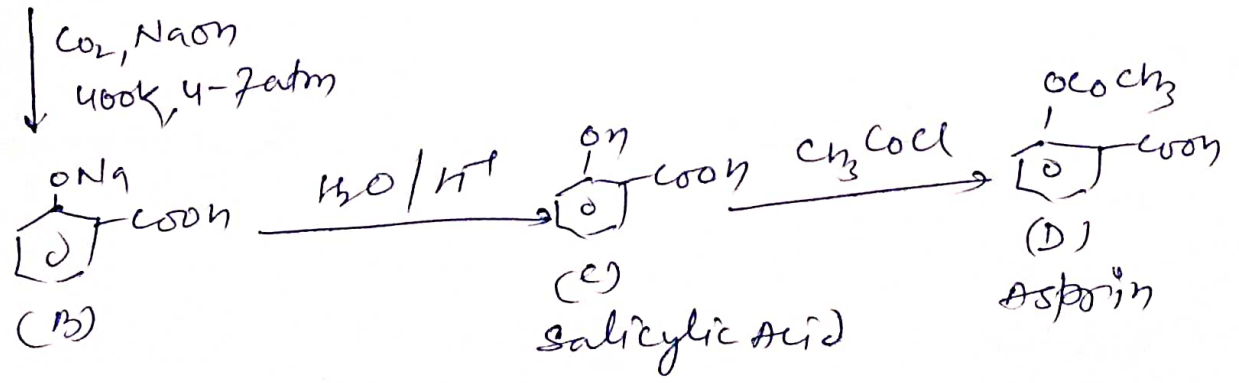
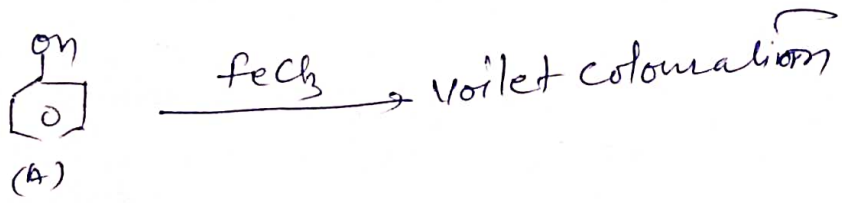
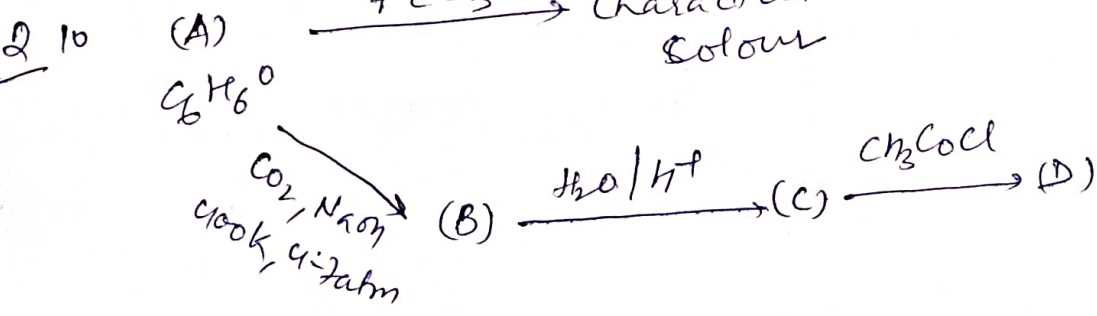
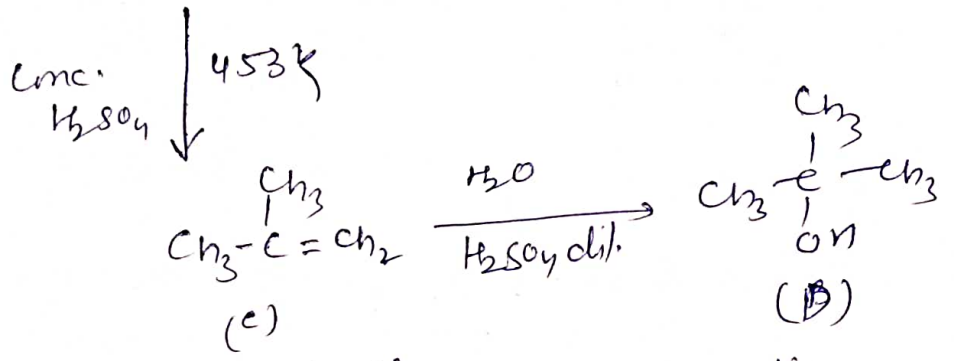
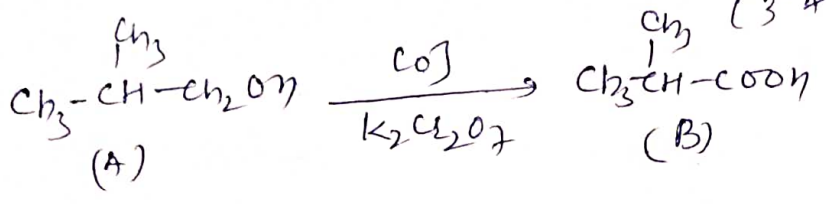
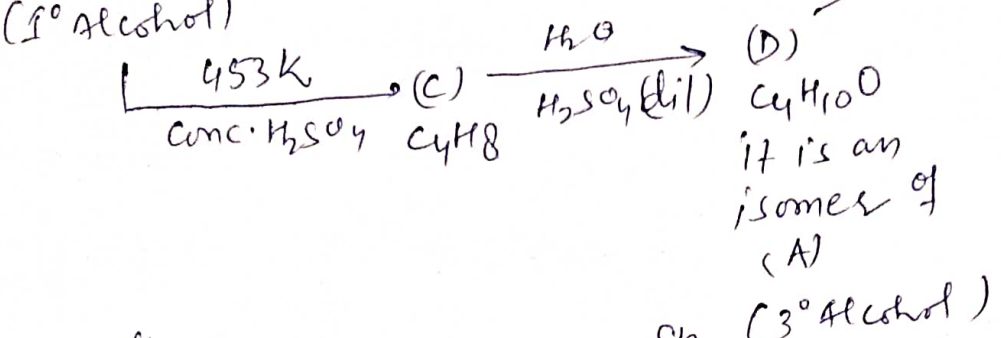
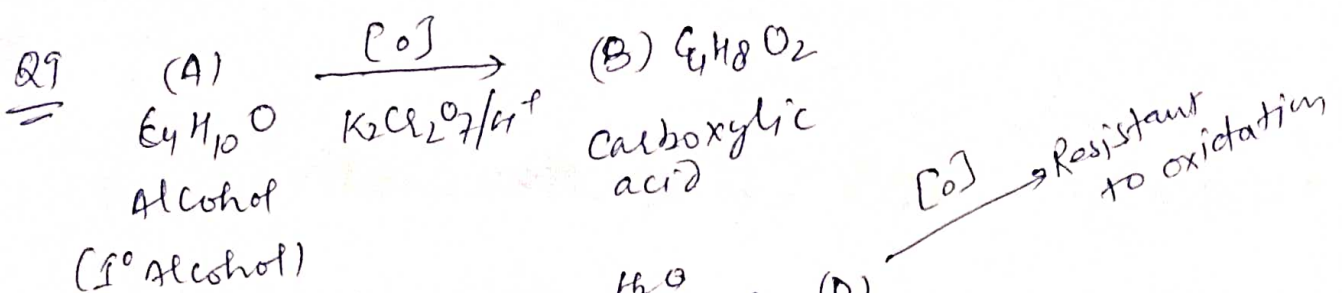


~~(xiv)~~

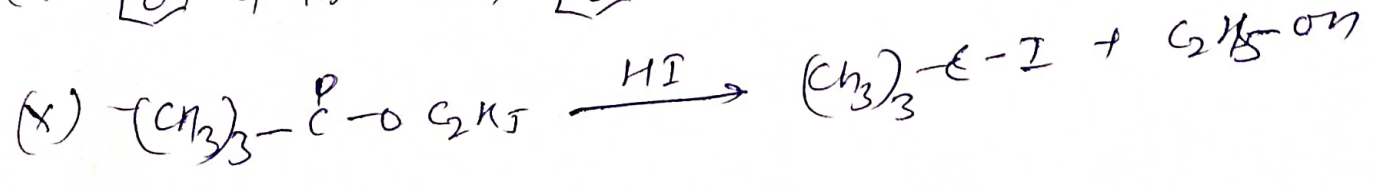
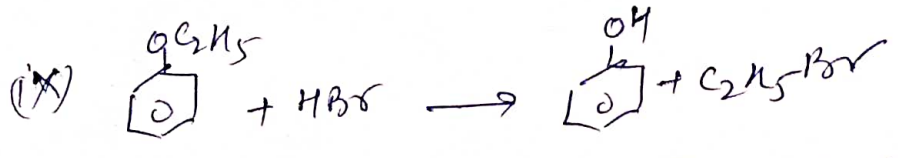
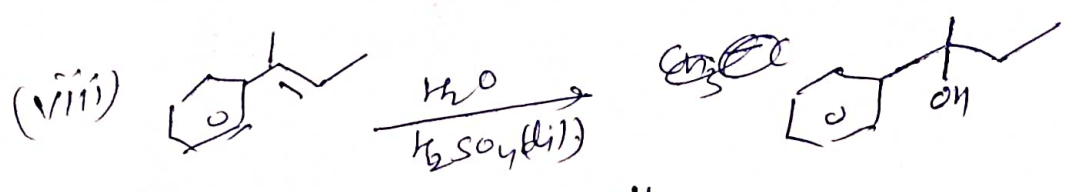
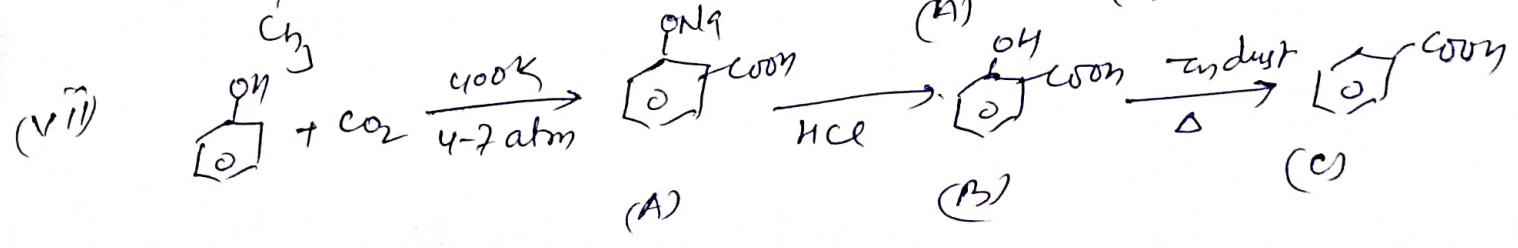
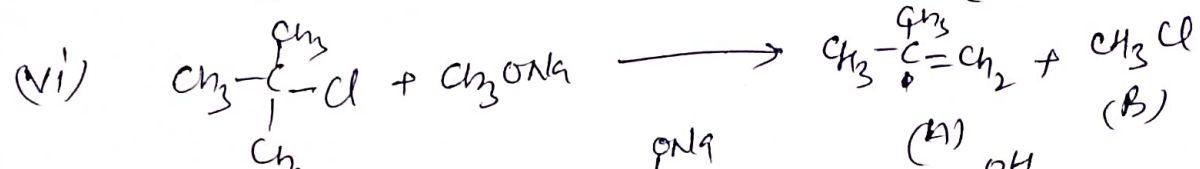
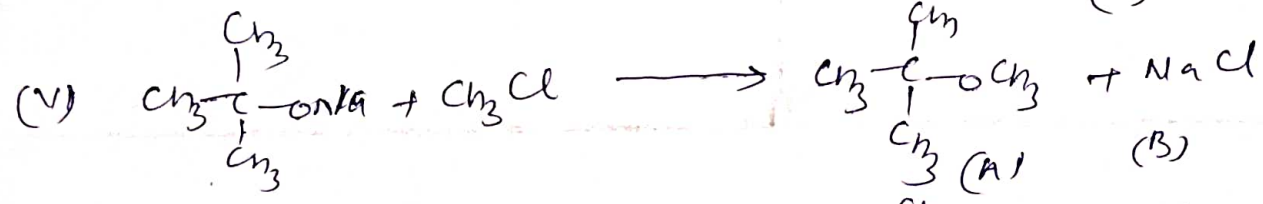
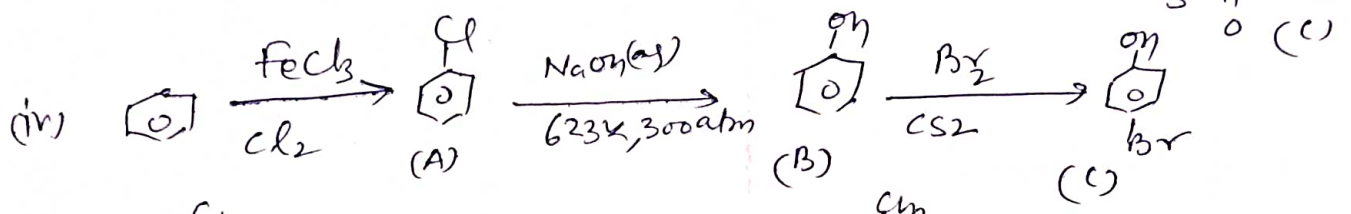
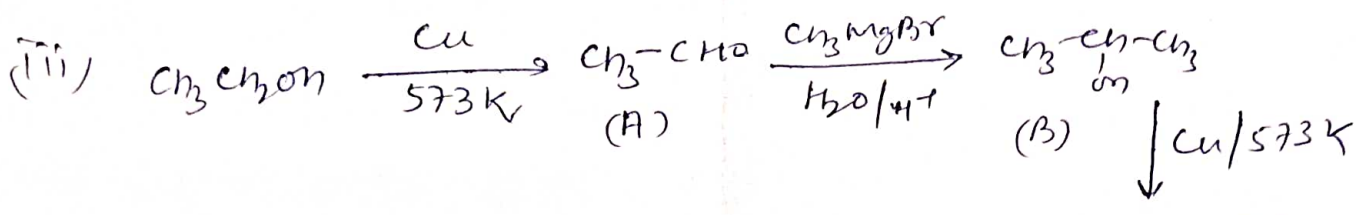
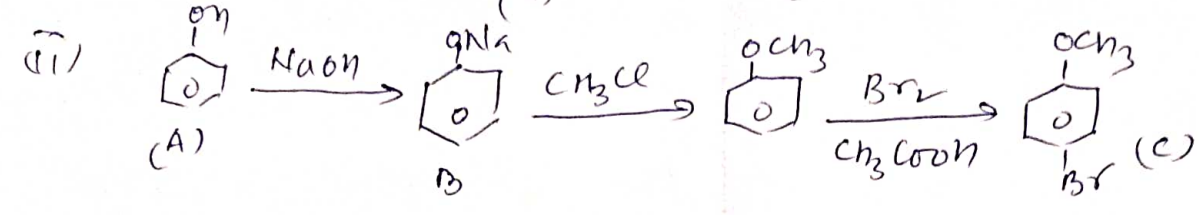
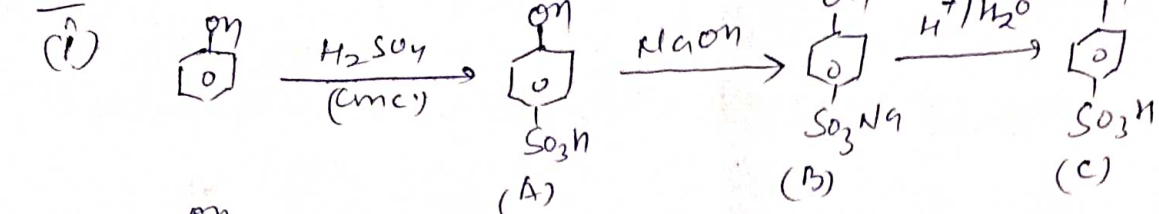


Q7 Answer is given itself in the assignment

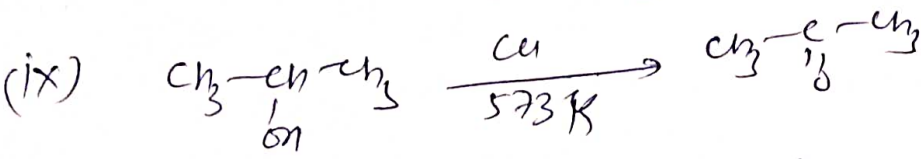
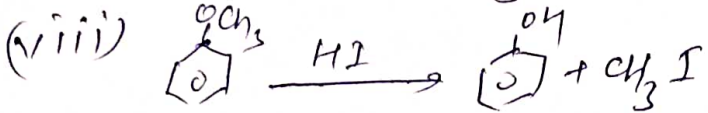
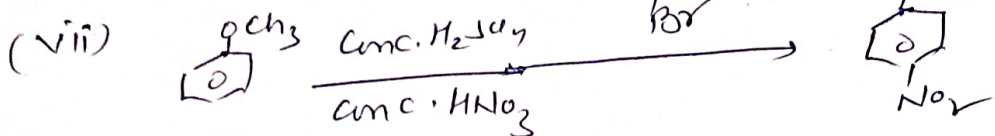
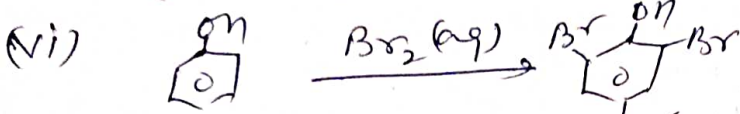
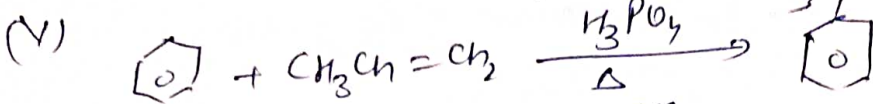
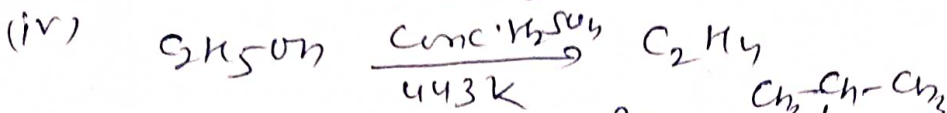
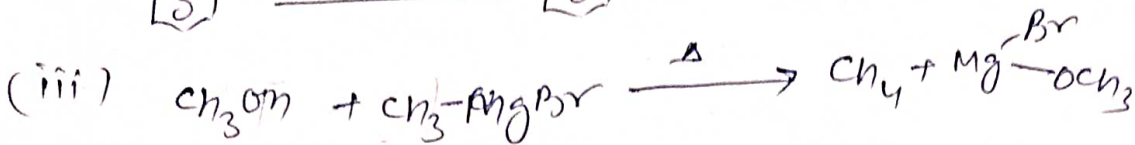
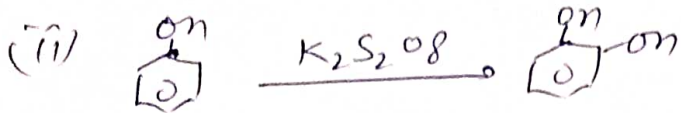
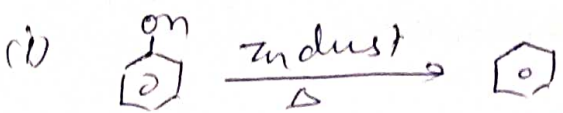
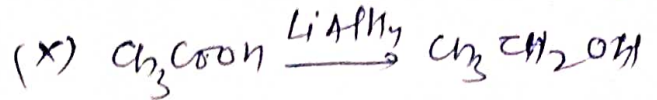




Q 11 complete the Rxn



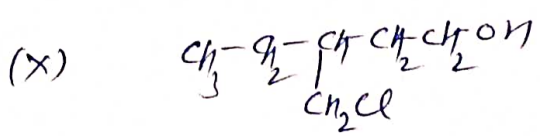
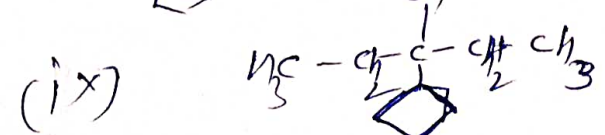
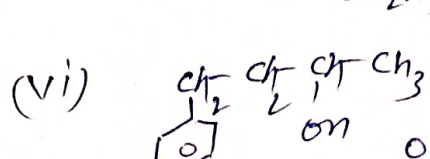
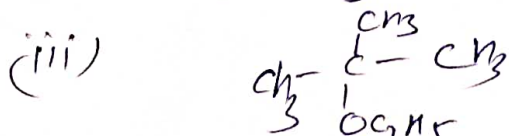
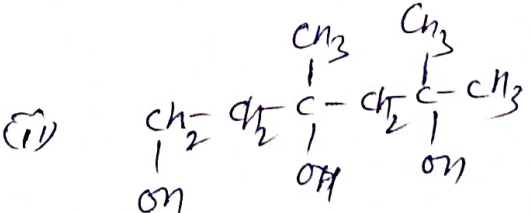
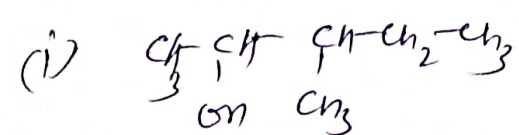
Q12 Write main product



Q13 Name the reagent used.

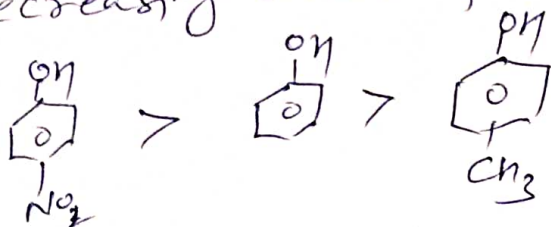
- (i) KMnO4/H+ (ii) PCC (iii) Br2(aq)
- (iv) conc. H2SO4/443K (v) LiAlH4

Q14 structure of comp.



Q15 (a) $\text{CH}_3\text{-}\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}\text{-OH}$ gives the fastest reaction with HBr as it will form 3° carbocation which is the most stable one. (11)

Q16 Decreasing order of acidic character



Q17 Complete the reactions

