2025/FYUG/ODD/SEM/
CHMDSC–202T/460

FYUG Odd Semester Exam., 2025

CHEMISTRY

(3rd Semester)

Course No. : CHMDSC–202T

(Functional Group Chemistry)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following questions : 2×2=4

(a) Cl in chlorobenzene is deactivating yet *ortho*- and *para*-directing. Explain.

(b) Arrange the following alkyl halides in order of their reactivity towards nucleophilic substitution reaction. Justify your answer.

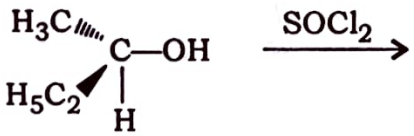
$CH_2=CH-Cl$, CH_3CH_2-Cl, $CH_2=CH-CH_2-Cl$

(c) How will you convert chlorobenzene to (i) benzene and (ii) DDT?

2. Answer any *one* of the following questions : 10

(a) (i) CH_3CH_2Cl hydrolyses slowly in the aqueous medium but the reaction is rapid in the presence of catalytic amount of KI. Explain. 2

(ii) Complete the following reaction and write the mechanism : 1+2=3



(iii) Give the mechanistic steps and mark the major product for the following reaction : 3

$$(CH_3)_3CBr \xrightarrow[75\,^\circ C]{H_2O}$$

(iv) What happens when alkyl halide is treated with NaCN and AgCN separately? Justify your answer with reason. 2

(b) (i) Which of the following reactions will yield $CH_3-O-C_6H_5$? Justify your answer. 2

$$CH_3ONa + C_6H_5Cl \longrightarrow$$

$$C_6H_5ONa + CH_3Cl \longrightarrow$$

(ii) Explain the mechanism of S_N1 reaction including stereochemistry using a suitable example. 3

(iii) Give a suitable mechanism for the following reaction : 3

$$CH_3-CH=CH-CH_2Cl \xrightarrow{NaOH} CH_3-CH=CH-CH_2OH +$$

$$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH=CH_2$$

(iv) Write the products of the following reactions : 1×2=2

(1) $CH_3COOAg + Br_2 \xrightarrow{CCl_4}$

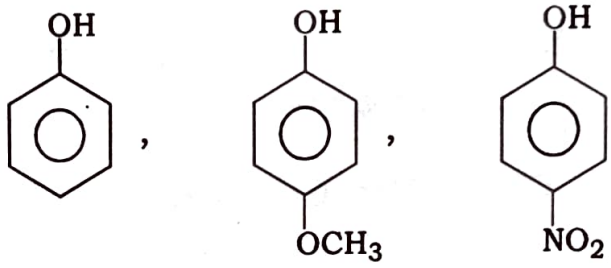
(2) $C_6H_5Cl + CH_3Cl \xrightarrow{Na}$

UNIT—II

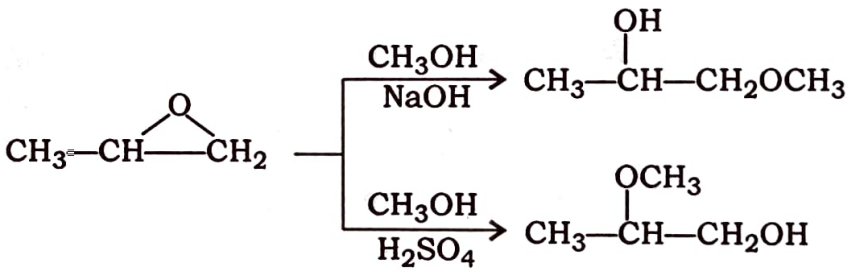
3. Answer any *two* of the following questions : 2×2=4

(a) How will you synthesize 2° and 3° alcohol using Grignard reagent? Give reactions.

(b) Arrange the following phenol in increasing order of acidity. Justify your answer with reason :



(c) Give reason to justify the following product formation :



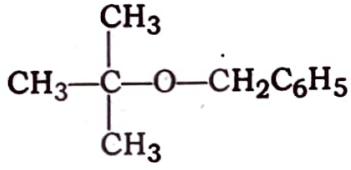
4. Answer any *one* of the following questions : 10

(a) *(i)* Complete the following reactions and write the mechanisms : 3×2=6

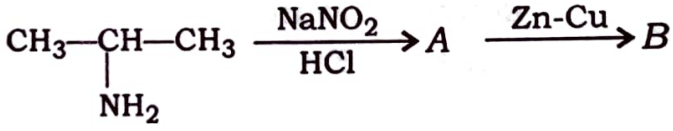
(1) $CH_3-\underset{OH}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_2}} \xrightarrow{HIO_4} ? + ?$

(2) $CH_3CH_2CH_2-\overset{O}{\overset{\|}{C}}-OC_2H_5 \xrightarrow[C_2H_5OH]{Na} ? + ?$

(ii) How will you synthesize the following by Williamson's synthesis? Write the mechanism of the reaction. 1+2=3

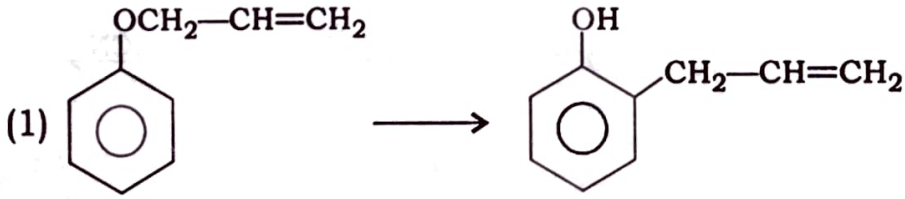


(iii) Identify *A* and *B* : ½×2=1

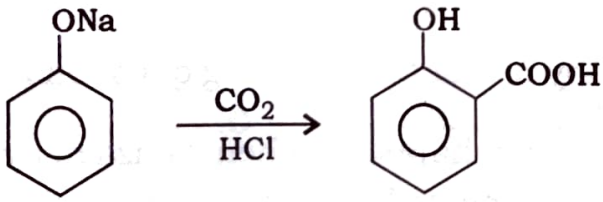


(b) *(i)* Write the mechanisms for the following reactions : 3×2=6

(1)



(2)



(ii) Convert the following : 1½×2=3

(1) $CH_3OH \longrightarrow CH_3CH_2OH$

(2) $C_6H_6 \longrightarrow C_6H_5OH$

(iii) Write the chemical reaction between phenol and ferric chloride solution. 1

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

(a) Aldehydes are more reactive than ketone towards nucleophilic addition reaction. Explain.

(b) Distinguish CH_3CHO and C_6H_5CHO with chemical reactions.

(c) Identify *A*, *B*, *C* and *D* : ½×4=2

(i) $PhCOCl \xrightarrow{H_2,\ Pd\text{-}BaSO_4} A \xrightarrow{KCN} B$

(ii) $HC{\equiv}CH \xrightarrow{HgSO_4,\ H_2SO_4} C \xrightarrow[HCl]{Zn\text{-}Hg} D$

6. Answer any *one* of the following questions : 10

(a) (i) What happens when benzaldehyde is heated with conc. NaOH solution? Give the mechanism of the reaction. 1+2=3

(ii) An alkene C_6H_{12} after ozonolysis yielded two products. One of these gave a positive iodoform test

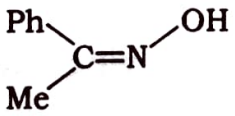
but negative Tollen's test. The other product gave a positive Tollen's test but negative iodoform test. Identify both the products and give chemical reaction of both positive iodoform and Tollen's test. 1+2=3

(iii) Give the mechanism of HCN addition to acetaldehyde. 2

(iv) Identify *A*, *B*, *C* and *D* : ½×4=2

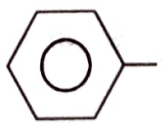
$$C_6H_5CHO \xrightarrow{HCN} A \xrightarrow{H_3O^+} B \xrightarrow{SOCl_2} C \xrightarrow{H_2,\ Pd\text{-}BaSO_4} D$$

(b) *(i)* Complete the following reactions and write the mechanisms : 3×3=9

(1) 

$\xrightarrow[ii)\ H_2O]{i)\ PCl_5/ether}$

(2) $CH_3CHO \xrightarrow[KOH]{NH_2NH_2}$

(3) 

$\xrightarrow{CH_3COONa}$

(ii) Give one example of crossed aldol condensation reaction. 1

UNIT—IV

7. Answer any *two* of the following questions : 2×2=4

(a) What happens when—

(i) maleic acid is heated;

(ii) oxalic acid is treated with $KMnO_4$ in acidic medium? 1+1=2

(b) Convert acetic acid to propanoic acid.

(c) Identify *A*, *B*, *C* and *D* : ½×4=2

(i) $CH_3COOCH_3 \xrightarrow{PCl_5} A + B$

(ii) $C_6H_6 + CH_3COCl \xrightarrow{AlCl_3} C$

(iii) $CH_3CONH_2 \xrightarrow{Br_2/NaOH} D$

8. Answer any *one* of the following questions : 10

(a) *(i)* Explain the following : 1½×2=3

(1) Formic acid reduces Tollen's reagent

(2) Oxalic acid is stronger than acetic acid

(ii) Sketch the mechanism of base catalyzed hydrolysis of ester by taking a suitable reaction. 3

(iii) Complete the following reactions : 1×4=4

(1) $CH_3CH(OH)COOH \xrightarrow[Fe^{3+}]{H_2O_2}$

(2) $\begin{matrix} CH_2COOH \\ | \\ CH(OH)COOH \end{matrix} \xrightarrow[\Delta]{2HI}$

(3) $\begin{matrix} HC—COOH \\ \| \\ HC—COOH \end{matrix} \xrightarrow{\text{Alk. } KMnO_4}$

(4) $\begin{matrix} HOOC—CH \\ \quad\quad \| \\ \quad\quad CH—COOH \end{matrix} \xrightarrow{Na/Hg}$

(b) *(i)* Describe the following reactions with mechanisms : 3×2=6

(1) Dieckmann reaction

(2) Reformatsky reaction

(ii) Explain why— 1½×2=3

(1) acetamide is a weak base;

(2) acid chloride is more reactive than ester towards nucleophilic substitution reaction.

(iii) Identify *A* and *B* : ½×2=1

$$CH_3CONH_2 \xrightarrow{P_2O_5} A \xrightarrow{H_3O^+} B$$

UNIT—V

9. Answer any *two* of the following questions : 2×2=4

(a) How will you synthesize benzene to benzene sulphonic acid and vice versa?

(b) Write a short note on diazocoupling reaction.

(c) Complete the following reactions : 1×2=2

(i) $CH_3CN \xrightarrow{SnCl_2/HCl}$

(ii) $C_6H_5NH_2 + CHCl_3 + NaOH \longrightarrow$

10. Answer any *one* of the following questions : 10

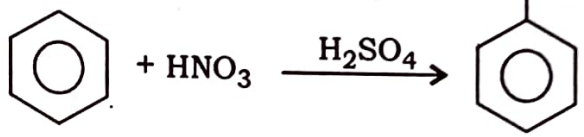
(a) *(i)* How do 1°, 2° and 3° amines react with nitrous acid? Give the chemical reaction. 3

(ii) Explain the following : 1½×2=3

(1) Aniline is less basic than methyl amine

(2) Aliphatic diazonium salt is unstable

(iii) Write the mechanisms of the following reactions : 2×2=4

(1) 

(2) $CH_3COCl + CH_3NH_2 \longrightarrow CH_3CONHCH_3$

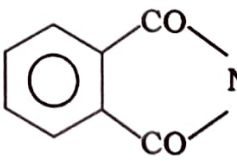
(b) *(i)* How will you distinguish the following pairs of compounds? 1½×2=3

(1) CH_3CN and CH_3NC

(2) CH_3NH_2 and CH_3NO_2

(ii) Complete the following reactions and write the mechanisms : 3×2=6

(1) $HCHO + (CH_3)_2NH + CH_3COCH_3 \xrightarrow{H^+} ?$

(2)  $+ CH_3Cl + KOH \longrightarrow ?$

(iii) Identify *A* and *B* : ½×2=1

$$CH_3OCH_3 \xrightarrow[\Delta]{P_2S_5} A \xrightarrow{H_2O_2} B$$

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