

Total No. of Printed Pages—7

**4 SEM TDC CHMH (CBCS) C 8**

**2024**

( May/June )

**CHEMISTRY**

( Core )

Paper : C-8

**( Inorganic Chemistry )**

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Select the correct answer : 1×6=6

(a) Which of the following has the highest lability?

(i)  $\text{SF}_6$

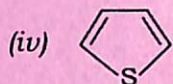
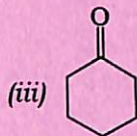
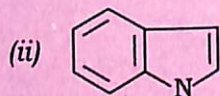
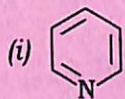
(ii)  $[\text{PF}_6]^-$

(iii)  $[\text{SiF}_6]^{2-}$

(iv)  $[\text{AlF}_6]^{3-}$

( 2 )

(b) Which of the following is not a heterocyclic compound?



(c) Which one of the following is not a terpene?

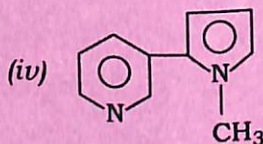
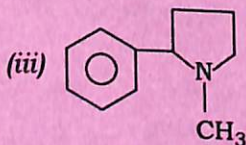
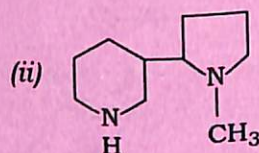
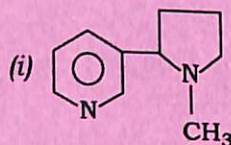
(i) Myrcene

(ii) Citral

(iii) Camphor

(iv) Quinine

(d) The chemical structure of nicotine is



P23/993

( Continued )

( 3 )

2. Answer any *four* questions from the following : 2×4=8

(a) What is diazotization? How is benzene diazonium chloride prepared in the laboratory?

(b) Aromatic amines are weaker bases than aliphatic amines. Explain.

(c) Sulphonation of naphthalene gives  $\alpha$ -isomer at low temperature and  $\beta$ -isomer at high temperature. Explain.

(d) Thiophene is more aromatic in nature than furan. Explain.

(e) What are the structural formulae of hygrine and conine?

#### UNIT—I

3. Answer any *three* questions : 3×3=9

(a) How would you distinguish among 1°, 2° and 3° amines with the help of nitrous acid?

(b) Write short notes on any *two* of the following : 1½×2=3

(i) Hofmann's exhaustive methylation

(ii) Hofmann elimination reaction

(iii) Gabriel phthalimide synthesis

P23/993

( Turn Over )

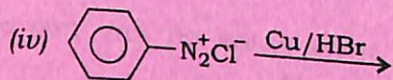
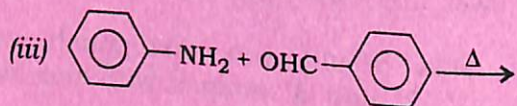
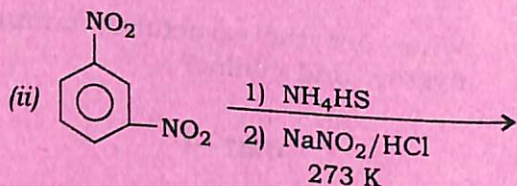
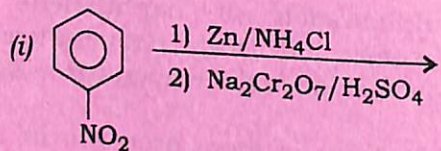
( 4 )

(c) Discuss the synthesis of the following :  
 $1\frac{1}{2}\times 2=3$

(i) Azobenzene from aniline

(ii) *m*-nitroaniline from nitrobenzene

(d) Complete the following reactions  
(any three) :  $1\times 3=3$

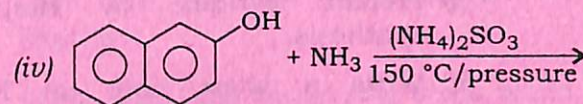
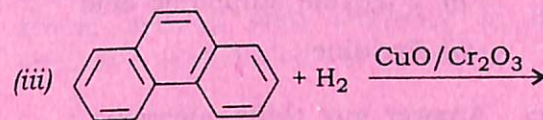
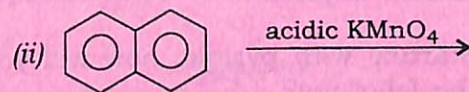
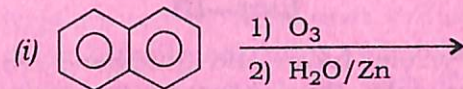


( 5 )

UNIT—II

4. Answer any three questions :  $3\times 3=9$

(a) Complete the following reactions  
(any three) :  $1\times 3=3$



(b) Explain why, electrophilic substitution of anthracene and phenanthrene mainly takes place at 9 and 10 positions.

(c) How will you convert any two of the following?  $1\frac{1}{2}\times 2=3$

(i) Naphthalene into  $\alpha$ -naphthol

(ii) Phenanthrene into diphenic acid

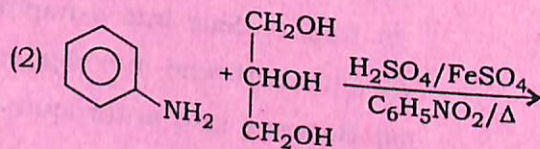
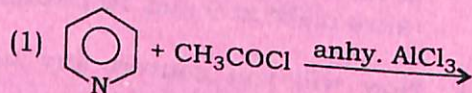
(iii) Benzene into anthraquinone

( 6 )

- (d) Prepare naphthalene with the help of Haworth's synthesis. What happens when naphthalene is treated with hydrogen in presence of nickel catalyst?  
2+1=3

**UNIT—III**

5. (a) Pyrrole, furan and thiophene are more reactive than benzene to electrophilic attack. Explain. 2
- (b) Starting with pyrrole, how will you get the following? 1+1=2
- (i) 2-pyrrole sulphonic acid
- (ii) Pyridine
- (c) Answer any three questions : 2×3=6
- (i) Prepare pyridine by Hantzsch synthesis.
- (ii) Write a short note on Knorr quinoline synthesis.
- (iii) Complete the following reactions : 1+1=2



P23/993

( Continued )

( 7 )

- (iv) Convert the following : 1+1=2
- (1) Thiophene from sodium succinate
- (2) Furan from furfural

- (d) Explain why pyridine does not undergo Friedel-Crafts reactions. What happens when pyridine is treated with  $\text{KNO}_3$  in presence of  $\text{H}_2\text{SO}_4$  at  $300^\circ\text{C}$ ? 2+1=3

**UNIT—IV**

6. (a) Explain Zeisel method and Herzig-Meyer method with reference to the structure elucidation of alkaloids. 2

Or

Give one method of synthesis of hygrine.

- (b) Write down the sequential steps when Hofmann exhaustive methylation is employed with nicotine and name the product. 2
- (c) Give one medicinal use each of morphine and quinine.  $\frac{1}{2} \times 2 = 1$

**UNIT—V**

7. (a) What is special isoprene rule? Explain with example. 1

P23/993

( Turn Over )

- (b) How will you show that citral is an  $\alpha$ ,  $\beta$  unsaturated aldehyde? 2

Or

Draw the geometrical structure of citral.

- (c) How will you synthesize the following (any one)? 2

(i) Citral from methylheptenone

(ii) Geranic acid from geraniol

\*\*\*

Total No. of Printed Pages—8

**4 SEM TDC CHMH (CBCS) C 10**

**2024**

( May/June )

**CHEMISTRY**

( Core )

Paper : C-10

**( Physical Chemistry )**

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Choose the correct answer (any five) :  $1 \times 5 = 5$

(a) The unit of ionic mobility is

(i)  $\text{ms}^{-1}$

(ii)  $\text{ms}^{-1}\text{V}^{-1}$

(iii)  $\text{m}^2\text{s}^{-1}\text{V}^{-1}$

(iv)  $\text{m}^1\text{s}^{-1}\text{V}^{-1}$

( 2 )

(b) During electrolysis, using non-attackable (Pt) electrode, the fall of concentration around the cathode is

(i) equal to the mobility of the cation,  $\nu_+$

(ii) equal to the mobility of the anion,  $\nu_-$

(iii) proportional to the mobility of the cation,  $\nu_+$

(iv) proportional to the mobility of the anion,  $\nu_-$

(c) If we increase the frequency of alternating current, the conductance of an electrolytic solution increases leading to a limiting value; which is called

(i) Walden's rule

(ii) Debye-Falkenhagen effect

(iii) Wien effect

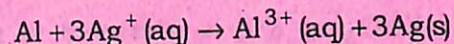
(iv) Fick's law

24P/1281

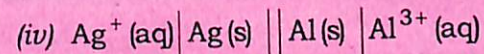
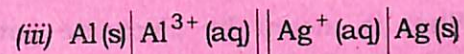
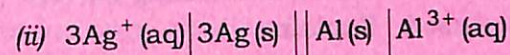
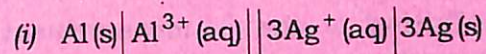
( Continued )

( 3 )

(d) For the cell reaction,



the correct cell notation is



(e) The ferromagnetic transition occurs at

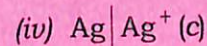
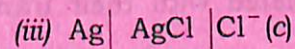
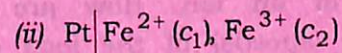
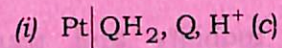
(i) Neel temperature

(ii) Curie temperature

(iii) Boyle's temperature

(iv) critical temperature

(f) Which is an example of metal-insoluble salt electrode?



24P/1281

( Turn Over )

( 4 )

2. Answer the following questions :  $2 \times 5 = 10$

- (a)  $\text{KNO}_3$  or  $\text{KCl}$  is preferred to make salt bridges. Explain why.
- (b) During the measurement of conductance alternating current (AC) is used. Explain.
- (c) What is meant by electrode potential and standard electrode potential?
- (d) Is the transport number constant for an ion? Justify with suitable examples.
- (e) Dipole moments of the three isomers of dihalo substituted benzene *P*, *Q* and *R* are 0 D, 1.5 D and 2.13 D respectively. Identify *P*, *Q* and *R*.

3. Answer the following questions {either (a) or (b)} : 3

- (a) Define ionic mobility and transport number of an ion. How are ionic mobilities (speeds) of the ions of an electrolyte related with their transport number?  $1+1+1=3$

( 5 )

Or

- (b) In conductometric titration, explain why the concentration of the titre solution should be 10 to 100 times more than the solution to be titrated. If not so, how can you correct the conductance readings?  $1+1+1=3$

4. Answer any *three* of the following questions :  $4 \times 3 = 12$

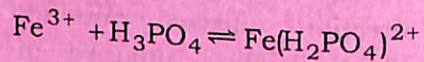
- (a) Define the terms 'specific conductance' and 'equivalent conductance'. Explain why on dilution the specific conductance decreases but equivalent conductance increases.  $2+2=4$
- (b) What is the principle underlining conductometric titration? Discuss the titration curves obtained in the titration of a mixture of  $\text{HCl}$  and  $\text{CH}_3\text{COOH}$  with sodium hydroxide.  $2+2=4$
- (c) Write short notes on the following :  $2 \times 2 = 4$
- (i) Debye-Falkenhagen effect
- (ii) Wien effect

( 6 )

- (d) In electrolysis of copper sulphate between copper electrodes the masses of copper per unit volume of the anode liquid before and after electrolysis were 0.79 g and 0.91 g respectively. The total mass of copper deposited at the cathode in the copper coulometer connected in series was 0.153g. Calculate the transport number of the  $\text{Cu}^{2+}$  and  $\text{SO}_4^{2-}$  ions. 2+2=4

5. Answer the following questions {either (a) or (b)} : 3

- (a)  $E^\circ$  of  $\text{Fe}^{3+}/\text{Fe}^{2+}$  system is 0.77 V. In the presence of phosphoric acid,  $\text{Fe}^{3+}$  is removed as phosphate complex as shown in below :



What will be the change on the potential of the system? If the value of equilibrium constant of the above equilibrium is  $1 \times 10^3$ , calculate the approximate value of the potential of the  $\text{Fe}^{3+}/\text{Fe}^{2+}$  system in the presence of  $\text{H}_3\text{PO}_4$ . 1+2=3

24P/1281

(Continued)

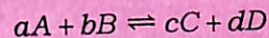
( 7 )

Or

- (b) Describe how the pH of a solution can be determined by using quinhydrone electrode. 3

6. Answer any three of the following questions : 4×3=12

- (a) Derive the expression for the e.m.f. of cell where the following reaction takes place :



- (b) What are concentration cells? The e.m.f. of a cell formed by dipping two electrodes of a metal (Z) in two solutions of its salt with concentrations 0.1 M and 0.01 M was observed to be 0.0295 volts at 25 °C. If liquid junction potential has been eliminated, what is the valency of the metal? 1+3=4

- (c) Establish a relationship between electrical energy and chemical energy ( $\Delta H$ ) of a cell reaction. Under what conditions, the electrical energy produced will be (i) equal to, (ii) less than and (iii) greater than the enthalpy change of the reaction? 2½+1½=4

24P/1281

(Turn Over)

(d) What is electrochemical series? Discuss two applications of the electrochemical series.

7. Answer any *two* of the following questions :

4×2=8

(a) Define dipole moment and magnetic moment. Calculate the magnetic moment of  $[\text{Cr}(\text{CN})_6]^{3-}$  and  $[\text{FeF}_6]^{3-}$  ions.

2+1+1=4

(b) Write the (i) Clausius-Mosotti equation and (ii) Debye equation. Show graphically the variation of molar polarization with temperature for polar and non-polar molecules.

1+1+2=4

(c) What are diamagnetic, paramagnetic, ferromagnetic and antiferromagnetic substances?

1+1+1+1=4

\*\*\*