

**General Instructions :**

Read the following instructions very carefully and follow them :

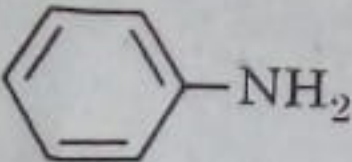
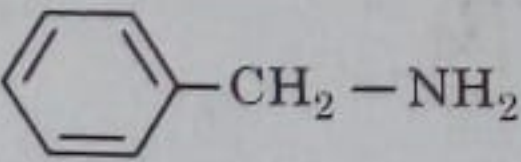
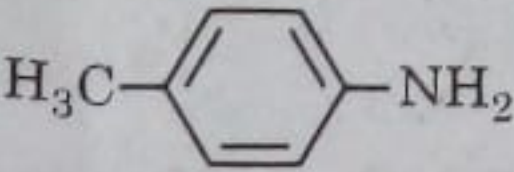

- (i) This Question Paper contains 35 questions. All questions are compulsory.
- (ii) Question Paper is divided into FIVE sections – Section A, B, C, D and E.
- (iii) In section A – question number 1 to 18 are Multiple Choice (MCQ) type questions carrying 1 mark each.
- (iv) In section B – question number 19 to 25 are Very Short Answer (VSA) type questions carrying 2 marks each.
- (v) In section C – question number 26 to 30 are Short Answer (SA) type questions carrying 3 marks each.
- (vi) In section D – question number 31 & 32 are case-based questions carrying 4 marks each.
- (vii) In section E – question number 33 to 35 are Long Answer (LA) questions carrying 5 marks each.
- (viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 2 questions in Section E.
- (ix) Use of calculator is NOT allowed.

**SECTION – A**

1. Auto oxidation of chloroform in air and sunlight produces a poisonous gas known as 1
  - (a) Tear gas
  - (b) Mustard gas
  - (c) Phosgene gas
  - (d) Chlorine gas
2. Which of the following ligands is an ambidentate ligand ? 1
  - (a) CO
  - (b) NO<sub>2</sub>
  - (c) NH<sub>3</sub>
  - (d) H<sub>2</sub>O





3. Among the following, which has the highest value of  $pK_b$ ? 1
- (a)  (b) 
- (c)  (d) 
4. The slope in the plot of  $\log \frac{[R]_0}{[R]}$  vs. time for a first order reaction is 1
- (a)  $\frac{+k}{2.303}$  (b)  $+k$
- (c)  $\frac{-k}{2.303}$  (d)  $-k$
5. When D-glucose reacts with HI, it forms 1
- (a) Gluconic acid (b) n-hexane
- (c) Saccharic acid (d) Iodohexane
6. Inversion of configuration occurs in 1
- (a)  $S_N2$  reaction
- (b)  $S_N1$  reaction
- (c) Neither  $S_N2$  nor  $S_N1$  reaction
- (d)  $S_N1$  as well as  $S_N2$  reaction
7. Solubility of gas in liquid decreases with increase in 1
- (a) Pressure (b) Temperature
- (c) Volume (d) Number of solute molecules





8. Which of the following relations is incorrect ? 1
- (a)  $R = \frac{1}{k} \left( \frac{l}{a} \right)$  (b)  $G = k \left( \frac{a}{l} \right)$
- (c)  $G = k \left( \frac{l}{a} \right)$  (d)  $\wedge_m = \frac{k}{c}$
9. The reagent that can be used to distinguish acetophenone and benzophenone is 1
- (a) 2, 4-dinitrophenyl hydrazine (b) aqueous  $\text{NaHSO}_3$
- (c) Fehling solution (d)  $\text{I}_2$  and  $\text{NaOH}$
10. Which of the following reactions are feasible ? 1
- (a)  $\text{CH}_3\text{CH}_2\text{Br} + \text{Na}^+ \text{O}^-\text{C}(\text{CH}_3)_3 \rightarrow \text{CH}_3\text{CH}_2\text{O} - \text{C}(\text{CH}_3)_3$
- (b)  $(\text{CH}_3)_3\text{C} - \text{Cl} + \text{Na}^+ \text{O}^-\text{CH}_2\text{CH}_3 \rightarrow \text{CH}_3\text{CH}_2\text{O} - \text{C}(\text{CH}_3)_3$
- (c) Both (a) and (b)
- (d) Neither (a) nor (b)
11. Which of the following compounds will undergo self-condensation in the presence of dilute  $\text{NaOH}$  solution ? 1
- (a)  $\text{C}_6\text{H}_5\text{CHO}$  (b)  $\text{CH}_3\text{CH}_2\text{CHO}$
- (c)  $(\text{CH}_3)_3\text{C} - \text{CHO}$  (d)  $\text{H} - \text{CHO}$
12. For the reaction  $3\text{A} \rightarrow 2\text{B}$ , rate of reaction  $-\frac{d[\text{A}]}{dt}$  is equal to 1
- (a)  $\frac{+3}{2} \frac{d[\text{B}]}{dt}$  (b)  $\frac{+2}{3} \frac{d[\text{B}]}{dt}$
- (c)  $\frac{+1}{3} \frac{d[\text{B}]}{dt}$  (d)  $\frac{+1}{2} \frac{d[\text{B}]}{dt}$





13. Which of the following transition metals shows + 1 and + 2 oxidation states ?

(a) Mn

(b) Zn

(c) Sc

(d) Cu

1

14. The formula of the complex Iron (III) hexacyanidoferrate (II) is :

(a)  $\text{Fe}_2 [\text{Fe}(\text{CN})_6]_3$

(b)  $\text{Fe}_4 [\text{Fe}(\text{CN})_6]_3$

(c)  $\text{Fe} [\text{Fe}(\text{CN})_6]$

(d)  $\text{Fe}_3 [\text{Fe}(\text{CN})_6]_2$

1

Given below are two statements labelled as Assertion (A) and Reason (R).  
Select the most appropriate answer from the options given below :

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

15. **Assertion (A) :** The enthalpy of mixing  $\Delta_{\text{mix}} H$  is equal to zero for an ideal solution.

1

**Reason (R) :** For an ideal solution the interaction between solute and solvent molecules is stronger than the interactions between solute-solute or solvent-solvent molecules.

16. **Assertion (A) :** Molar conductivity decreases with increase in concentration.

1

**Reason (R) :** When concentration approaches zero, the molar conductivity is known as limiting molar conductivity.

17. **Assertion (A) :** Transition metals show their highest oxidation state with oxygen.

1

**Reason (R) :** The ability of oxygen to form multiple bonds to metals.



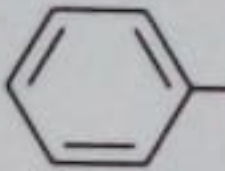



18. **Assertion (A)** : Chlorobenzene is resistant to nucleophilic substitution reaction at room temperature.

1

**Reason (R)** : C-Cl bond gets weaker due to resonance.

### SECTION - B

19. What are nucleic acids ? Why two strands in DNA are not identical but are complementary ? 1 × 2
20. Do the following conversions in not more than two steps : 2 × 1
- (a)  $\text{CH}_3\text{COOH}$  to  $\text{CH}_3\text{COCH}_3$
- (b)   $\text{CH}_2\text{CH}_3$  to   $\text{COOH}$
21. Write the chemical equation involved in the following reactions : 2 × 1
- (a) Reimer-Tiemann reaction
- (b) Acetylation of Salicylic acid
22. (a) The conversion of molecule A to B followed second order kinetics. If concentration of A increased to three times, how will it affect the rate of formation of B ? 2 × 1
- (b) Define Pseudo first order reaction with an example.
23. The vapour pressure of pure liquid X and pure liquid Y at 25 °C are 120 mm Hg and 160 mm Hg respectively. If equal moles of X and Y are mixed to form an ideal solution, calculate the vapour pressure of the solution. 2





24. (a) Give reasons :

2 × 1

- (i) Mercury cell delivers a constant potential during its life time.
- (ii) In the experimental determination of electrolytic conductance, Direct Current (DC) is not used.

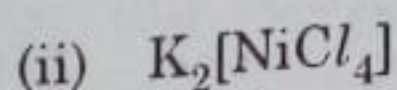
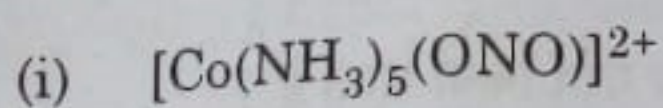
OR

(b) Define fuel cell with an example. What advantages do the fuel cells have over primary and secondary batteries ?

2

25. (a) Write the IUPAC names of the following :

2 × 1



OR

(b) (i) What is a chelate complex ? Give one example.

(ii) What are heteroleptic complexes ? Give one example.

2 × 1

### SECTION - C

26. Answer any 3 of the following :

3 × 1

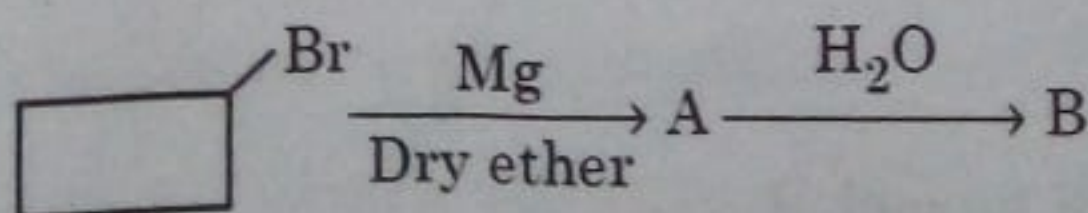
(a) Which isomer of  $\text{C}_5\text{H}_{10}$  gives a single monochloro compound  $\text{C}_5\text{H}_9\text{Cl}$  in bright sunlight ?

(b) Arrange the following compounds in increasing order of reactivity towards  $\text{S}_\text{N}2$  reaction :

2-Bromopentane, 1-Bromopentane, 2-Bromo-2-methylbutane

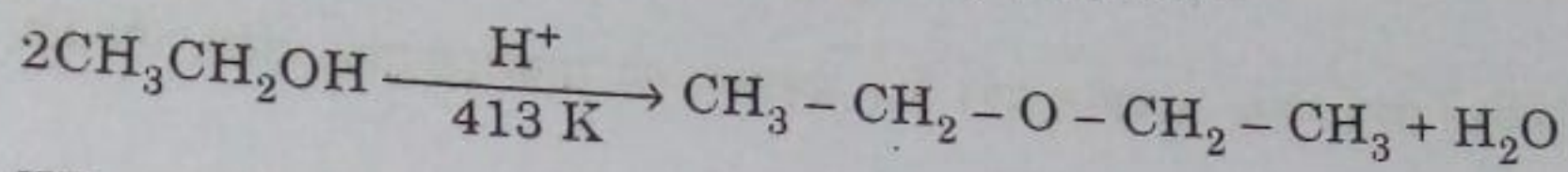
(c) Why p-dichlorobenzene has higher melting point than those of ortho- and meta-isomers ?

(d) Identify A and B in the following :





27. (a) (i) Write the mechanism of the following reaction : 2 + 1



- (ii) Why ortho-nitrophenol is steam volatile while para-nitrophenol is not ?

OR

- (b) What happens when

- (i) Anisole is treated with  $\text{CH}_3\text{Cl}$ /anhydrous  $\text{AlCl}_3$  ? 3 × 1
- (ii) Phenol is oxidised with  $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}^+$  ?
- (iii)  $(\text{CH}_3)_3\text{C} - \text{OH}$  is heated with  $\text{Cu}/573\text{ K}$  ?

Write chemical equation in support of your answer.

28. (a) Draw the geometrical isomers of  $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$ . Which geometrical isomer of  $[\text{Co}(\text{en})_2\text{Cl}_2]^{2+}$  is not optically active and why ? 2 + 1

- (b) Write the hybridisation and magnetic behaviour of  $[\text{CoF}_6]^{3-}$ .

[Given : Atomic number of Co = 27]

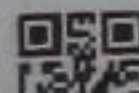
29. A first order reaction is 50% complete in 30 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy ( $E_a$ ) for the reaction.

[ $R = 8.314\text{ J K}^{-1}\text{ mol}^{-1}$ ]

[Given :  $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6021$ ]

30. When 19.5 g of  $\text{F} - \text{CH}_2 - \text{COOH}$  (Molar mass =  $78\text{ g mol}^{-1}$ ), is dissolved in 500 g of water, the depression in freezing point is observed to be  $1^\circ\text{C}$ . Calculate the degree of dissociation of  $\text{F} - \text{CH}_2 - \text{COOH}$ .

[Given :  $K_f$  for water =  $1.86\text{ K kg mol}^{-1}$ ]





32. Carbohydrates are optically active polyhydroxy aldehydes and ketones. They are also called saccharides. All those carbohydrates which reduce Fehling's solution and Tollen's reagent are referred to as reducing sugars. Glucose, the most important source of energy for mammals, is obtained by the hydrolysis of starch. Vitamins are accessory food factors required in the diet. Proteins are the polymers of  $\alpha$ -amino acids and perform various structural and dynamic functions in the organisms. Deficiency of vitamins leads to many diseases.

Answer the following :

- (a) The penta-acetate of glucose does not react with Hydroxylamine. What does it indicate ? 1
- (b) Why cannot vitamin C be stored in our body ? 1
- (c) Define the following as related to proteins :
- (i) Peptide linkage
- (ii) Denaturation 2 × 1

OR

- (c) Define the following as related to carbohydrates :
- (i) Anomers
- (ii) Glycosidic linkage 2 × 1

### SECTION - E

33. (a) (I) Give reasons : 3 + 2
- (i) Aniline on nitration gives good amount of m-nitroaniline, though  $-NH_2$  group is o/p directing in electrophilic substitution reactions.
- (ii)  $(CH_3)_2NH$  is more basic than  $(CH_3)_3N$  in an aqueous solution.
- (iii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.



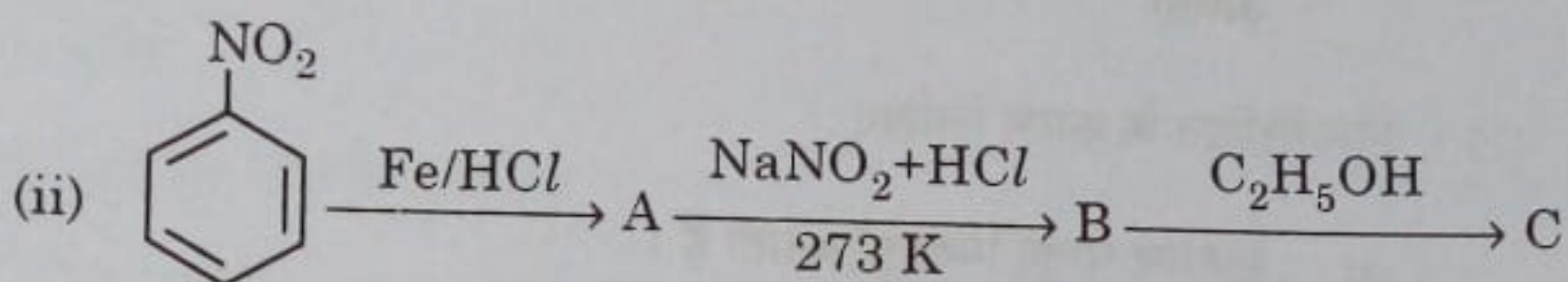
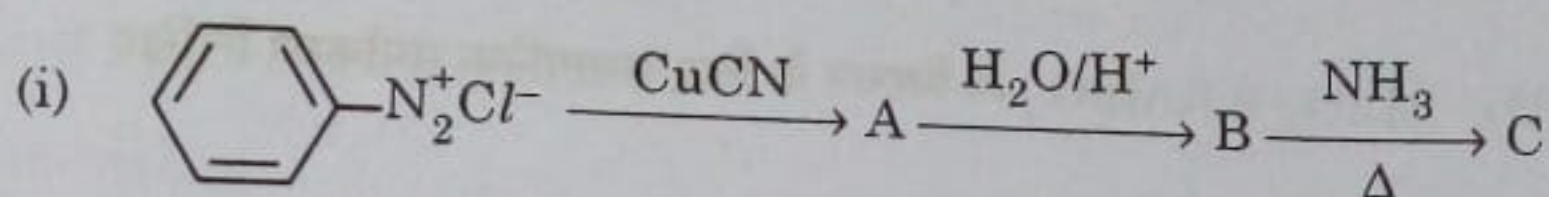


(II) Write the reaction involved in the following :

- (i) Carbyl amine test
- (ii) Gabriel phthalimide synthesis

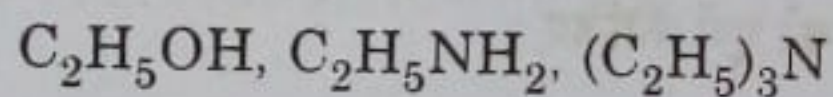
OR

(b) (I) Write the structures of A, B and C in the following reactions : 3 + 1 + 1



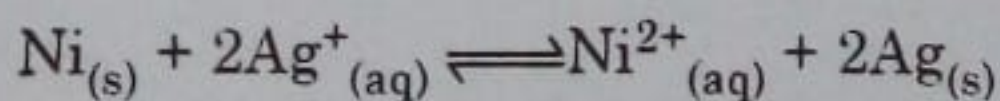
(II) Why aniline does not undergo Friedal-Crafts reaction ?

(III) Arrange the following in increasing order of their boiling point :



34. (a) Conductivity of  $2 \times 10^{-3}$  M methanoic acid is  $8 \times 10^{-5}$  S  $\text{cm}^{-1}$ . Calculate its molar conductivity and degree of dissociation if  $\wedge_m^0$  for methanoic acid is  $404$  S  $\text{cm}^2\text{mol}^{-1}$ . 3 + 2

(b) Calculate the  $\Delta_r G^\circ$  and  $\log K_c$  for the given reaction at 298 K :



Given :  $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25$  V,  $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80$  V

$1F = 96500$  C  $\text{mol}^{-1}$ .





35. (a) (I) Account for the following :

3 + 2

- (i)  $E^{\circ}$  value for  $\text{Mn}^{3+}/\text{Mn}^{2+}$  couple is much more positive than that for  $\text{Cr}^{3+}/\text{Cr}^{2+}$ .
  - (ii)  $\text{Sc}^{3+}$  is colourless whereas  $\text{Ti}^{3+}$  is coloured in an aqueous solution.
  - (iii) Actinoids show wide range of oxidation states.
- (II) Write the chemical equations for the preparation of  $\text{KMnO}_4$  from  $\text{MnO}_2$ .

OR

(b) (I) Account for the following :

2 + 2 + 1

- (i) Transition metals form alloys.
  - (ii)  $\text{Ce}^{4+}$  is a strong oxidising agent.
- (II) Write one similarity and one difference between chemistry of Lanthanoids and Actinoids.
- (III) Complete the following ionic equation :

