

GENERAL INSTRUCTIONS :

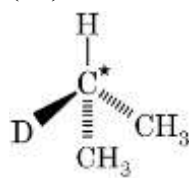
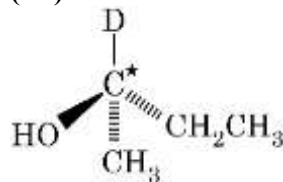
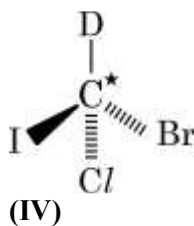
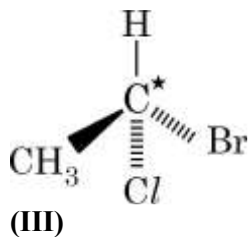
Read the following instructions carefully and follow them:

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) Question paper is divided into FIVE sections - Section A, B, C, D and E.
- (iii) Section A - question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B - question number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C-question number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D - question number 29 and 30 are case-based questions. Each question carries 4 marks.
- (vii) Section E - question number 31 to 33 are long answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except section A.
- (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
- (x) Use of calculator is NOT allowed.

SECTION-A

Question No. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

1. The specific sequence in which amino acids are arranged in a protein is called its
 - (a) Primary structure
 - (b) Secondary structure
 - (c) Tertiary structure
 - (d) Quaternary structure
2. The correct name of the given reaction is $\text{Ar} - \text{N}_2^+ \text{X}^- \xrightarrow{\text{CuCN/KCN}} \text{Ar} - \text{CN} + \text{N}_2$
 - (a) Sandmeyer's reaction
 - (b) Gabriel Phthalimide synthesis
 - (c) Carbyl amine reaction
 - (d) Hoffmann bromamide degradation reaction
3. Out of the following alkenes, the one which will produce tertiary butyl alcohol on acid catalysed hydration is
 - (a) $\text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2$
 - (b) $\text{CH}_3\text{CH} = \text{CH}_2$
 - (c) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$
 - (d) $(\text{CH}_3)_2\text{C} = \text{CH}_2$
4. Auto-oxidation of chloroform in air and light produces a poisonous gas known as
 - (a) Phosphine
 - (b) Mustard gas
 - (c) Phosgene
 - (d) Tear gas
5. Transition metals are known to make interstitial compounds. Formation of interstitial compounds makes the transition metal
 - (a) more hard
 - (b) more soft
 - (c) more ductile
 - (d) more metallic
6. Isotonic solutions have the same
 - (a) density
 - (b) refractive index
 - (c) osmotic pressure
 - (d) volume
7. Which of the following cell was used in Apollo space programme ?
 - (a) Mercury cell
 - (b) $\text{H}_2 - \text{O}_2$ fuel cell
 - (c) Dry cell
 - (d) Ni - Cd cell
8. The rate of a reaction increases sixteen times when the concentration of the reactant increases four times. The order of the reaction is
 - (a) 2.5
 - (b) 2.0
 - (c) 1.5
 - (d) 0.5
9. In which of the following molecules, C atom marked with asterisk is chiral?
 - (I)
 - (II)



(a) I, II, III

(b) I, II, III, IV

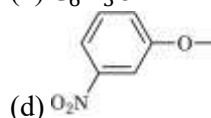
(c) II, III, IV

(d) I, III, IV

10. Which of the following species can act as the strongest base ?

(a) OH^-

(b) $\text{C}_6\text{H}_5\text{O}^-$

(c) RO^-


11. Dilution affects both conductivity as well as molar conductivity. Effect of dilution on both is as follows:

(a) both increase with dilution.

(b) both decrease with dilution.

(c) conductivity increases whereas molar conductivity decreases on dilution.

(d) conductivity decreases whereas molar conductivity increases on dilution.

12. Van't Hoff factor for $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ solution, assuming complete ionization is

(a) 1

(b) 3

(c) 13

(d) 2

For questions number 13 to 16, two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

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

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

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

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

13. Assertion (A) : Zr and Hf are of almost similar atomic radii.

Reason (R) : This is due to Lanthanoid contraction.

14. Assertion (A) : The units of rate constant of a zero order reaction and rate of reaction are the same.

Reason (R) : In zero order reaction, the rate of reaction is independent of the concentration of reactants.

15. Assertion (A) : Inversion of configuration is observed in $\text{S}_{\text{N}}2$ reaction.

Reason (R) : The reaction proceeds with the formation of carbocation.

16. Assertion (A) : p-methoxyphenol is a stronger acid than p-nitrophenol.

Reason (R) : Methoxy group shows +I effect whereas nitro group shows -I effect.

SECTION - B

17. State:

(A) Kohlrausch law of independent migration of ions.

(B) Faraday's first law of electrolysis.

18. Classify the following sugars into monosaccharides and disaccharides:

Galactose, Glucose, Lactose and Maltose

19. (A) Carry out the following conversions:

(i) Nitrobenzene to Aniline

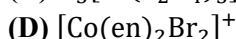
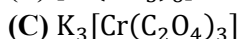
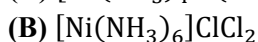
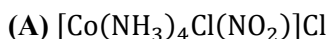
(ii) Aniline to Phenol

OR

- (B) (i) Write a chemical test to distinguish between Dimethyl amine and Ethanamine.
(ii) Write the product formed when benzene diazonium chloride is treated with KI.
20. Show that in case of a first order reaction, the time taken for completion of 99% reaction is twice the time required for 90% completion of the reaction. ($\log 10 = 1$)
21. Resistance of a conductivity cell filled with $0.2 \text{ mol L}^{-1} \text{KCl}$ solution is 200Ω . If the resistance of the same cell when filled with $0.05 \text{ mol L}^{-1} \text{KCl}$ solution is 620Ω , calculate the conductivity and molar conductivity of $0.05 \text{ mol L}^{-1} \text{KCl}$ solution. The conductivity of $0.2 \text{ mol L}^{-1} \text{KCl}$ solution is 0.0248 S cm^{-1} .

SECTION-C

22. Write the IUPAC names of the following coordination compounds (any three) :



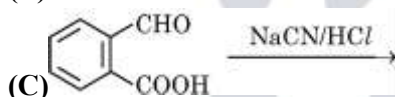
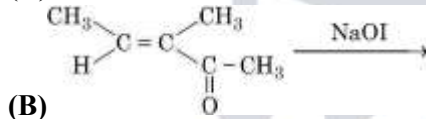
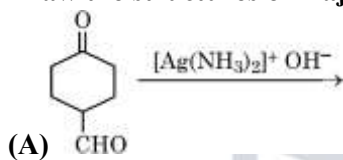
23. Give the structure of the major product expected from the following reactions :

(A) Reaction of Ethanal with methyl-magnesium bromide followed by hydrolysis.

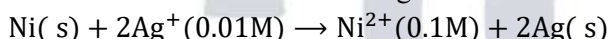
(B) Hydration of But-1-ene in the presence of dilute sulphuric acid.

(C) Reaction of phenol with bromine water.

24. Draw the structures of major product(s) in each of the following reactions:



25. Calculate the emf of the following cell :



Given that $E_{\text{cell}}^\circ = 1.05 \text{ V}$, $\log 10 = 1$

26. Account for the following :

(A) Haloalkanes react with AgCN to form isocyanide as main product.

(B) Allyl chloride shows high reactivity towards $\text{S}_{\text{N}}1$ reaction.

(C) Haloarenes are extremely less reactive towards nucleophilic substitution reactions.

27. The rate constant of a reaction quadruples when the temperature changes from 300 K to 320 K . Calculate the activation energy for this reaction. [$\log 2 = 0.30$, $\log 4 = 0.60$, $2.303R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$]

28. A compound 'X' with molecular formula $\text{C}_3\text{H}_9\text{N}$ reacts with $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$ to give a solid, insoluble in alkali. Identify 'X' and give the IUPAC name of the product. Write the reaction involved.

SECTION - D

The following questions are case-based questions. Read the case carefully and answer the questions that follow :

29. The oxidation number of the central atom in a complex is defined as the charge it would carry if all the ligands are removed along with the electron pairs that are shared with the central atom. Similarly the charge on the complex is the sum of the charges of the constituent parts i.e. the sum of the charges on the central metal ion and its surrounding ligands. Based on this, the complex is called neutral if the sum of the charges of the constituents is equal to zero. However, for an anion or cationic complex, the sum of the charges of the constituents is equal to the charge on the coordination sphere.

Based on the above information, answer the following questions:

(A) Define ambidentate ligand with an example.

(B) What type of isomerism is shown by $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$?

(C) Define Chelate effect. How it affects the stability of complex?

OR

(c) Find the coordination number and oxidation state of chromium in $\text{Na}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$.

30. Certain organic compounds are required in small amounts in our diet but their deficiency causes specific disease.

These compounds are called vitamins. Most of the vitamins cannot be synthesized in our body but plants can synthesize almost all of them. So they are considered as essential food factors. However, the bacteria of the gut can produce some of the vitamins required by us. All the vitamins are generally available in our diet. The term 'vitamin' was coined from the words vital + amine, since the earlier identified compounds had amino group.

Vitamins are classified into two groups depending upon their solubility in water or fat namely-fat soluble vitamins and water soluble vitamins.

Answer the following questions:

(A) What is the other name of vitamin B_6 ?

(B) Name the vitamin whose deficiency causes increased blood clotting time.

(C) Xerophthalmia is caused by the deficiency of which vitamin? Give two sources of this vitamin.

OR

(c) Why can't vitamin C be stored in our body? Name the disease caused by the deficiency of this vitamin.

SECTION - E

31. Attempt any five of the following :

(A) Ce (III) is easily oxidised to Ce (IV). Comment.

(B) $E^\circ(\text{Mn}^{2+}/\text{Mn})$ is -1.18 V . Why is this value highly negative in comparison to neighbouring d block elements?

(C) Which element of 3d series has lowest enthalpy of atomisation and why?

(D) What happens when sodium chromate is acidified?

(E) Zn, Cd and Hg are soft metals. Why?

(F) Why is permanganate titration not carried out in the presence of HCl?

(G) The lower oxides of transition metals are basic whereas the highest are amphoteric/acidic. Give reason.

32. (A) (i) Ishan's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (Molar mass = 62 g mol^{-1}) must Ishan add to get the freezing point of the solution lowered to 2.8°C . K_f for water is $1.86\text{ K kg} \cdot \text{mol}^{-1}$.

(ii) What type of deviation from Raoult's law is shown by ethanol and acetone mixture? Give reason.

OR

(B) (i) Boiling point of water at 750 mm Hg pressure is 99.68°C . How much sucrose (Molar mass = 342 g mol^{-1}) is to be added to 500 g of water such that it boils at 100°C ? (K_b for water = $0.52\text{ K kg mol}^{-1}$).

(ii) State Henry's law and write its any one application.

33. (A) An organic compound (A) with the molecular formula $\text{C}_9\text{H}_{10}\text{O}$ forms 2, 4-DNP derivative, reduces Fehling solution and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1, 2-benzene dicarboxylic acid.

(i) Identify the compound (A) and write its IUPAC name.

(ii) Write the reaction of compound (A) with

(1) 2, 4-Dinitrophenyl hydrazine and

(2) Fehling solution

(iii) Write the equation of compound (A) when it undergoes Cannizzaro reaction.

OR

(B) (i) Account for the following:

(1) The alpha (α)-hydrogens of aldehydes and ketones are acidic in nature.

(2) Oxidation of aldehydes is easier than ketones.

(ii) Arrange the following in :

(1) Decreasing reactivity towards nucleophilic addition reaction propanal, acetone, benzaldehyde.

(2) Increasing order of boiling point :

Propane, Ethanol, Dimethylether, Propanal

(iii) Give simple chemical test to distinguish between Benzoic acid and Benzaldehyde.

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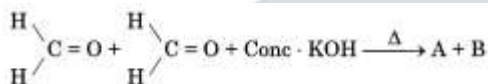
SECTION-A

Question No. 1 to 16 are Multiple Choice type questions carrying 1 mark each.

34. The molar ionic conductivities of Ca^{2+} and Cl^- are 119.0 and 76.3 $\text{S cm}^2 \text{mol}^{-1}$ respectively. The value of limiting molar conductivity of CaCl_2 will be :

- (a) 195.3 $\text{S cm}^2 \text{mol}^{-1}$
- (b) 43.3 $\text{S cm}^2 \text{mol}^{-1}$
- (c) 314.3 $\text{S cm}^2 \text{mol}^{-1}$
- (d) 271.6 $\text{S cm}^2 \text{mol}^{-1}$

35. Consider the following reaction :



Identify A and B from the given options :

- (a) A-Methanol, B - Potassium formate
- (b) A-Ethanol, B-Potassium formate
- (c) A-Methanal, B - Ethanol
- (d) A-Methanol, B-Potassium acetate

36. Which of the following acids represents Vitamin C ?

- (a) Saccharic acid
- (b) Gluconic acid
- (c) Ascorbic acid
- (d) Benzoic acid

37. Rosenmund reduction is used for the preparation of Aldehydes. The catalyst used in this reaction is

- (a) $\text{Pd} - \text{BaSO}_4$
- (b) Anhydrous AlCl_3
- (c) Iron (III) oxide
- (d) HgSO_4

38. Which alkyl halide from the given options will undergo $\text{S}_{\text{N}}1$ reaction faster?

- (a) $(\text{CH}_3)_3\text{C} - \text{Br}$
- (b) $(\text{CH}_3)_2\text{CH} - \text{Br}$
- (c) $\text{CH}_3 - \text{CH}_2 - \text{Br}$
- (d) $(\text{CH}_3)_3\text{C} - \text{CH}_2 - \text{Br}$

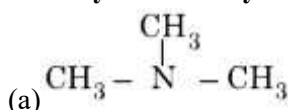
39. From the elements of 3d series given below, which element shows the maximum number of oxidation states?

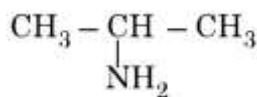
- (a) Scandium
- (b) Manganese
- (c) Chromium
- (d) Titanium

40. The correct Mathematical expression of Arrhenius equation is

- (a) $k = -Ae^{\frac{E_a}{RT}}$
- (b) $k = e^{\frac{E_a}{RT}}$
- (c) $k = Ae - \frac{E_a}{RT}$
- (d) $k = -Ae - \frac{E_a}{RT}$

41. Identify the tertiary amine from the following :



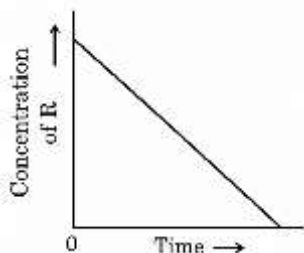


- (b)
(c) $\text{CH}_3 - \text{NH} - \text{CH}_2 - \text{CH}_3$
(d) $(\text{C}_2\text{H}_5)_2\text{CHNH}_2$

42. Nucleophilic addition of Grignard reagent to ketones followed by hydrolysis with dilute acids forms :

- (a) Alkene (b) Primary alcohol
(c) Tertiary alcohol (d) Secondary alcohol

43. In a given graph of zero order reaction, the slope and intercept are:



- (a) Slope = k, Intercept = $[\text{R}]_0$
(b) Slope = $-k$, Intercept = $[\text{R}]_0$
(c) Slope = $-\frac{k}{2.303}$, Intercept = $\ln[\text{R}]_0$
(d) Slope = $-\frac{k}{2.303}$, Intercept = $\ln A$

44. Match the reagents required for the given reactions:

(I)	Oxidation of primary alcohols to	(P)	NaBH_4 aldehydes
(II)	Butan-2-one to Butan-2-ol	(Q)	85% phosphoric acid at 440 K
(III)	Bromination of Phenol to 2, 4, 6-Tribromophenol	(R)	PCC
(IV)	Dehydration of propan-2-ol to propene	(S)	Bromine water

- (a) (I) – (R), (II) – (P), (III) – (S), (IV) – (Q)
(b) (I) – (Q), (II) – (R), (III) – (P), (IV) – (S)
(c) (I) – (S), (II) – (Q), (III) – (P), (IV) – (R)
(d) (I) – (P), (II) – (S), (III) – (R), (IV) – (Q)

45. The general electronic configuration of d-block elements is :

- (a) $(n-1)d^{1-10} ns^{1-2}$ (b) $(n-1)d^{10} ns^{1-2}$
(c) $(n-1)d^{10} ns^{2-3}$ (d) $(n-1)d^0 ns^{1-2}$

Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

46. Assertion (A) : p-nitrophenol is less acidic than phenol.

Reason (R) : Nitro group is electron withdrawing and helps in the stabilisation of p-nitrophenoxide ion.

47. Assertion (A) : Benzoic acid does not undergo Friedel - Crafts reaction.

Reason (R) : Carboxyl group is deactivating and the catalyst aluminium chloride gets bonded to the carboxyl group.

48. Assertion (A) : Fructose is a reducing sugar.

Reason (R) : Fructose does not reduce Fehling solution and Tollen's reagent.

49. Assertion (A) : For a Daniell cell, $\text{Zn}/\text{Zn}^{2+}(1\text{M})\|\text{Cu}^{2+}(1\text{M})/\text{Cu}$ with $E^\circ_{\text{cell}} = 1.1\text{ V}$, if the external opposing potential is more than 1.1 V , the electrons flow from Cu to Zn.

Reason (R) : Cell acts like a galvanic cell.

SECTION - B

50. Define the following terms:

(A) Order of a reaction

(B) Activation energy

51. 18 g of a non-volatile solute is dissolved in 200 g of H_2O freezes at 272.07 K . Calculate the molecular mass of solute (K_f for water = $1.86\text{ K kg mol}^{-1}$)

52. (A) Which compound in the given pair would undergo $\text{S}_{\text{N}}2$ reaction at a faster rate and why?

$\text{CH}_3 - \text{CH}_2 - \text{I}$ and $\text{CH}_3 - \text{CH}_2 - \text{Br}$

(B) Arrange the following compounds in the increasing order of their boiling points:

Butane, 1-Bromobutane, 1-Iodobutane, 1-Chlorobutane

53. (A) Write the stepwise mechanism of nucleophilic addition reactions in the carbonyl compounds.

OR

(B) How will you convert the following :

(i) Toluene to benzoic acid.

(ii) Ethanol to 3-Hydroxybutanal

54. (A) What happens when glucose reacts with bromine water ? Write chemical equation.

(B) Two bases are mentioned below, identify which is present in DNA and which one is present in RNA :

(i) Thymine (ii) Uracil.

SECTION - C

55. (A) Draw the geometrical isomers of the given complex :

$[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$

(B) Write the electronic configuration for d^4 ion if $\Delta_0 < P$ on the basis of crystal field theory.

(C) What is meant by a unidentate ligand ? Give an example.

56. Calculate emf of the following cell at 25°C :

$\text{Sn}/\text{Sn}^{2+}(0.001\text{M})\|\text{H}^+(0.01\text{M})|\text{H}_{2(\text{g})}(1\text{ bar})|\text{Pt}_{(\text{s})}$

Given : $E^\circ(\text{Sn}^{2+}/\text{Sn}) = -0.14\text{ V}$, $E^\circ\text{H}^+/\text{H}_2 = 0.00\text{ V}(\log 10 = 1)$

57. Write chemical equations for the following reactions: (Do any three)

(A) Hydroboration-oxidation reaction

(B) Williamson Synthesis

(C) Friedel-Crafts Alkylation of Anisole

(D) Reimer-Tiemann Reaction

58. (A) Give chemical tests to distinguish between the following pairs of compounds:

(i) Phenol and Benzoic acid

(ii) Propanal and Propanone

(B) Which one of the given compounds is a stronger acid and why ?

$\text{CH}_2\text{FCH}_2\text{CH}_2\text{COOH}$ or $\text{CH}_3\text{CHFCH}_2\text{COOH}$

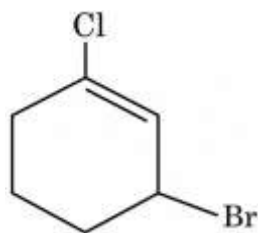
59. Explain the following terms :

(A) Essential amino acids

(B) Peptide bond

(C) Denaturation

60. (A) Write the IUPAC name of the given compound :



(B) The presence of $-\text{NO}_2$ group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions. Give reason to explain the above statement.

(C) What happens when ethyl chloride is treated with alcoholic potassium hydroxide?

61. Show that the time required for 99.9% completion in a first order reaction is 10 times of half-life ($t_{1/2}$) of the reaction [$\log 2 = 0.3010, \log 10 = 1$].

SECTION-D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

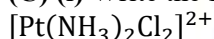
62. The nature of bonding, structure of the coordination compound can be explained to some extent by valence bond theory. The central metal atom/ion makes available a number of vacant orbitals equal to its coordination number. The appropriate atomic orbitals (s, p and d) of the metal hybridise to give a set of equivalent orbitals of definite geometry such as square planar, tetrahedral, octahedral and so on. A strong covalent bond is formed only when the orbitals overlap to the maximum extent. The d-orbitals involved in the hybridisation may be either inner d-orbitals i.e. (n-1) d or outer d-orbitals i.e. nd. The complexes formed are called inner orbital complex (low spin complex) and outer orbital complex (high spin complex) respectively. Further, the complexes can be paramagnetic or diamagnetic in nature. The drawbacks of this theory are that this involves number of assumptions and also does not explain the colour of the complex.

Answer the following questions:

(A) Predict whether $[\text{CoF}_6]^{3-}$ is diamagnetic or paramagnetic and why? [Atomic number : Co = 27]

(B) What is the coordination number of Co in $[\text{Co}(\text{en})_2\text{Cl}_2]^+$?

(C) (i) Write the IUPAC name of the given complex :



(ii) Explain $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital or outer orbital complex.

OR

(c) Using valence bond theory, deduce the shape and hybridisation of $[\text{Ni}(\text{NH}_3)_6]^{2+}$ [Atomic number of Ni = 28]

63. In a galvanic cell, chemical energy of a redox reaction is converted into electrical energy, whereas in an electrolytic cell the redox reaction occurs on passing electricity. The simplest galvanic cell is in which Zn rod is placed in a solution of ZnSO_4 and Cu rod is placed in a solution of CuSO_4 . The two rods are connected by a metallic wire through a voltmeter. The two solutions are joined by a salt bridge. The difference between the two electrode potentials of the two electrodes is known as electromotive force. In the process of electrolysis, the decomposition of a substance takes place by passing an electric current. One mole of electric charge when passed through a cell will discharge half a mole of a divalent metal ion such as Cu^{2+} . This was first formulated by Faraday in the form of laws of electrolysis.

Answer the following questions:

(A) What is the function of a salt bridge in a galvanic cell?

(B) When does galvanic cell behave like an electrolytic cell?

(C) Can copper sulphate solution be stored in a pot made of zinc? Explain with the help of the value of E° cell.

$(E^\circ \text{Cu}^{2+}/\text{Cu} = 0.34 \text{ V})$

$(E^\circ \text{Zn}^{2+}/\text{Zn} = -0.76 \text{ V})$

OR

(C) How much charge in terms of Faraday is required for the following:

(i) 1 mol of MnO_4^- to Mn^{2+}

(ii) 1 mol of H_2O to O_2

SECTION - E

64. Attempt any five of the following :

- (A) Why Zinc is not regarded as a transition element ?
 (B) What is Lanthanoid contraction?
 (C) Why is first ionization enthalpy of chromium lower than that of Zn ?
 (D) Why are transition elements good catalysts?
 (E) Compounds of transition metals are generally coloured. Give reason.
 (F) Out of KMnO_4 and K_2MnO_4 , which one is paramagnetic and why ?
 (G) Complete the following ionic equation :
 $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow$

65. (A) (i) Define reverse osmosis.

- (ii) Why are aquatic species more comfortable in cold water in comparison to warm water ?
 (iii) A solution containing 2 g of glucose ($M = 180 \text{ g mol}^{-1}$) in 100 g of water is prepared at 303 K . If the vapour pressure of pure water at 303 K is 32.8 mm Hg , what would be the vapour pressure of the solution?

OR

- (B) (i) Predict whether Van't Hoff factor will be less or greater than one, when Ethanoic acid is dissolved in benzene.

(ii) Define ideal solution.

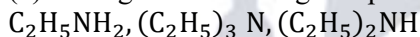
- (iii) Calculate the mass of CaCl_2 (molar mass = 111 g mol^{-1}) to be dissolved in 500 g of water to lower its freezing point by 2 K , assuming that CaCl_2 undergoes complete dissociation. (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

66. (A) An amide 'A' with molecular formula $\text{C}_7\text{H}_7\text{ON}$ undergoes Hoffmann Bromamide degradation reaction to give amine 'B'. 'B' on treatment with nitrous acid at 273 – 278 K form 'C' and on treatment with chloroform and ethanolic potassium hydroxide forms 'D'. 'C' on treatment, with ethanol gives 'E'. Identify 'A', 'B', 'C' 'D' and 'E.' and write the sequence of chemical equations.

OR

- (B) (i) (1) What is Hinsberg's reagent ?

(2) Arrange the following compounds in the increasing order of their basic strength in gaseous phase :



(ii) Give reasons for the following :

- (1) Methyl amine is more basic than aniline.
 (2) Aniline readily reacts with bromine water to give 2, 4, 6tribromoaniline.
 (3) Primary amines have higher boiling points than tertiary amines.

GENERAL INSTRUCTIONS :

Read the following instructions carefully and follow them:

- (i) This question paper contains 33 questions. All questions are compulsory.
 (ii) Question paper is divided into FIVE sections - Section A, B, C, D and E.
 (iii) Section A - question number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
 (iv) Section B - question number 17 to 21 are very short answer type questions. Each question carries 2 marks.
 (v) Section C-question number 22 to 28 are short answer type questions. Each question carries 3 marks.
 (vi) Section D - question number 29 and 30 are case-based questions. Each question carries 4 marks.
 (vii) Section E - question number 31 to 33 are long answer type questions. Each question carries 5 marks.
 (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except section A.
 (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
 (x) Use of calculator is NOT allowed.

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

67. Which of the following does not show variable oxidation states ?

- (a) Fe (b) Cu
 (c) Mn (d) Sc

68. The type of isomerism shown by the complex $[\text{CoCl}_2(\text{en})_2]^+$ is :

- (a) Ionisation isomerism
 (b) Geometrical isomerism
 (c) Linkage isomerism

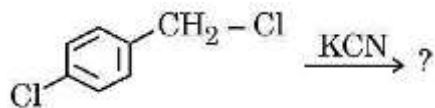
(d) Coordination isomerism

69. Which of the following is diamagnetic in nature?

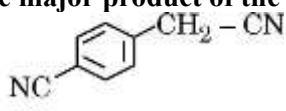
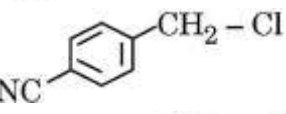
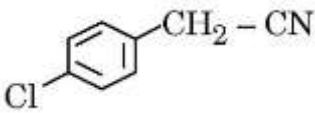
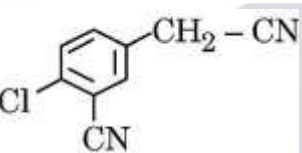
[Atomic number : Co = 27]

- (a) Co^{3+} , octahedral complex with strong field ligand
- (b) Co^{3+} , octahedral complex with weak field ligand
- (c) Co^{3+} , in a square planar complex
- (d) Co^{3+} , in a tetrahedral complex

70. Consider the following reaction :



The major product of the reaction is :

- (a) 
- (b) 
- (c) 
- (d) 

71. Which one of the following compounds has the lowest pK_a value ?

- (a) p-Cresol
- (b) p-Nitrophenol
- (c) m-Nitrophenol
- (d) 2,4,6-Trinitrophenol

72. $(\text{CH}_3)_2\text{CH} - \text{O} - \text{CH}_3$ when treated with HI gives :

- (a) $(\text{CH}_3)_2\text{CH} - \text{I} + \text{CH}_3\text{OH}$
- (b) $(\text{CH}_3)_2\text{CH} - \text{OH} + \text{CH}_3 - \text{I}$
- (c) $(\text{CH}_3)_2\text{CH} - \text{I} + \text{CH}_3 - \text{I}$
- (d) $(\text{CH}_3)_2\text{CH} - \text{OH} + \text{CH}_3\text{OH}$

73. Which of the following compounds on treatment with benzene sulphonyl chloride forms an alkali-soluble precipitate?

- (a) CH_3CONH_2
- (b) $(\text{CH}_3)_3\text{N}$
- (c) $(\text{CH}_3)_2\text{NH}$
- (d) $\text{CH}_3\text{CH}_2\text{NH}_2$

74. The order of increasing basicities of CH_3NH_2 (I), $(\text{CH}_3)_2\text{NH}$ (II), $(\text{CH}_3)_3\text{N}$ (III) and $\text{C}_6\text{H}_5\text{NH}_2$ (IV) in aqueous media is :

- (a) $\text{IV} < \text{III} < \text{I} < \text{II}$
- (b) $\text{II} < \text{I} < \text{IV} < \text{III}$
- (c) $\text{I} < \text{II} < \text{III} < \text{IV}$
- (d) $\text{II} < \text{III} < \text{I} < \text{IV}$

75. The vitamin which plays an important role in coagulating blood is :

- (a) Vitamin A
- (b) Vitamin E
- (c) Vitamin D
- (d) Vitamin K

76. When a catalyst increases the rate of a chemical reaction, then the rate constant (k) :

- (a) remains constant
- (b) decreases
- (c) increases
- (d) may increase or decrease depending on the order of the reaction

77. A 1% solution of solute 'X' is isotonic with a 6% solution of sucrose (molar mass = 342 g mol^{-1}). The molar mass of solute 'X' is :

- (a) $34 \cdot 2 \text{ g mol}^{-1}$ (b) 57 g mol^{-1}
(c) 114 g mol^{-1} (d) 3.42 g mol^{-1}

78. During the electrolysis of aqueous NaCl, the cathodic reaction is :

- (a) Oxidation of Cl^- ion
(b) Reduction of Na^+ ion
(c) Oxidation of H_2O
(d) Reduction of H_2O

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

79. **Assertion (A)** : Addition of ethylene glycol to water lowers its freezing point.

Reason (R) : Ethylene glycol is insoluble in water due to lack of its ability to form hydrogen bonds with water molecules.

80. **Assertion (A)** : Order of reaction and molecularity are always same for complex reactions.

Reason (R) : Order is determined experimentally and molecularity is applicable only for elementary reactions.

81. **Assertion (A)** : The boiling point of ethanol is higher than that of dimethyl ether.

Reason (R) : Ethanol molecules are associated through hydrogen bonding whereas in dimethyl ether, it is not possible.

82. **Assertion (A)** : Aniline does not undergo Friedel-Crafts reaction.

Reason (R) : Friedel-Crafts reaction is an electrophilic substitution reaction.

SECTION B

83. (A) Define molal depression constant. How is it related to enthalpy of fusion?

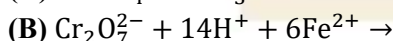
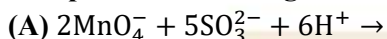
OR

(B) What type of deviation is shown by ethanol and acetone mixture ? Give reason. What type of azeotropic mixture is formed by that deviation?

84. (A) In a reaction, if the concentration of reactant 'X' is tripled, the rate of reaction becomes twenty-seven times. What is the order of the reaction?

(B) State a condition under which a bimolecular reaction is kinetically a first-order reaction. Give an example of such a reaction.

85. Complete the following ionic equations:



86. (A) Which halogen compound in the following pair will react faster in $\text{S}_{\text{N}}2$ reactions and why?



(B) Why is chloroform stored in closed dark coloured bottles ?

87. Give reaction of glucose with the following :

(A) HCN

(B) Conc. HNO_3

SECTION -C

88. A solution is prepared by dissolving 5 g of a non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 300 K . Calculate the molar mass of the solute.

(Vapour pressure of pure water at 300 K = 32 mmHg)

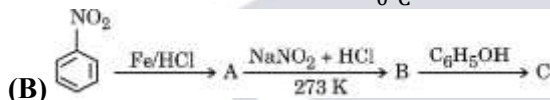
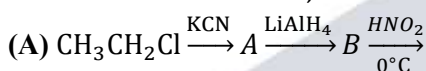
89. The conductivity of 0.2 M solution of KCl is $2.48 \times 10^{-2} \text{ S cm}^{-1}$. Calculate its molar conductivity and degree of dissociation (α).

Given :

$$\lambda_{K^+}^0 = 73.5 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\lambda_{Cl^-}^0 = 76.5 \text{ S cm}^2 \text{ mol}^{-1}$$

90. A first-order reaction is 25% complete in 40 minutes. Calculate the value of rate constant. In what time will the reaction be 80% complete ?
[Given : $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 4 = 0.60$, $\log 5 = 0.69$]
91. (A) What type of nucleophilic substitution (S_N1 or S_N2) occurs in the hydrolysis of 2-Bromobutane to form ($\pm$)-Butan-2-ol ? Give reason.
(B) What happens when chlorobenzene and methyl chloride are treated with sodium metal in dry ether?
92. (A) Write the equations of the reactions involved in the following :
(i) Reimer-Tiemann reaction
(ii) Kolbe's reaction
(B) Name the reagent used in the bromination of phenol to form 2,4,6-Tribromophenol.
93. How will you bring about the following conversions? (any three)
(A) Benzoic acid to Benzaldehyde
(B) Ethanal to Propanone
(C) Acetophenone to Benzoic acid
(D) Bromobenzene to 1-Phenylethanol
94. Give the structures of A, B and C in the following reactions :



SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

95. The involvement of $(n-1)d$ electrons in the behaviour of transition elements impart certain distinct characteristics to these elements. Thus, in addition to variable oxidation states, they exhibit paramagnetic behaviour, catalytic properties and tendency for the formation of coloured ions. The transition metals react with a number of non-metals like oxygen, nitrogen and halogens. KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ are common examples. The two series of inner transition elements, lanthanoids and actinoids, constitute the f-block of the periodic table. In the lanthanoids, there is regular decrease in atomic size with increase in atomic number due to the imperfect shielding effect of 4f-orbital electrons which causes contraction.

Answer the following questions:

- (A) Why do transition metals and their compounds act as good catalysts ?
(B) What is the cause of contraction in the atomic size of lanthanoids ?
(C) Define lanthanoid contraction. How does it affect the atomic radii of the third transition series and the second transition series?

OR

- (C) In aqueous media, which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?

96. Proteins are the most abundant biomolecules of the living system. Proteins are the polymers of about twenty different α -amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases. On the basis of their molecular shape, proteins are classified into two types : Fibrous and Globular proteins. Structure and shape of proteins can be studied at four different levels i.e., primary, secondary, tertiary and quaternary, each level being more complex than the previous one. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called denaturation of proteins.

Answer the following questions:

- (A) What are essential amino acids ?
(B) What is meant by zwitter ionic form of amino acids?

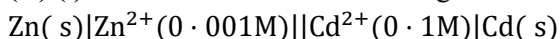
- (C) (i) Give one example each for Fibrous protein and Globular protein.
(ii) What type of linkages hold monomers of proteins together?

OR

- (C) (i) What is the structural feature which characterises a reducing sugar?
(ii) What is the structural difference between nucleoside and nucleotide?

SECTION E

97. (A) (i) Calculate emf of the following cell at 25°C :

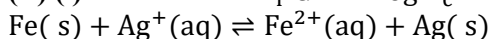


Given : $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{ V}$, $E_{\text{Cd}^{2+}/\text{Cd}}^0 = -0.40\text{ V}$ [$\log 10 = 1$]

- (ii) State Faraday's second law of electrolysis. How will the pH of aqueous NaCl solution be affected when it is electrolysed ?

OR

- (B) (i) Calculate the $\Delta_r G^\circ$ and $\log K_c$ for the following cell reaction :

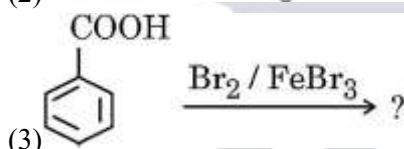
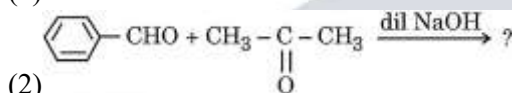
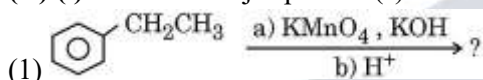


Given : $E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.44\text{ V}$, $E_{\text{Ag}^+/\text{Ag}}^0 = +0.80\text{ V}$,

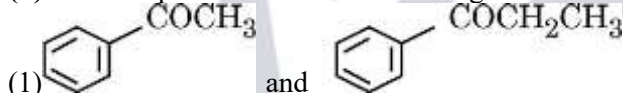
$$1\text{ F} = 96500\text{ C mol}^{-1}$$

- (ii) Write any two advantages of the fuel cells over primary and secondary batteries?
(iii) How many Faradays are required for the oxidation of 1 mole of H_2O to O_2 ?

98. (A) (i) Write the major product(s) in the following reactions :



- (ii) Give simple chemical tests to distinguish between the following pairs of compounds:



- (2) Pentanal and Pentan-3-one

OR

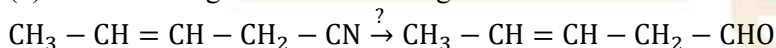
- (B) (i) Give reasons for the following :

- (1) In semicarbazide, only one $-\text{NH}_2$ group is involved in the formation of semicarbazone.
(2) Acetaldehyde is more reactive than acetone towards addition of HCN .

- (ii) (1) Arrange the following in decreasing order of their acidic strength :



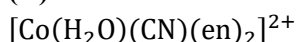
- (2) Name the reagent in the following reaction :



- (iii) Write the reaction involved in Hell-Volhard-Zelinsky reaction.

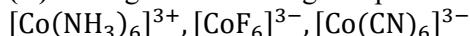
99. Attempt any five of the following :

- (A) Write the IUPAC name of the complex :



- (B) Why is geometrical isomerism not possible in tetrahedral complexes having two different types of unidentate ligands coordinated with the central metal ion?

- (C) Arrange the following complex ions in increasing order of their crystal field splitting energy (Δ_0) :



- (D) Write the hybridization and magnetic character of the complex $[\text{Ni}(\text{CO})_4]$ on the basis of valence bond theory.

[Atomic No. : Ni = 28]

- (E) Out of $[\text{CoF}_6]^{3-}$ and $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$, which one complex is :

- (i) more stable?
(ii) the high spin complex?

(F) What is the difference between an ambidentate ligand and bidentate ligand?

(G) Write the electronic configuration of d^5 in terms of t_{2g} and e_g in an octahedral field when :

(i) $\Delta_o > P$, and (ii) $\Delta_o < P$

General Instructions :

Read the following instructions carefully and follow them:

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(ii) This question paper is divided into five sections - Section A, B, C, D and E.

(iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.

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(viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the sections except Section A.

(ix) Kindly note that there is a separate question paper for Visually Impaired candidates.

(x) Use of calculators is not allowed.

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

100. When MnO_2 is fused with KOH in air, it gives :

- (a) $KMnO_4$ (b) K_2MnO_4
(c) Mn_2O_7 (d) Mn_2O_3

101. Ligand $EDTA^{4-}$ is an example of a :

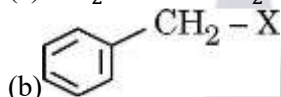
- (a) Monodentate ligand (b) Didentate ligand
(c) Tridentate ligand (d) Polydentate ligand

102. Which of the following ligand forms chelate complex?

- (a) $C_2O_4^{2-}$ (b) Cl^-
(c) NO_2^- (d) NH_3

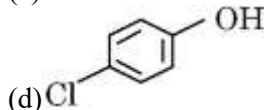
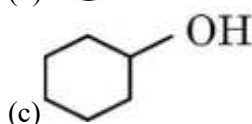
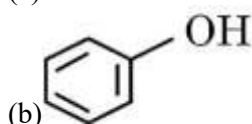
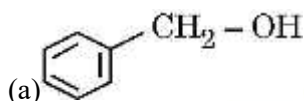
103. Which of the following contains sp^2 hybridised carbon bonded to X ?

- (a) $CH_2 = CH - CH_2 - X$

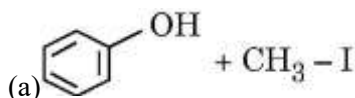


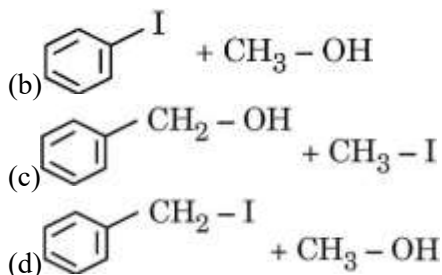
- (c) $CH_2 = CH - X$
(d) $CH_3 - CH_2 - X$

104. Which of the following is most acidic ?



105. Anisole reacts with HI to give :





106. Ethanol on heating with conc. H₂SO₄ at 413 K gives :

- (a) C₂H₅OSO₃H (b) C₂H₅ - O - CH₃
(c) C₂H₅ - O - C₂H₅ (d) CH₂ = CH₂

107. An azeotropic solution of two liquids has boiling point lower than either of them when it :

- (a) is saturated
(b) shows positive deviation from Raoult's law
(c) shows negative deviation from Raoult's law
(d) shows no deviation from Raoult's law

108. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0225 . The mole fraction of the non-volatile solute is :

- (a) 0.80 (b) 0.725
(c) 0.15 (d) 0.0225

109. During electrolysis of aqueous solution of NaCl :

- (a) H₂(g) is liberated at cathode
(b) Na is formed at cathode
(c) O₂(g) is liberated at anode
(d) Cl₂(g) is liberated at cathode

110. The addition of catalyst during a chemical reaction alters which of the following quantities of the reaction?

- (a) Enthalpy (b) Activation energy
(c) Entropy (d) Internal energy

111. For the elementary reaction P → Q, the rate of disappearance of ' P ' increases by a factor of 8 upon doubling the concentration of ' P '. The order of the reaction with respect to ' P ' is :

- (a) 3 (b) 4
(c) 2 (d) 1

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

112. **Assertion (A)** : Aliphatic primary amines can be prepared by Gabriel phthalimide synthesis.

Reason (R) : Alkyl halides undergo nucleophilic substitution with anion formed by phthalimide.

113. **Assertion (A)** : Uracil base is present in DNA.

Reason (R) : DNA undergoes self-replication.

114. **Assertion (A)** : Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

Reason (R) : Diazonium salts of aliphatic amines show resonance.

115. **Assertion (A)** : p-nitroaniline is a weaker base than p-toluidine.

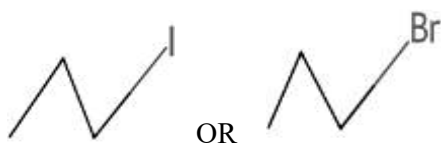
Reason (R) : The electron withdrawing effect of -NO₂ group in p-nitroaniline makes it a weaker base.

SECTION B

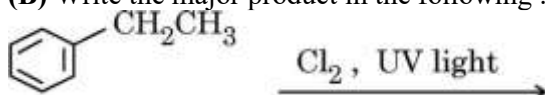
116. A 6% solution of glucose (molar mass = 180 g mol^{-1}) is isotonic with 2.5% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.
117. A first order reaction has a rate constant $1.25 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 2.5 g ?
[$\log 2 = 0.301$, $\log 3 = 0.4771$, $\log 4 = 0.6021$]
118. (A) What is lanthanoid contraction ? Actinoid contraction is greater from element to element than lanthanoid contraction. Why?

OR

- (B) Why do transition metals have high enthalpy of atomization ? Which element of 3d-series has lowest enthalpy of atomization?
119. (A) In the following pair of compounds, which compound undergoes S_N2 reaction faster and why?



- (B) Write the major product in the following :

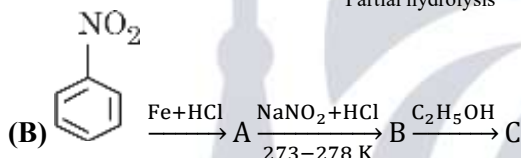
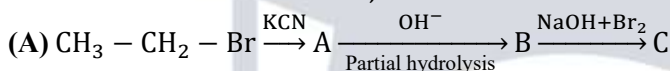


120. Define the following terms:

- (A) Denaturation of protein
(B) Invert sugar

SECTION C

121. Write the structures of A, B and C in the following reactions :



122. Write the reaction involved in the following :

- (A) Wolff-Kishner reduction
(B) Decarboxylation reaction
(C) Cannizzaro reaction

123. Give the equations of reactions for the preparation of : (any three)

- (A) Phenol from chlorobenzene
(B) Salicylaldehyde from phenol
(C) 2-Methoxyacetophenone from anisole
(D) Picric acid from phenol

124. Give reasons for the following :

- (A) Chlorine is ortho/para directing in electrophilic aromatic substitution reactions, though chlorine is an electron withdrawing group.
(B) Racemic mixture is optically inactive.
(C) Allyl chloride is hydrolysed more readily than *n*-propyl chloride.

125. The vapour pressure of a solvent at 283 K is 100 mm Hg . Calculate the vapour pressure of a dilute solution containing 1 mole of a strong electrolyte AB in 50 moles of the solvent at 283 K (assuming complete dissociation of solute AB).

126. Calculate emf of the following cell :



Given : $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76 \text{ V}$, $E_{\text{Sn}^{2+}/\text{Sn}}^0 = -0.14 \text{ V}$ [$\log 10 = 1$]

127. The rate of a gaseous reaction triples when temperature is increased from 17°C to 27°C. Calculate the energy of activation for this reaction.

[Given : $2.303R = 19.15 \text{ J K}^{-1} \text{ mol}^{-1}$, $\log 3 = 0.48$]

SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

128. Carbohydrates are essential for life in both plants and animals. Carbohydrates are used as storage molecules as starch in plants and glycogen in animals. Chemically they are polyhydroxy aldehydes or ketones. On the basis of their behaviour on hydrolysis, carbohydrates are classified as monosaccharides, oligosaccharides and polysaccharides. All monosaccharides are reducing sugars, i.e., they are oxidized by Tollens' reagent and Fehling's solution. A monosaccharide like glucose is aldohexose and its molecular formula was found to be $\text{C}_6\text{H}_{12}\text{O}_6$. After reacting with different reagents like HI, $\text{H}_2\text{N}-\text{OH}$, Bromine water, $(\text{CH}_3\text{CO})_2\text{O}$, etc. its structure was found to contain one aldehyde group, one primary alcoholic group, $(-\text{CH}_2\text{OH})$ and four secondary alcoholic groups ($>\text{CHOH}$). Despite having the aldehyde group, glucose does not give some of the reactions of aldehyde group like Schiff's test, NaHSO_3 addition. This explains the existence of glucose in two cyclic hemiacetal forms which differ only in the configuration of the hydroxyl group at C – 1.

Answer the following questions:

(A) What are reducing sugars ?

(B) Classify the following into monosaccharide and disaccharide : Fructose, Sucrose, Lactose, Galactose

(C) Name the polysaccharide which is known as 'animal starch'. Why is it called 'animal starch'?

OR

(C) (i) Name the isomers of glucose which in the cyclic form differ only in the configuration of the -OH group at C – 1.

(ii) Presence of which functional group was detected when glucose reacted with Br_2 water?

129. Transition metals have incomplete d-subshell either in neutral atom or in their ions. The presence of partly filled d-orbitals in their atoms makes transition elements different from that of the non-transition elements. With partly filled d-orbitals, these elements exhibit certain characteristic properties such as display of a variety of oxidation states, formation of coloured ions and entering into complex formation with a variety of ligands. The transition metals and their compounds also exhibit catalytic properties and paramagnetic behaviour. The transition metals are very hard and have low volatility. An examination of the $E_{\text{M}^{2+}/\text{M}}^0$ values shows the varying trends:

$E_{\text{M}^{2+}/\text{M}}^0$	
V	-1.18
Cr	-0.91
Mn	-1.18
Fe	-0.44
Co	-0.28
Ni	-0.25
Cu	+0.34
Zn	-0.76

Answer the following questions:

(A) On what basis can we say that Cu is a transition element but Zn is not? (Atomic number : Cu = 29, Zn = 30)

(B) Why do transition elements show variety of oxidation states?

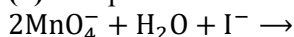
(C) (i) Why do $E_{\text{M}^{2+}/\text{M}}^0$ values show irregular trend from Vanadium to Zinc?

(ii) How is the variability in oxidation states of transition metals different from that of the non-transition elements?

OR

(C) (i) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. Why? (Atomic number: $\text{Cr} = 24, \text{Mn} = 25$)

(ii) Complete the following ionic equation :

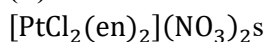


SECTION E

130. Answer any five of the following :

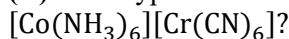
(A) How is the crystal field splitting energy for octahedral complex (Δ_o) related to that of tetrahedral complex (Δ_t) ?

(B) Write the IUPAC name of the following complex :



(C) Write the geometry and magnetic behaviour of the complex $[\text{Ni}(\text{CO})_4]$ on the basis of Valency Bond Theory (VBT).

(D) What type of isomerism is shown by the complex



(E) For the coordination compound on the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$. Is the coordination compound a high spin or low spin complex?

(f) Out of $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$, which complex is heteroleptic and why?

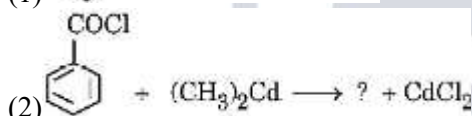
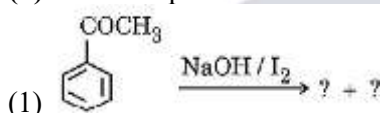
(g) Draw the structures of optical isomers of $[\text{PtCl}_2(\text{en})_2]^{2+}$.

131. (A) (i) Account for the following :

(1) Oxidation of aldehydes is easier as compared to ketones.

(2) The alpha (α) hydrogen atoms of aldehydes are acidic in nature.

(ii) Write the products in the following reactions :

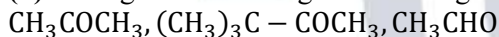


(iii) Give a simple chemical test to distinguish between ethanoic acid and ethanal.

OR

(B) (i) Draw structure of the 2,4-dinitrophenylhydrazone of benzaldehyde.

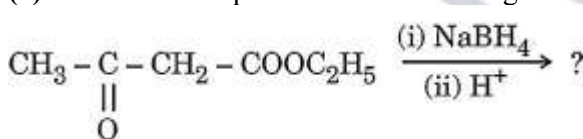
(ii) Arrange the following in increasing order of their reactivity towards HCN :



(iii) How can you convert phenyl magnesium bromide to benzoic acid?

(iv) Give a simple chemical test to distinguish between benzaldehyde and ethanal.

(v) Write the main product in the following reaction :



132. (A) (i) The resistance of $0.05\text{MCH}_3\text{COOH}$ solution is found to be 100 ohm . If the cell constant is 0.0354 cm^{-1} , calculate the molar conductivity of the acetic acid solution.

(ii) State Faraday's first law of electrolysis. How much charge in Faraday is required for the reduction of 1 mol of MnO_4^- to Mn^{2+} ?

OR

(B) (i) The conductivity of 0.0025 mol L^{-1} acetic acid is $5.25 \times 10^{-5}\text{ S cm}^{-1}$. Calculate its degree of dissociation if Λ_m° for acetic acid is $390\text{ S cm}^2\text{ mol}^{-1}$.

(ii) Write anode, cathode and overall reaction of lead storage battery.

General Instructions :

Read the following instructions carefully and follow them:

(i) This question paper contains 33 questions. All questions are compulsory.

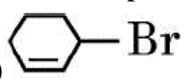
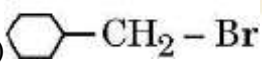
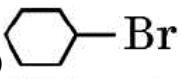
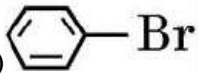
(ii) This question paper is divided into five sections - Section A, B, C, D and E.

(iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.

- (iv) Section B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
 (v) Section C-questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
 (vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks.
 (vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
 (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the sections except Section A.
 (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
 (x) Use of calculators is not allowed.

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

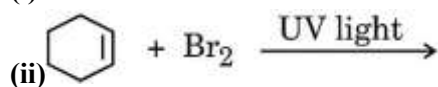
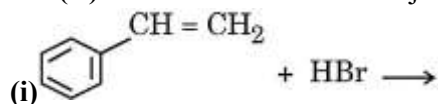
133. Which one of the following first row transition elements is expected to have the highest third ionization enthalpy?
- (a) Iron (Z = 26) (b) Manganese (Z = 25)
 (c) Chromium (Z = 24) (d) Vanadium (Z = 23)
134. Which of the following compounds will give a ketone on oxidation with chromic anhydride (CrO₃)?
- (a) (CH₃)₂CH - CH₂OH
 (b) CH₃CH₂CH₂OH
 (c) (CH₃)₃C - OH
 (d) $\begin{array}{c} \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_3 \\ | \\ \text{OH} \end{array}$
135. Two among the three components of DNA are β-D-2-deoxyribose and a heterocyclic base. The third component is :
- (a) Adenine (b) Phosphoric acid
 (c) Sulphuric acid (d) Uracil
136. For an electrolyte undergoing association in a solvent, the van't Hoff factor :
- (a) is always greater than one
 (b) has negative value
 (c) has zero value
 (d) is always less than one
137. For the reaction $\text{X} + 2\text{Y} \rightarrow \text{P}$, the differential form equation of the rate law is:
- (a) $\frac{2}{dt} \frac{d[\text{P}]}{dt} = \frac{-d[\text{Y}]}{dt}$ (b) $\frac{-d[\text{P}]}{dt} = \frac{-d[\text{X}]}{dt}$
 (c) $\frac{+d[\text{X}]}{dt} = \frac{-d[\text{P}]}{dt}$ (d) $\frac{-2}{dt} \frac{d[\text{Y}]}{dt} = \frac{+d[\text{P}]}{dt}$
138. The compound which undergoes S_N1 reaction most rapidly is :
- (a) 
 (b) 
 (c) 
 (d) 
139. Acetic acid reacts with PCl₅ to give :
- (a) Cl - CH₂ - COCl (b) Cl - CH₂ - COOH
 (c) CH₃ - COCl (d) CCl₃ - COOH
140. The formation of cyanohydrin from an aldehyde is an example of :
- (a) nucleophilic addition
 (b) electrophilic addition
 (c) nucleophilic substitution
 (d) electrophilic substitution

141. In the Arrhenius equation, when $\log k$ is plotted against $1/T$, a straight line is obtained whose :
- slope is $\frac{A}{R}$ and intercept is E_a .
 - slope is A and intercept is $\frac{-E_a}{R}$.
 - slope is $\frac{-E_a}{RT}$ and intercept is $\log A$.
 - slope is $\frac{-E_a}{2.303R}$ and intercept is $\log A$.
142. The reaction of an alkyl halide with sodium alkoxide forming ether is known as:
- Wurtz reaction
 - Reimer-Tiemann reaction
 - Williamson synthesis
 - Kolbe reaction
143. The correct order of the ease of dehydration of the following alcohols by the action of conc. H_2SO_4 is :
- $(CH_3)_3C - OH > (CH_3)_2CH - OH > CH_3CH_2 - OH$
 - $(CH_3)_2CH - OH > CH_3CH_2 - OH > (CH_3)_3C - OH$
 - $CH_3CH_2 - OH > (CH_3)_2CH - OH > (CH_3)_3C - OH$
 - $(CH_3)_2CH - OH > (CH_3)_3C - OH > CH_3CH_2 - OH$
144. Which functional groups of glucose interact to form cyclic hemiacetal leading to pyranose structure?
- Aldehyde group and hydroxyl group at C - 4
 - Aldehyde group and hydroxyl group at C - 5
 - Ketone group and hydroxyl group at C - 4
 - Ketone group and hydroxyl group at C - 5
- For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
- Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 - Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 - Assertion (A) is true, but Reason (R) is false.
 - Assertion (A) is false, but Reason (R) is true.
145. **Assertion (A)** : When NaCl is added to water a depression in freezing point is observed.
Reason (R) : NaCl undergoes dissociation in water.
146. **Assertion (A)** : Separation of Zr and Hf is difficult.
Reason (R) : Zr and Hf have similar radii due to lanthanoid contraction.
147. **Assertion (A)** : The pK_a of ethanoic acid is lower than that of $Cl - CH_2 - COOH$.
Reason (R) : Chlorine shows electron withdrawing (-I) effect which increases the acidic character of $Cl - CH_2 - COOH$.
148. **Assertion (A)** : Aniline is a stronger base than ammonia.
Reason (R) : The unshared electron pair on nitrogen atom in aniline becomes less available for protonation due to resonance.

SECTION B

149. Calculate the potential of Iron electrode in which the concentration of Fe^{2+} ion is 0.01 M .
 ($E^\circ Fe^{2+}/Fe = -0.45$ V at 298 K) [Given : $\log 10 = 1$]
150. Define molecularity of the reaction. State any one condition in which a bimolecular reaction may be kinetically of first order.
151. What happens when D-glucose is treated with the following reagents ?
- HI
 - Conc. HNO_3

152. (A) Draw the structures of major monohalo products in each of the following reactions :



OR

(B) Give reasons for the following :

(i) Grignard reagent should be prepared under anhydrous conditions.

(ii) Alkyl halides give alcohol with aqueous KOH whereas in the presence of alcoholic KOH, alkenes are formed.

153. Write the chemical equation when :

(A) Butan-2-one is treated with Zn(Hg) and conc. HCl.

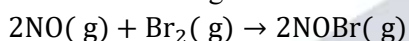
(B) Two molecules of benzaldehyde are treated with conc. NaOH.

SECTION C

154. When a certain conductivity cell was filled with 0.05 M KCl solution, it has a resistance of 100 ohm at 25°C. When the same cell was filled with 0.02 M AgNO₃ solution, the resistance was 90 ohm. Calculate the conductivity and molar conductivity of AgNO₃ solution.

(Given : Conductivity of 0.05 M KCl solution = $1.35 \times 10^{-2} \text{ ohm}^{-1} \text{ cm}^{-1}$)

155. The following initial rate data were obtained for the reaction :



Expt. No.	[NO] /molL ⁻¹	[Br ₂] /molL ⁻¹	Initial Rate (molL ⁻¹ s ⁻¹)
1	0.05	0.05	1.0×10^{-3}
2	0.05	0.15	3.0×10^{-3}
3	0.15	0.05	9.0×10^{-3}

(A) What is the order with respect to NO and Br₂ in the reaction?

(B) Calculate the rate constant (k).

(C) Determine the rate of reaction when concentration of NO and Br₂ are 0.4 M and 0.2 M, respectively.

156. (A) Write the formula for the following coordination compound :

Potassium tetrahydroxidozincate (II)

(B) Arrange the following complexes in the increasing order of conductivity of their solution :

[Cr(NH₃)₅Cl]Cl₂, [Cr(NH₃)₃Cl₃], [Cr(NH₃)₆]Cl₃

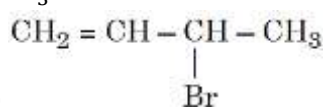
(C) Identify the type of isomerism exhibited by the following complexes:

(i) [Co(NH₃)₃NO₂]²⁺

(ii) [Co(en)₃]Cl₃

157. (A) Which of the following is an allylic halide?

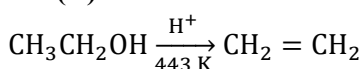
(i) CH₃ - CH = CH - Br



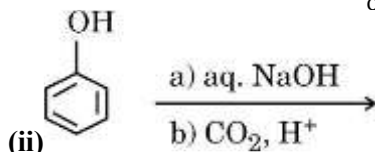
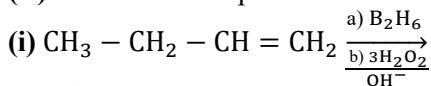
(B) Out of chlorobenzene and 2,4,6-trinitrochlorobenzene, which is more reactive towards nucleophilic substitution and why?

(C) Which isomer of C₄H₉Cl has the lowest boiling point?

158. (A) Write the mechanism of the following reaction :



(B) Write the main product in each of the following reactions :



159. Answer the following : (any three)

(A) What is peptide linkage ?

(B) What type of bonds hold a DNA double helix together?

(C) Which one of the following is a polysaccharide?

Sucrose, Glucose, Starch, Fructose

(D) Give one example each for water-soluble vitamins and fat-soluble vitamins.

160. Compound (A) ($\text{C}_6\text{H}_{12}\text{O}_2$) on reduction with LiAlH_4 gives two compounds (B) and (C). The compound (B) on oxidation with PCC gives compound (D) which upon treatment with dilute NaOH and subsequent heating gives compound (E). Compound (E) on catalytic hydrogenation gives compound (C). The compound (D) is oxidized further to give compound (F) which is found to be a monobasic acid (Molecular weight = 60). Identify the compounds (A), (B), (C), (D), (E) and (F).

SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

161. Batteries and fuel cells are very useful forms of galvanic cell. Any battery or cell that we use as a source of electrical energy is basically a galvanic cell. However, for a battery to be of practical use it should be reasonably light, compact and its voltage should not vary appreciably during its use. There are mainly two types of batteries - primary batteries and secondary batteries.

In the primary batteries, the reaction occurs only once and after use over a period of time the battery becomes dead and cannot be reused again, whereas the secondary batteries are rechargeable.

Production of electricity by thermal plants is not a very efficient method and is a major source of pollution. To solve this problem, galvanic cells are designed in such a way that energy of combustion of fuels is directly converted into electrical energy, and these are known as fuel cells. One such fuel cell was used in the Apollo space programme.

Answer the following questions:

(A) How do primary batteries differ from secondary batteries?

(B) The cell potential of Mercury cell is 1.35 V, and remains constant during its life. Give reason.

(C) Write the reactions involved in the recharging of the lead storage battery.

OR

(C) Write two advantages of fuel cells over other galvanic cells.

162. The Valence Bond Theory (VBT) explains the formation, magnetic behaviour and geometrical shapes of coordination compounds whereas 'The Crystal Field Theory' for coordination compounds is based on the effect of different crystal fields (provided by ligands taken as point charges), on the degeneracy of d-orbital energies of the central metal atom/ion. The splitting of the d-orbitals provides different electronic arrangements in strong and weak crystal fields. The crystal field theory attributes the colour of the coordination compounds to d - d transition of the electron. Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.

Answer the following questions:

(A) What is crystal field splitting energy?

(B) Give reason for the violet colour of the complex $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ on the basis of crystal field theory.

(C) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ is paramagnetic while $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic.

Explain why. [Atomic No. : Cr = 24, Ni = 28]

OR

(C) Explain why $[\text{Fe}(\text{CN})_6]^{3-}$ is an inner orbital complex, whereas $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is an outer orbital complex. [Atomic No. : Fe = 26]

SECTION E

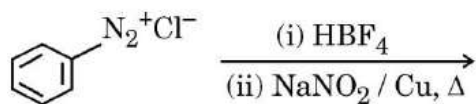
163. (A) (i) At the same temperature, CO_2 gas is more soluble in water than O_2 gas. Which one of them will have higher value of K_H and why?
- (ii) How does the size of blood cells change when placed in an aqueous solution containing more than 0.9% (mass/volume) sodium chloride?
- (iii) 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionized. Calculate the boiling point of the solution (Given : K_b for $\text{H}_2\text{O} = 0.52 \text{ K kg mol}^{-1}$)

OR

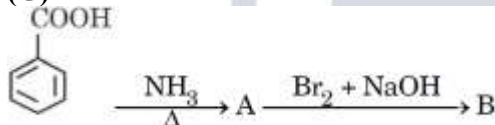
- (B) (i) The vapour pressures of A and B at 25°C are 75 mm Hg and 25 mm Hg, respectively. If A and B are mixed such that the mole fraction of A in the mixture is 0.4, then calculate the mole fraction of B in vapour phase.
- (ii) Define colligative property. Which colligative property is preferred for the molar mass determination of macromolecules?
- (iii) Why are equimolar solutions of sodium chloride and glucose not isotonic?

164. Answer any five questions of the following :

- (A) N,N-diethyl-benzenesulphonamide is insoluble in alkali. Give reason.
- (B) Aniline does not undergo Friedel-Crafts reaction. Why ?
- (C) Write a simple chemical test to distinguish between methylamine and aniline.
- (D) Write the chemical reaction involved in Gabriel phthalimide synthesis.
- (E) How will you convert aniline to p-bromoaniline?
- (F) Complete the following reaction :

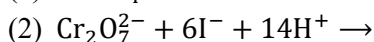
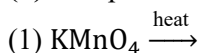


- (G) Write the structures of A and B in the following reaction :



165. (A) (i) Account for the following :

- (1) The melting and boiling points of Zn, Cd and Hg are low.
- (2) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing.
- (3) E° value of Cu^{2+}/Cu is $+0.34 \text{ V}$.
- (ii) Complete and balance the following chemical equations:



- (B) (i) Out of Cu_2Cl_2 and CuCl_2 , which is more stable in aqueous solution and why?
- (ii) Write the general electronic configuration of f-block elements.
- (iii) Predict which of the following will be coloured in aqueous solution and why?
 Sc^{3+} , Fe^{3+} , Zn^{2+}

[Atomic number : Sc = 21, Fe = 26, Zn = 30]

- (iv) How can you obtain potassium dichromate from sodium chromate?
- (v) Why do transition metals and their compounds show catalytic activities?

General Instructions :

Read the following instructions carefully and follow them:

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) This question paper is divided into five sections - Section A, B, C, D and E.
- (iii) Section A - questions number 1 to 16 are multiple choice type questions. Each question carries 1 mark.
- (iv) Section B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.
- (v) Section C - questions number 22 to 28 are short answer type questions. Each question carries 3 marks.
- (vi) Section D - questions number 29 and 30 are case-based questions. Each question carries 4 marks.
- (vii) Section E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in

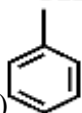
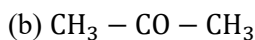
few questions in all the sections except Section A.

(ix) Use of calculators is not allowed.

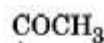
SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

166. Low concentration of oxygen in the blood and tissues of people living at high altitudes is due to :
- Low temperature
 - Low atmospheric pressure
 - High atmospheric pressure
 - High temperature
167. The quantity of charge required to obtain one mole of Al from Al_2O_3 is :
- 1 F
 - 6 F
 - 3 F
 - 2 F
168. Which of the following oxidation state is common for all lanthanoids?
- +2
 - +4
 - +6
 - +3
169. Which of the following ions has the electronic configuration $3d^3$? [Atomic number : Cr = 24, Mn = 25, Fe = 26, Co = 27]
- Cr^{3+}
 - Mn^{3+}
 - Fe^{3+}
 - Co^{3+}
170. When 1 mole of $\text{CoCl}_3 \cdot 5\text{NH}_3$ is treated with excess of AgNO_3 , 2 moles of AgCl are obtained. The secondary valency of Co will be:
- 6
 - 4
 - 3
 - 5
171. A primary alkyl halide would prefer to undergo ____.
- $\text{S}_\text{N}2$ reaction
 - $\text{S}_\text{N}1$ reaction
 - Electrophilic substitution reaction
 - Racemisation
172. Phenol is less acidic than :
- Ethanol
 - o-cresol
 - p-cresol
 - o-nitrophenol
173. Reduction of aromatic nitro compounds using Sn and HCl gives:
- Aromatic amide
 - Aromatic oxime
 - Aromatic primary amine
 - Aromatic hydrocarbon
174. Nucleic acids are the polymers of :
- Nucleotides
 - Nucleosides
 - Bases
 - Sugars
175. Methylamine reacts with HNO_2 to form :
- $\text{CH}_3 - \text{O} - \text{N} = \text{O}$
 - $\text{CH}_3 - \text{O} - \text{CH}_3$
 - $\text{CH}_3 - \text{OH}$
 - $\text{CH}_3 - \text{CHO}$
176. Which one of the following has the lowest pK_b value ?
- Ammonia
 - Aniline
 - Methylamine
 - Dimethylamine
177. Which of the following compounds is most reactive towards nucleophilic addition reactions?
- CH_3CHO



(c)



(d)

For Questions number 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

178. **Assertion (A) :** Vitamin C cannot be stored in our body.

Reason (R) : Vitamin C is fat soluble and is excreted from the body in urine.

179. **Assertion (A) :** Bromination of benzoic acid gives m-bromobenzoic acid.

Reason (R) : Carboxyl group acts as a deactivating and meta-directing group.

180. **Assertion (A) :** When NaCl is added to water, a depression in freezing point is observed.

Reason (R) : The lowering of vapour pressure of a solution causes depression in the freezing point.

181. **Assertion (A) :** Linkage isomerism arises in coordination compounds containing ambidentate ligand.

Reason (R) : Ambidentate ligand has two same donor atoms.

SECTION B

182. Why does a solution containing non-volatile solute have higher boiling point than a pure solvent? Why is elevation of boiling point a colligative property?

183. (A) Write the formulae of the following compounds:

- (i) Potassium tetrahydroxidozincate (II)
 (ii) Hexaammineplatinum (IV) chloride

OR

(B) Define the following terms:

- (i) Homoleptic complex
 (ii) Chelate ligand

184. (A) Out of $(\text{CH}_3)_3\text{C} - \text{Br}$ and $(\text{CH}_3)_3\text{C} - \text{I}$, which one is more reactive towards $\text{S}_\text{N}1$ and why?

(B) Write the product formed when p-nitrochlorobenzene is heated with aqueous NaOH at 443 K followed by acidification.

185. Write the reactions involved in the following:

- (A) Reimer-Tiemann reaction
 (B) Friedel-Crafts alkylation of anisole

186. A and B are two functional isomers of compound $\text{C}_3\text{H}_6\text{O}$. On heating with NaOH and I_2 , isomer B forms a precipitate of iodoform whereas isomer A does not form any precipitate. Write the formulae of A and B.

SECTION C

187. Calculate the boiling point of the solution when 4 g of MgSO_4 ($M = 120 \text{ g mol}^{-1}$) was dissolved in 100 g of water, assuming MgSO_4 undergoes complete ionization.

(K_b for water = $0.52 \text{ K kg mol}^{-1}$)

188. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.

189. A reaction is first order in A and second order in B.

(A) Write the differential rate equation.

(B) How is the rate affected on increasing the concentration of B three times?

(C) How is the rate affected when the concentrations of both A and B are doubled?

190. Define Crystal field splitting energy. On the basis of Crystal field theory, write the electronic configuration of d^5 ion when :

(A) $\Delta_0 > P$

(B) $\Delta_0 < P$

191. Write the main products when : (any three)

(A) Methyl chloride is treated with KCN .

(B) 2,4,6-trinitrochlorobenzene is subjected to hydrolysis.

(C) Methyl chloride is treated with sodium in the presence of dry ether.

(D) n -butylchloride is treated with alcoholic KOH .

192. Explain the following :

(A) Carbylamine reaction

(B) Hoffmann bromamide degradation reaction

(C) Ammonolysis

193. How do you convert the following?

(A) Propan-2-ol to Propanone

(B) Phenol to Benzene

(C) Propene to Propan-2-ol

SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

194. Rate of reaction depends upon the experimental conditions such as concentration of reactants, temperature and catalyst. Mathematical representation of rate of a reaction is given by rate law:

$$\text{Rate} = k[A]^p[B]^q$$

A balanced chemical equation never gives us a true picture of how a reaction takes place since rarely does a reaction get completed in one step. The reactions taking place in one step are called elementary reactions. When a sequence of elementary reactions give us the products, the reactions are called complex reactions. Order and molecularity of an elementary reaction are same.

(A) For a reaction $A + B \rightarrow \text{Product}$, the rate law is given by

$$\text{Rate} = k[A]^1[B]^{1/2}$$

What is the overall order of the reaction?

(B) How are order and molecularity different for complex reactions?

(C) For a first order reaction, show that the time required for 99% completion is twice the time required for the completion of 90% of reaction. [Given : $\log 10 = 1$]

OR

(C) What is meant by zero order reaction ? Give any one example of zero order reaction.

195. Aldehydes and ketones undergo nucleophilic addition reactions onto the carbonyl group but carboxylic acids do not undergo nucleophilic addition reaction. The α (α)-hydrogens of aldehydes and ketones are acidic in nature. Therefore aldehydes and ketones having at least one α -hydrogen undergo Aldol condensation. Aldehydes are easily oxidized by mild oxidizing agents such as Tollens' reagent and Fehling's reagent.

(A) Why does methanal not undergo Aldol condensation?

(B) Why are α -hydrogens of aldehydes and ketones acidic in nature?

(C) (i) Why are aldehydes easily oxidised as compared to ketones?

(ii) Why is addition of sodium hydrogen sulphite to aldehydes used for separation and purification of aldehydes ?

OR

(C) What happens when :

(i) ethanal is treated with dilute $NaOH$?

(ii) propanone is treated with HCN ?

SECTION E

196. Do any five of the following:

- (A) Pentaacetate of glucose does not react with hydroxylamine. Give reason.
- (B) Why do amino acids behave like salts ?
- (C) Why must water soluble vitamins be taken regularly in diet?
- (D) Why are the two strands in DNA complementary to each other?
- (E) What happens when D-glucose is heated with HI ?
- (F) What is meant by glycosidic linkage ?
- (G) What are enzymes ?

197. The elements of 3d transition series are given as:

Se Ti V Cr Mn Fe Co Ni Cu Zn

(A) Answer the following :

- (i) Which element shows +1 oxidation state?
- (ii) Which element is a strong reducing agent in +2 oxidation state and why?
- (iii) Write the element which shows maximum number of oxidation states. Give reason.
- (iv) Which element has the lowest value of enthalpy of atomization and why?
- (v) Which element shows only +3 oxidation state?

OR

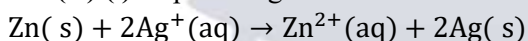
(B) (i) Account for the following :

- (1) Cu^{2+} salts are coloured while Zn^{2+} salts are white.
- (2) Mn^{3+} is a strong oxidising agent.
- (3) Transition metals and their many compounds act as good catalysts.

(ii) What is lanthanoid contraction ?

Write one consequence of lanthanoid contraction.

198. (A) (i) Depict the galvanic cell in which the reaction



takes place. Further show:

- (1) which of the electrodes is negatively charged ?
- (2) the carriers of the current in the cell.
- (ii) Define fuel cell. Write two fuels that can be used in fuel cells.

OR

(B) (i) State the following:

- (1) Kohlrausch law
- (2) Faraday's first law of electrolysis

(ii) Define the following :

- (1) Corrosion
- (2) Primary batteries and secondary batteries Give one example in each case.