CHEMISTRY

Roll No.:.....

Total No. of Questions: 4]

Total No. of Printed Pages: 3

Paper 1

Time: 3 Hours]

[**Maximum Marks:** 70

General Instructions:

(i) There are total four Sections in the question paper. All questions are compulsory.

(ii) Section-A contains 10 Objective Type Questions (Multiple Choice Questions) of 1 mark each. (1 × 10 = 10 marks)

(iii) Section-B contains 9 Very Short Answer Type Questions of 2 marks each to be answered in 20-30 words. (2 × 9 = 18 marks)

(iv) Section-C contains 9 Short Answer Type Questions of 3 marks each to be answered in 100-150 words. (3 × 9 = 27 marks)

(v) Section-D contains 3 Long Answer Type Questions of 5 marks each to be answered in 150-200 words. (5 × 3 = 15 marks)

(vi) Use log table if necessary. Use of scientific calculators is not allowed.

Section-A (Objective Type Questions/Multiple Choice Questions)

1. **Select the correct one:**

(i) The molal elevation constant is the ratio of the elevation in B.P. to:

(A) Molarity (B) Molality

(C) Mole fraction of solute (D) Mole fraction of solvent

(ii) Which of the following solutions will have the highest boiling point at 1 atm pressure?

(A) 0.1 m $FeCl_3$ (B) 0.1 m $BaCl_2$

(C) 0.1 m NaCl (D) 0.1 m Urea (NH_2CONH_2)

(iii) Nernst equations give effect of:

(A) Temperature on EMF (B) Concentration on EMF

(C) Pressure of the gas (if any) on EMF

(D) All the three above

(iv) The rate constant of a reaction is 2.5×10^{-2} sec^{-1}. The order of the reaction is:

(A) One (B) Zero

(C) Two (D) Three

(v) SN^1 reactions occur through the intermediate formations of:
(A) Carbocation (B) Carbanions
(C) Free radical (D) None of these

(vi) On heating with Sodalime, salicylic acid gives:
(A) Phenol (B) Benzoic acid
(C) Sodium salicylate (D) Benzene

(vii) Reduction of nitroethane with $LiAlH_4$ gives:
(A) Ethyl hydroxylamine (B) Ethanol
(C) Ethylamine (D) Ethanamide

(viii) A complex in which dsp^2 hybridisation takes place is:
(A) Square planar (B) Tetrahedral
(C) Triangular planar (D) Pyramidal

(ix) Adenosine is an example of a:
(A) Nucleotide (B) Nucleoside
(C) Purine base (D) Pyridine base

(x) Which of the following biomolecules contains a non-transition metal ion?
(A) Haemoglobin (B) Chlorophyll
(C) Insulin (D) Vitamin B_{12}

Section-B (Very Short Answer Type Questions)

2. (i) Calculate the half-life of a first-order reaction from their rate constants given below:
(a) $200\ s^{-1}$ (b) $2\ min^{-1}$

(ii) Why does a transition series consist of 10 elements?

(iii) Why is an alkylamine more basic than ammonia?

(iv) What is Lucas reagent?

(v) What are essential and non-essential amino acids?

(vi) Write the IUPAC names of:
(a) $Zn_2[Fe(CN)_6]$
(b) $[Pt(NH_3)_4Cl_2]^{2+}$

(vii) Define rate of reaction and rate constant.

(viii) Why cannot molecularity of any reaction be equal to zero?

(ix) Give a brief account of Wurtz reaction.

Section-C (Short Answer Type Questions)

3. (i) What do you mean by a Nucleophilic addition reaction? Give its mecha

(ii) Define Kohlrausch's law. How can it be used to find the degr dissociation of a weak electrolyte?

(iii) Explain why transition metal ions usually show paramagnetic behavio

(iv) What happens when acidified $KMnO_4$ reacts with:
(a) H_2S
(b) Oxalic acid
(c) KNO_2?

(v) Define cis and trans isomerism. Draw the cis and trans isom $[Co(NH_3)_4Cl_2]^+$ ion.

(vi) How will you convert ethyl bromide to:
(a) Ethoxyethane
(b) Ethane
(c) Ethanol

(vii) How will you distinguish between primary, secondary, and tertiary alcohols by Victor Meyer's test? Give chemical reactions.

(viii) What is Diazotisation? Discuss its mechanism.

(ix) What are Carbohydrates? How are they classified?

Section-D (Long Answer Type Questions)

4. (i) State and explain Raoult's law for:
(a) Volatile solute
(b) Non-volatile solute.

Or

What do you understand by Colligative properties of a solution? Explain briefly osmosis and osmotic pressure.

(ii) What is an electrochemical cell? Describe the working of Daniell cell.

Or

What is Corrosion? Give the mechanism (electrochemical phenomenon) of rusting of iron. What do you understand by cathodic and barrier protection of corrosion?

(iii) Describe any five general methods of preparation of carboxylic acids.

Or

Giving chemical equations, write a brief account of the following:
(a) Aldol condensation
(b) Cannizzaro reaction
(c) Rosenmund reduction

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Paper 2

Time: 3 Hours]

[Maximum Marks: 70

Section-A (Objective Type Questions/Multiple Choice Questions)

1. Select the correct one:

(i) In which mode of expression does the concentration of a solution remain independent of temperature?
(A) Molarity (B) Normality
(C) Formality (D) Molality

(ii) If an aqueous solution of glucose is allowed to freeze, then crystals of which will be separated out first?
(A) Glucose (B) Water
(C) Both of these (D) None of these

(iii) The amount of an ion liberated on an electrode during electrolysis does not depend upon:
(A) Current strength (B) Conductance of the solution
(C) Time
(D) Electrochemical equivalent of the element

(iv) Collision theory is applicable to:
(A) First order reaction (B) Zero order reaction
(C) Bimolecular reaction (D) Intramolecular reaction

(v) Alkyl halides undergoing nucleophilic bimolecular substitution involve:
(A) Formation of carbocation (B) Racemic mixture
(C) Inversion of configuration (D) Retention of configuration

(vi) Among the following compounds, the strongest acid is:
(A) $HC \equiv CH$ (B) C_6H_6
(C) C_2H_6 (D) CH_3OH

(vii) The weakest base among the following is:
(A) Dimethylamine (B) Aniline
(C) Methylamine (D) Ethylamine

(viii) A transition metal exists in its highest oxidation state. It is expected to behave as:

(A) A chelating agent
(B) A central metal in a coordination compound
(C) An oxidising agent (D) A reducing agent

(ix) The human body does not produce:
(A) Enzymes (B) DNA
(C) Vitamins (D) Hormones

(x) Adenosine is an example of:
(A) Nucleotide (B) Nucleoside
(C) Purine base (D) Pyrimidine base

Section-B (Very Short Answer Type Questions)

2. (i) What is the difference between Rate Law and Law of Mass Action?
(ii) What is meant by didentate and ambidentate ligands?
(iii) Why are alcohols less acidic than water?
(iv) What is diazotisation?
(v) Write two main functions of carbohydrates in plants.
(vi) Write IUPAC names of:
(a) $[CrCl_2(en)(NH_3)_2]^+$
(b) $K_3[Fe(CN)_6]$
(vii) Why is molecularity applicable only for elementary reactions and order is applicable for both elementary and complex reactions?
(viii) How does the average rate of reaction differ from the instantaneous reaction rate?
(ix) Why are haloarenes less reactive than haloalkanes towards nucleophilic substitution reactions?

Section-C (Short Answer Type Questions)

3. (i) Formic acid (methanoic acid) is a stronger acid than acetic acid (ethanoic acid). Explain.
(ii) Define conductivity and molar conductivity for the solution of an electrolyte.
(iii) Explain the following about transition metals:
(a) Magnetic behaviour
(b) Oxidation states
(iv) How is potassium dichromate prepared from chromite ore? Give its three oxidising properties.
(v) Discuss briefly, giving an example in each case, the role of coordination compounds in:
(a) Biological system
(b) Medicinal chemistry
(vi) How will you convert ethyl bromide to:
(a) Ethane (b) Ethoxyethane

(c) Ethanenitrile?

(vii) What are phenols? How do they differ structurally from aromatic alcohols?

(viii) What is Hinsberg's reagent? How will you distinguish between primary, secondary, and tertiary amines by it?

(ix) What are α-amino acids? How are they related to proteins? Give the structure of two amino acids.

Section-D (Long Answer Type Questions)

4. (i) Define:

(a) Mole fraction (b) Molality

(c) Molarity

Calculate the mole fraction of ethylene glycol ($C_2H_6O_2$) in a solution containing 20% of $C_2H_6O_2$ by mass.

Or

Define and explain elevation in boiling point. How can you calculate the molecular mass of a non-volatile solute with it?

(ii) Define Kohlrausch's law. How does it help in:

(a) Calculation of Λ^0 for a weak electrolyte

(b) Degree of dissociation of a weak electrolyte?

Or

What are fuel cells? Describe H_2-O_2 fuel cell.

(iii) Describe the following:

(a) Esterification (b) Cannizzaro reaction

(c) Cross aldol condensation (d) Decarboxylation

Or

(a) Write five methods for the preparation of aldehydes.

(b) How are aldehydes distinguished from ketones using Tollen's and Fehling's reagents? Give chemical reactions.

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Paper 3

Time: 3 Hours] **[Maximum Marks:** 70

Section-A (Objective Type/Multiple Choice Questions)

1. Select the correct one:

(i) The osmotic pressure of a solution is directly proportional to:
- (A) The molecular concentration of the solute
- (B) The absolute temperature at a given concentration
- (C) The lowering of vapour pressure
- (D) All of these

(ii) Which of the following 0.1 M aqueous solutions will have the lowest freezing point?
- (A) Potassium sulphate (B) Sodium Chloride
- (C) Urea (D) Glucose

(iii) The cell reaction $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ is best represented by:
- (A) $Cu|Cu^{2+}||Zn^{2+}|Zn$ (B) $Pt|Zn^{2+}||Cu^{2+}|Pt$
- (C) $Zn|Zn^{2+}||Cu^{2+}|Cu$ (D) Any of these

(iv) A first order reaction has a half-life period of 34.65 seconds. Its rate constant is:
- (A) $3 \times 10^{-2}\ s^{-1}$ (B) $4 \times 10^{-2}\ s^{-1}$
- (C) $20\ s^{-1}$ (D) $2 \times 10^{-2}\ s^{-1}$

(v) The general outer electronic configuration of a transition element is:
- (A) $(n-1)d^{1-10}ns^{1}$ (B) $(n-1)d^{10}ns^{2}$
- (C) $(n-1)d^{1-10}ns^{1-2}$ (D) $(n-1)d^{5}ns^{1}$

(vi) Haloalkanes in the presence of alcoholic KOH undergo:
- (A) Polymerisation (B) Elimination
- (C) Substitution (D) Dimerisation

(vii) Alcohol which is used as a beverage is:
- (A) Methanol (B) Ethanol
- (C) Butan-1-ol (D) Propan-1-ol

(viii) Benzene diazonium chloride reacts with phenol to give:
- (A) p-hydroxy azo-benzene (B) Phenol
- (C) Chloral (D) Nitro-benzene

(ix) Maltose is made of:
(A) Two α-D glucose (B) α and β-D glucose
(C) Glucose and fructose (D) Fructose only

(x) Vitamin B1 is:
(A) Riboflavin (B) Cobalamine
(C) Thiamine (D) Pyridoxine

Section-B (Very Short Answer Type Questions)

2. (i) Define activation energy of a reaction. Why do different reactions proceed at different speeds?
(ii) Define half-life period. How can you find the half-life period of a first-order reaction?
(iii) How does rate law differ from law of mass action?
(iv) Give two main basic postulates of Werner's theory of coordination compounds.
(v) Write IUPAC names of:
(a) $[Co(NH_3)_6]^{3+}$ (b) $[Cu(H_2O)_6]^{2+}$.
(vi) Give the uses and environmental effects of D.D.T.
(vii) Explain briefly the dehydration of ethyl alcohol with H_2SO_4 at temperatures 443 K and 413 K.
(viii) What are Amines? How are they classified?
(ix) What are carbohydrates? How are they classified?

Section-C (Short Answer Type Questions)

3. (i) Define the terms:
(a) Cell constant (b) Molar conductivity
(c) Corrosion
(ii) What is lanthanide contraction? How is it caused?
(iii) What are transition elements? Why are they called d-block elements? Wr the electronic configuration of the 1st and last member of 3d transiti series.
(iv) Define the following terms with examples:
(a) Ionisation isomerism (b) Bidentate ligand
(v) How will you convert ethyl bromide into:
(a) Ethylnitrite (b) Ethylcarbylamine
(c) Ethene?
(vi) How is phenol converted into:
(a) Salicylaldehyde (b) Phenylacetate?
(vii) Aldehydes are more reactive than ketones. Explain. Give reasons.
(viii) What are diazonium salts? How does benzene diazonium chloride reac KI on warming?

(ix) Describe the secondary structure of Proteins.

Section-D (Long Answer Type Questions)

4. (i) State and explain depression in freezing point. Derive the relationship between depression in freezing point and molar mass of solute.

Or

What is Van't Hoff factor? How is it related to the degree of dissociation of the electrolyte in the solution? What is its value when the solute undergoes association and dissociation?

(ii) State and explain Faraday's Laws of electrolysis. What is meant by electrochemical equivalent?

Or

Explain the term Electrode potential and e.m.f. of a cell. Discuss Nernst equation for the cell potential.

(iii) What happens when Acetone is treated with:

(a) Sodium bisulphite (b) Hydrazine
(c) Grignard reagent (d) Hydroxylamine
(e) Hydrogen cyanide?

Or

Give two methods of preparation of carboxylic acids. How do they react with:

(a) NaOH (b) NH_3
(c) C_2H_5OH/H_2SO_4?

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Paper 4

Time: 3 Hours]

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Section-A (Objective Type Questions/Multiple Choice Questions)

1. Choose the correct answer and write in your answer book:

(i) The molarity of pure water is:

(A) 5.556 mol/litre (B) 55.56 mol/litre

(C) 18 mol/litre (D) 0.18 mol/litre

(ii) Isotonic solutions are solutions having the same:

(A) Surface tension (B) Vapour pressure

(C) Osmotic pressure (D) Viscosity

(iii) The units of cell constant are:

(A) Ohm^{-1} (B) Ohm-cm

(C) Cm^{-1} (D) $Ohm^{-1}\ cm^2\ equiv.^{-1}$

(iv) The specific rate for a reaction is 1.0×10^{-4} mol L^{-1} min^{-1}. The order of t reaction is:

(A) Zero (B) One

(C) Two (D) Three

(v) Half-life period of any first-order reaction is:

(A) Directly proportional to the initial concentration of the reactants

(B) Half of the rate constant

(C) Same for all reactions

(D) Independent of initial concentration of reactants

(vi) The maximum oxidation state of osmium is:

(A) +6 (B) +7

(C) +8 (D) +5

(vii) The brand name of dichlorodifluoromethane is:

(A) Westron (B) Westrosol

(C) Freon (D) DDT

(viii) Ethers are isomeric with:

(A) Aldehydes (B) Alcohols

(C) Vinyl alcohols (D) Ketones

(ix) Which of the following compounds does not have a carboxyl group?

(A) Benzoic acid (B) Palmitic acid

(C) Picric acid (D) Oleic acid

(x) Fructose is a:

(A) Aldose (B) Ketose

(C) Both aldose and ketose (D) None of these

Section-B (Very Short Answer Type Questions)

2. (i) Define rate law with an example.

(ii) Name the type of isomerism exhibited by the following isomers:

(a) $[Co(NH_3)_6][Cr(CN)_6] - [Cr(NH_3)_6][Co(CN)_6]$

(b) $[Co(NH_3)_5(NO_2)Cl]Cl_2 - [Co(NH_3)_5(ONO)Cl_2]$

(iii) Define the following with examples:

(a) Cationic complex (b) Anionic complex

(iv) Give two uses and two environmental effects of trichloromethane.

(v) Why do alcohols have higher boiling points than hydrocarbons of corresponding molecular masses but lower boiling points than corresponding carboxylic acids?

(vi) Describe Cannizzaro's reaction.

(vii) Why is methyl amine more basic than ammonia?

(viii) How is aniline prepared from chlorobenzene?

(ix) What are cyanides and isocyanides? Give examples in each case.

Section-C (Short Answer Type Questions)

3. (i) Distinguish between potential difference and E.M.F.

(ii) With the help of valence bond theory, compare the magnetic behaviour of $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ complex ions.

(iii) State and explain the concept of activation energy.

(iv) What are transition elements? Why are they called d-block elements? Write the electronic configuration of the first and last member of 3d-series.

(v) Compare the chemistry of actinoids with that of lanthanoids with special reference to:

(a) Electronic configuration (b) Chemical reactivity

(vi) Explain the nature of C-X bond in case of haloalkanes.

(vii) What happens to primary, secondary, and tertiary alcohols when they are dehydrogenated?

(viii) Explain mutarotation with an example.

(ix) What are proteins? How are they classified on the basis of molecular structure?

Section-D (Long Answer Type Questions)

4. (i) What are ideal and non-ideal solutions? Illustrate with the help of diagrams, types of non-ideal solutions. Explain the reasons for negative and positive deviations.

Or

What is depression in freezing point? Show that depression in freezing point is a colligative property. Derive the relationship between depression in freezing point and molar mass of solute.

(ii) Define electrochemical cell. Discuss the construction and working of Galvanic cell. How is a Galvanic cell represented?

Or

What is meant by corrosion? Name the important factors affecting corrosion. Explain the electrochemical theory of rusting.

(iii) (a) Give any three methods of preparation of aldehydes.

(b) How is acetone prepared from

(i) acid chloride and

(ii) calcium acetate?

Or

How will you convert:

(a) (i) Benzoic acid into benzyl alcohol

(ii) Benzoic acid into benzyl alcohol

(iii) Benzoic acid into methyl benzoate

(b) Give important uses of carboxylic acids.