

CLASS-XII

POST MID TERM EXAM (2025-26)

CHEMISTRY (043)

SET A2

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- (e) SECTION D consists of 2 case-based questions carrying 4 marks each.
- (f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculators is not allowed.

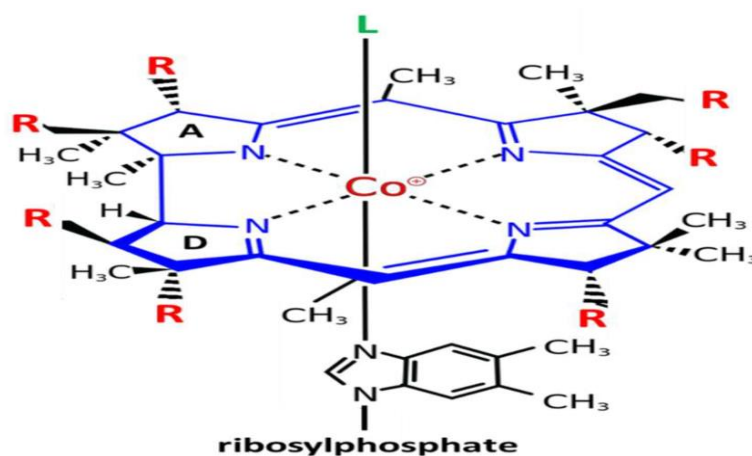
	SECTION A	
	<i>The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.</i>	
1.	The decreasing order of acidity is: (i) o-Nitrophenol > m-Nitrophenol > p-Nitrophenol (ii) p-Nitrophenol > m-Nitrophenol > o-Nitrophenol (iii) m-Nitrophenol > p-Nitrophenol > o-Nitrophenol (iv) All have same acidity	1
2.	Which of the following is not a factor in the corrosion of iron? (i) Presence of water and oxygen (ii) High conductivity of the medium (iii) Presence of inhibitors (which slow down corrosion) (iv) Passive oxide layer on the metal	1
3.	Which of the following compounds will give racemic mixture on nucleophilic substitution by OH⁻ ion? (a) CH₃CH(C₂H₅)Br (b) CH₃C(C₂H₅)(Br)CH₃ (c) CH₃CH(C₂H₅)CH₂Br (i) (a) (ii) (a), (b), (c) (iii) (b), (c) (iv) (a), (c)	1
4.	Which of the following reagents converts a ketone directly into a hydrocarbon under suitable conditions?	1

	(i) Zn(Hg) + HCl (iii) PCC	(ii) NaBH ₄ (iv) H ₂ , Pd	
5.	Which of the following will have the highest boiling point elevation? (i) 0.1 M NaCl (iii) 0.1 M Glucose	(ii) 0.1 M CaCl ₂ (iv) 0.1 M KNO ₃	1
6.	Which of the following compounds will be hydrolysed most rapidly under similar reaction conditions? (i) 1-Chloropropane (iii) 2-Chloro-2-methylpropene	(ii) 1-Chlorobutane (iv) 2-Chlorobutane	1
7.	The strongest acid among the following is: (i) Trichloroacetic acid (iii) Acetic acid	(ii) Formic acid (iv) Monochloroacetic acid	1
8.	In the Kohlrausch relationship for strong electrolytes at low concentration: Which of the following equality holds true? (i) $\Lambda_m = \Lambda_m^0$ as $C \rightarrow A^{1/2}$ (ii) $\Lambda_m = \Lambda_m^0$ as $C \rightarrow 0$ (iii) $\Lambda_m = \Lambda_m^0$ as $C \rightarrow \infty$ (iv) $\Lambda_m = \Lambda_m^0$ as $C \rightarrow 1$		1
9.	Aliphatic amines are stronger bases than aromatic amines because: (i) +I effect of alkyl group (iii) Resonance in aniline	(ii) -I effect of aryl group (iv) All of the above .	1
10.	A student prepares 0.5 molal aqueous NaCl. If $K_f = 1.86 \text{ K kg/mol}$ and $i = 1.9$, calculate ΔT_f . (i) 0.93 K (ii) 1.77 K (iii) 1.86 K (iv) 2.00 K		1
11.	The monomer units of cellulose are linked by: (i) α -1,4-glycosidic bond (iii) α -1,6-glycosidic bond	(ii) β -1,4-glycosidic bond (iv) β -1,6-glycosidic bond	1
12.	In the reaction of phenol with CHCl ₃ and NaOH, the electrophile involved is: (i) -CHCl ₂ (ii) :CCl ₂ (iii) :CH ₂ (iv) -CH ₂ Cl		1
	In the following Q.Nos.8 and 9 a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. a. Both A and R are true and R is the correct explanation of A b. Both A and R are true but R is not the correct explanation of A. c. A is true but R is false. d. A is false but R is true.		
13.	Assertion (A): The half- life for a zero order reaction is independent of the initial concentration of the reactant. Reason (R): For a zero-order reaction, Rate = k		1
14.	Assertion (A): Glucose does not form the hydrogensulphite addition product with NaHSO ₃ . Reason (R): Glucose exists in a six-membered cyclic structure called pyranose structure.		1
15.	Assertion (A): Secondary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas quantitatively. Reason(R): Nitrogen gas evolved on reaction with nitrous acid can be used for the estimation of proteins and amino acids.		1

16.	Assertion (A): $[\text{Mn}(\text{CN})_6]^{3-}$ has a magnetic moment of two unpaired electrons while $[\text{MnCl}_6]^{3-}$ has a paramagnetic moment of four unpaired electrons. Reason (R): $[\text{Mn}(\text{CN})_6]^{3-}$ is inner orbital complexes involving d^2sp^3 hybridisation, on the other hand, $[\text{MnCl}_6]^{3-}$ is outer orbital complexes involving sp^3d^2 hybridisation.	1
	SECTION B <i>This section contains 4 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.</i>	
17.	How is 1-Propoxypropane synthesized from propan-1-ol? Write mechanism of this reaction.	2
18.	(i) Which of the following lanthanoids show +2 oxidation state besides the characteristic oxidation state +3 of lanthanoids? (a) Ce (b) Eu (c) Yb (d) Tb (ii) Although Zr belongs to 4d and Hf belongs to 5d transition series, but it is quite difficult to separate them. Why?	1+1
19.	Using valence bond theory, explain the following in relation to the complex $[\text{NiCl}_4]^{2-}$: (i) IUPAC name (ii) Type of hybridisation. (iii) Magnetic behaviour. (iv) The shape of the complex	$\frac{1}{2} \times 4$
20.	(i) Illustrate Gabriel phthalimide synthesis. (ii) Arrange the following in increasing order of basic strength in aqueous solution: (a) NH_3 (b) CH_3NH_2 (c) $(\text{CH}_3)_2\text{NH}$ (d) $(\text{CH}_3)_3\text{N}$	1+1
21.	(i) A binary liquid mixture A–B shows total vapour pressure higher than expected from ideal behaviour at 298 K. State whether the mixture shows positive or negative deviation from Raoult's law and explain the molecular reason. (ii) For determination of molar mass of polymers and proteins, which colligative property is preferred and why? OR (i) Why oxygen cylinders are essential for mountain climbers? (ii) Explain why ethanol–water form a minimum-boiling azeotrope, whereas nitric acid–water form a maximum-boiling azeotrope?	1+1
	SECTION C <i>This section contains 3 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.</i>	
22.	Calculate the cell emf and ΔG^0 for the cell at 25 °C $\text{Mg (s)} / \text{Mg}^{2+} (0.001\text{M}) // \text{Cu}^{2+} (0.0001\text{M}) / \text{Cu (s)}$	3

	Given: $E^0_{\text{Mg}^{2+}/\text{Mg}} = -2.37\text{V}$, $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$, Use $F=96500\text{C/mol}$	
23.	(i) How can methyl bromide be preferentially converted to methyl cyanide and methyl isocyanide? (ii) A hydrocarbon of molecular mass 72 g mol^{-1} gives a single monochloro derivative and two dichloro derivatives on photo chlorination. Give the structure of the hydrocarbon. (iii) What are freons? Also give one use of freon.	1+1+1
24.	What will be the vapour pressure of a 1 molal aqueous solution of MgCl_2 , assuming dissociation of MgCl_2 to be 70 mole percent? (Vapor pressure of pure water at 25°C is 23.8 mmHg)	3
25.	(i) The decomposition of N_2O_5 in CCl_4 follows first-order kinetics: $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$ When concentration of N_2O_5 changes from 0.5 mol/L to 0.1 mol/L in 966 s, calculate the rate constant k and the half-life period of the reaction. [Given: $\log 5=0.6990$] (ii) Give one example of pseudo first order reaction.	2+1
26.	A reaction has an activation energy of 60 kJ mol^{-1}. By what factor will the rate of the reaction increase if the temperature rises from 300 K to 310 K? [Use; $R = 8.314\text{ J/mol K}$, $e^{0.775}=2.17$]	3
27.	(i) An organic compound with molecular formula $\text{C}_9\text{H}_{10}\text{O}$ forms, 2, 4-DNP derivatives, reduces Tollen's reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1,2- benzene dicarboxylic acid. Identify the compound. Write equation for the reactions involved. (ii) Give a simple test to distinguish between formic acid and acetic acid.	2+1
28.	(i) Explain why the $-\text{OH}$ group in phenol cannot be replaced by Cl^- easily, whereas in alcohols it can. (ii) In Kolbes' reaction, instead of phenol, phenoxide ion is treated with carbon dioxide. Why? (iii) Give a chemical test to distinguish between propan-2-ol and benzyl alcohol. OR How do you convert: i. Phenol to toluene ii. Formaldehyde to ethanol iii. Anisole to phenol	1+1+1
	SECTION D	
29.	Read the given passage and answer the questions that follow:	2+1+1

VITAMIN B-12 - Cobalamin.

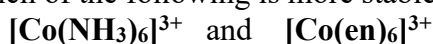


Coordination chemistry is essential for understanding how some vitamins, particularly vitamin B-12 and vitamin C, function. Vitamin B12, or cobalamin, is a large and complex molecule with a central cobalt atom at the core of a corrin ring, which is made of four pyrrole subunits. Attached to this cobalt atom are different "upper" ligands, such as a methyl group (methyl cobalamin), an adenosyl group (adenosyl cobalamin), a cyano group (cyanocobalamin), or a hydroxyl group (hydroxocobalamin). Vitamin B-12 is a natural chelate. Vitamin B12 is a vital nutrient used for maintaining nerve and blood cell health, producing DNA, and preventing a type of anemia that causes fatigue and weakness.

(i) A metal ion M^{n+} of the first transition series having d^5 configuration combines with three bidentate ligands. Assuming $\Delta_0 < P$:

Draw the crystal field energy level diagram for the 3d orbital of this complex. Also name the type of isomerism exhibited by this complex.

(ii) Which of the following is more stable complex and why?



(iii) Give the use of EDTA in medicinal chemistry. What is its denticity?

30

Read the given passage and answer the questions that follow:

Graphical Analysis of Conductivity for Strong and Weak Electrolytes

The conductivity of an electrolyte solution is directly related to its ion concentration, with more ions leading to higher conductivity.

The following graph shows the variation of **molar conductivity (Λ_m)** with **$\sqrt{c}$ (square root of concentration)** for strong, weak and intermediate electrolytes, at 298 K.

- KCl shows a nearly straight-line decrease in Λ_m with $\sqrt{c}$ and extrapolates to a finite intercept Λ_m^0 .
- Acetic acid shows a sharp rise in Λ_m on dilution and could not be extrapolated easily to Λ_m^0

1+1+2

	i. Using the graph, explain why , a) Λ_m for KCl decreases slightly with an increase in $\sqrt{c}$. b) Λ_m for Acetic acid increases rapidly with dilution. ii. If Λ_m^0 for HCl = 426 S cm²/ mol and Λ_m at 0.01 M = 390 S cm²/ mol, calculate α and comment on its significance. iii. Suggest how Λ_m^0 value for Acetic acid can be determined. State the law used.	
	SECTION E	
	<i>The following questions are long answer type and carry 5 marks each.</i>	
31.	(i) When a chromite ore (A) is fused with sodium carbonate in free excess of air and the product is dissolved in water, a yellow solution of compound (B) is obtained. After treatment of this yellow solution with sulphuric acid, compound (C) can be crystallized from the solution. When compound (C) is treated with KCl, orange crystals of compound (D) crystallise out. Identify A to D and explain the reactions. (ii) Account for the following: a. The enthalpies of atomization of transition metals are quite high. b. Transition metals act as catalysts. OR Following are the transition metal ions of 3d series: Ti⁴⁺, V²⁺, Mn³⁺, Cr³⁺ (Atomic numbers: Ti = 22, V = 23, Mn = 25, Cr = 24) Answer the following questions: a. Which ion is most stable in an aqueous solution and why? b. Which ion is a strong oxidizing agent and why? c. Which ion is colourless and why? (ii) Complete the following equations: a. $2\text{MnO}_4^- + 16\text{H}^+ + 5\text{S}^{2-} \rightarrow$ b. $\text{KMnO}_4 + \text{heat} \rightarrow$	3+2 3+2
32.	i. Under what conditions glucose is converted to gluconic and saccharic acid? ii. Which sugar is called invert sugar? Why is it called so? iii. Which vitamin must be supplied regularly in diet and why? iv. Identify and give any one point of difference between the protein present in insulin and protein present in muscle. OR	1+1+1+2

	Answer the following questions: i. Structures of glycine and alanine are given below. Show the peptide linkage in glycylalanine. NH₂CH₂COOH (Glycine) and NH₂CH(CH₃)COOH (alanine) ii. Coagulation of egg white on boiling is an example of denaturation of protein. Explain it in terms of structural changes. iii. Ruth suffers from a disease that results in increased blood clotting time. The doctor's prescription mentioned that Ruth is suffering from deficiency of some vitamin in her diet. Help the doctor identify the vitamin and suggest any one food source to help her recover faster. iv. What is the difference between a nucleoside and nucleotide? v. What are essential amino acids? Give one example.	1x5
33.	i. Carry out the following conversions in not more than two steps: a. Benzoic acid to benzaldehyde b. Propanone to propene. c. Ethanal to but-2-enal ii. Illustrate the HVZ reaction. iii. Write a test to differentiate between pentan-2-one and pentan-3-one. OR i. Account for the following: a. Carboxylic acids contain carbonyl group but do not show the nucleophilic addition reaction like aldehydes or ketones. b. The boiling points of aldehydes and ketones are lower than those of corresponding carboxylic acids c. Aldehydes without α-hydrogen undergo Cannizzaro reaction while those with α-hydrogen generally do not. ii. Write the structures of the following compounds: a. α-methoxy propionaldehyde b. 4-Nitropropiophenone	3+2 3+2