



# BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS  
SENIOR SECONDARY | CO-ED DAY CUM BOYS' RESIDENTIAL  
SCHOOL

PRE-BOARD III EXAMINATION 2024-25  
CHEMISTRY (043)



Class : XII  
Date : 13.1.25  
Admission No.:

Duration : 3Hrs  
Max. Marks : 70  
Roll No.:

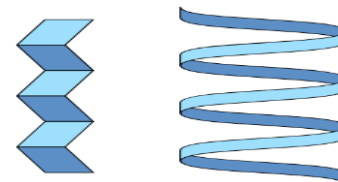
**GENERAL INSTRUCTIONS: Read the following instructions carefully.**

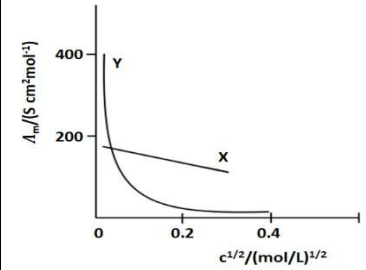
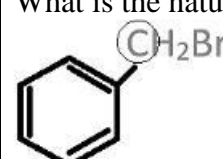
- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- (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

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section

Q.1	Which of the following aldehydes will undergo disproportionation with conc. NaOH to give corresponding alcohol and acid? a) $(\text{CH}_3)_3\text{CCHO}$ b) $\text{C}_6\text{H}_5\text{CHO}$ c) $\text{HCHO}$ d) All of these
Q.2	A hexadentate ligand is used in treatment of lead poisoning. Identify the ligand a) Ethane-1,2-diamine    b) EDTA    c) Dimethylglyoxime    d) oxalate
Q.3	The best reagent for converting, 2-phenylpropanamide into 1-phenylethanamine is: a) excess $\text{H}_2/\text{Pt}$ b) $\text{NaOH}/\text{Br}_2$ c) $\text{NaBH}_4$ d) $\text{LiAlH}_4/\text{ether}$
Q.4	The given structures represent a) Primary structure of proteins b) Secondary structure of proteins c) Tertiary structure of proteins d) structure of RNA and DNA
Q.5	Total vapour pressure of a mixture of 1 mol A ( $p_A^\circ = 150$ torr) and 2 moles B ( $p_B^\circ = 240$ torr) is 200 torr. In this case: - a) There is a positive deviation from Raoult's law b) There is a negative deviation from Raoult's law c) There is no deviation from Raoult's law d) None of these



Q.6	 <p>The strong electrolyte in the above graph is represented by:</p> <p>a) X                  b) Y                  c) Both X and Y                  d) Data given is not sufficient to predict.</p>								
Q.7	<p>Match the properties with the elements of 3d series:</p> <table border="0"> <tr> <td>(i) Element with highest M.P. in 3d series</td> <td>(p) Cr<sup>3+</sup></td> </tr> <tr> <td>(ii) Element showing +3 oxidation state only</td> <td>(q) Cr</td> </tr> <tr> <td>(iii) Most stable ion in aqueous solution</td> <td>(r) Fe</td> </tr> <tr> <td></td> <td>(s) Sc</td> </tr> </table> <p>a) (i) (q), (ii) (s), (iii) (p)                                  b) (i) (s), (ii) (q), (iii) (r)</p> <p>c) (i) (q), (ii) (p), (iii) (r)                                  d) (i) (p), (ii) (q), (iii) (r)</p>	(i) Element with highest M.P. in 3d series	(p) Cr <sup>3+</sup>	(ii) Element showing +3 oxidation state only	(q) Cr	(iii) Most stable ion in aqueous solution	(r) Fe		(s) Sc
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(iii) Most stable ion in aqueous solution	(r) Fe								
	(s) Sc								
Q.8	<p>What is the nature of the circled C atom in the following compound?</p>  <p>a) sp<sup>2</sup> hybridized                  b) allylic</p> <p>c) benzylic                                  d) vinylic</p>								
Q.9	<p>S<sub>N</sub>1 reaction of alkyl halides lead to</p> <p>a) Retention of configuration b) Racemisation c) Inversion of configuration d) None of these</p>								
Q.10	<p>Which of the following alcohol reacts fastest with conc. HCl and anhydrous ZnCl<sub>2</sub></p> <p>a) Butan-1-ol                  b) Butan-2-ol                  c) 2-Methylbutan-1-ol                  d) 2-Methylpentan-2-ol</p>								
Q.11	<p>The correct statement about charging of the lead storage battery is:</p> <p>a) PbSO<sub>4</sub> at anode is reduced to Pb.                  b) PbSO<sub>4</sub> at cathode is reduced to Pb.</p> <p>c) PbSO<sub>4</sub> at cathode is oxidised to Pb.                  d) PbSO<sub>4</sub> at anode is oxidised to PbO<sub>2</sub>.</p>								
Q.12	<p>If the rate of the reaction is equal to the rate constant, the order of the reaction is</p> <p>a) 3                  b) 0                  c) 1                  d) 2</p>								
	<p><i>For the question numbers 13 to 16 select the most appropriate answer from the options given below:</i></p> <p>a. Both A and R are true and R is the correct explanation of A</p> <p>b. Both A and R are true but R is not the correct explanation of A.</p> <p>c. A is true but R is false.</p> <p>d. A is false but R is true.</p>								
Q.13	<p><b>Assertion</b> : Presence of a nitro group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution.</p> <p><b>Reason</b> : Nitro group, being an electron withdrawing group decreases the electron density over the benzene ring.</p>								
Q.14	<p><b>Assertion</b> : Transition metals show variable valency.</p> <p><b>Reason</b> : Transition metals have a large energy difference between the ns and (n – 1)d electrons.</p>								

Q.15	<b>Assertion</b> : Half life of first order reaction is independent of initial concentration of reactants. <b>Reason</b> : Half life is the time period in which final concentration of reactants become half of its initial concentration.
Q.16	<b>Assertion</b> : When NaCl is added to water a depression in freezing point is observed. <b>Reason</b> : The lowering of vapour pressure of a solution causes depression in the freezing point.

### SECTION B

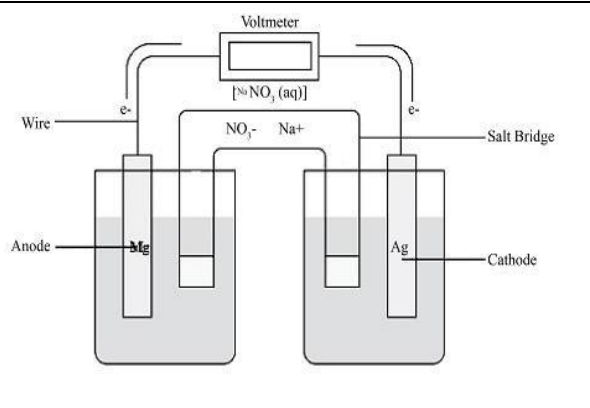
*This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.*

Q.17	For the reaction $2A+B \rightarrow C$ , on doubling the concentration of B alone, half-life does not change, but on doubling the concentration of A alone, rate of the reaction doubles. a) Write the rate law expression and order of reaction. b) Find the unit of rate constant
Q.18	a) The pKa of carboxylic acids is generally around 4–5, while the pKa of phenols is around 10. Justify the statement with reason. b) Which one of the following will be most acidic and why? Butanoic acid, 2-Chlorobutanoic acid, 3-Chlorobutanoic acid, 4-Chlorobutanoic acid.
Q.19	How are the following conversions carried out? a) Propene to propan-1-ol b) Phenol to Picric acid. <b>OR</b> Write the reaction mechanism of acid-catalysed dehydration of ethanol to form ethene.
Q.20	Answer the following (Any 2) a) On the basis of valence bond theory, write the hybridisation and magnetic behaviour of $[\text{Ni}(\text{CN})_4]^{2-}$ b) What type of isomerism is shown by the following complex: $[\text{Co}(\text{en})_3]^{3+}$ . Write coordination number of cobalt in the complex. c) Write the IUPAC name of structural isomer of the compound: $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ .
Q.21	Give the structure of A and B in the following reactions: a) $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{CuCN}} \text{A} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{B}$ b) $\text{C}_6\text{H}_5\text{NO}_2 \xrightarrow{\text{Sn}+\text{HCl}} \text{A} \xrightarrow[273\text{K}]{\text{NaNO}_2+\text{HCl}} \text{B}$

### SECTION C

*This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.*

Q.22	a) Write one difference between nucleoside and nucleotide. b) Name the reducing disaccharide which on hydrolysis gives two molecules of alpha D-glucose. c) What is the structural difference between starch and cellulose?
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Q.23	<p>a) Give the overall balanced equation for the given cell.</p> <p>b) Find the EMF of this cell:</p> <p><b>Mg(s)   Mg<sup>2+</sup> (0.1 M)    Ag<sup>+</sup> (1 x 10<sup>-4</sup>M)   Ag</b></p> <p>Given:</p> <p><b>E<sup>o</sup> Ag<sup>+</sup>/Ag = 0.80 V, E<sup>o</sup> Mg<sup>2+</sup>/Mg = -2.37 V</b></p>	
Q.24	<p>a) Arrange the following compounds in an increasing order of basic strength: C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub>, C<sub>6</sub>H<sub>5</sub>N(CH<sub>3</sub>)<sub>2</sub>, (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>NH and CH<sub>3</sub>NH<sub>2</sub></p> <p>b) Give a chemical test to distinguish between Ethylamine and Aniline.</p> <p>c) Give equation for Hofmann's Bromamide reaction.</p>	
Q.25	<p>The rate of a reaction quadruples when the temperature changes from 293K to 313K. Calculate the energy of activation of the reaction assuming that it does not change with temperature.</p> <p style="text-align: center;"><b>OR</b></p> <p>a) Why is the rate of reaction does not remain constant throughout the course of the reaction?</p> <p>b) Show that the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of reaction.</p>	
Q.26	<p>Write the major product in each of the following reactions:</p> <p>(a) <math>\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}-\text{O}-\text{CH}_3 + \text{HI} \longrightarrow</math></p> <p>(b) <math>\text{CH}_3-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_3 \xrightarrow{\text{Cu}/573 \text{ K}}</math></p> <p>(c) <math>\text{C}_6\text{H}_5-\text{OH} \xrightarrow[\text{(ii) H}^+]{\text{(i) CHCl}_3 + \text{aq. NaOH}}</math></p>	
Q.27	<p>a) Amino acids show amphoteric behaviour. Why?</p> <p>b) Write down the structures and names of the products formed when D-glucose is treated with (i) Hydroxylamine (ii) Conc. HNO<sub>3</sub></p>	
Q.28	<p>a) Write the structure of an isomer of compound C<sub>4</sub>H<sub>9</sub>Br which is most reactive towards S<sub>N</sub>1 reaction.</p> <p>b) Which of the following is optically active compound? 1-Chlorobutane, 2-Chloropropane, 3-Chloropentane, 2-Chloropentane</p> <p>c) Why does <i>p</i>-Dichlorobenzene have a higher melting point than its <i>o</i>- and <i>m</i>- isomers?</p>	

#### SECTION D

*The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.*

Q.29	<p><b>CASE STUDY-1:</b> The d-orbital splitting in coordination complexes results in a gap (<math>\Delta</math>) that happens to be just the right magnitude to absorb visible light. Because metal complexes can absorb visible light, they display an array of colours. Not only is the colour attractive to the eye, it is an indication of the chemical and physical properties of the metal complex. The colour depends on the identity of the metal ion, the coordination geometry, and the ligand identity. The following cobalt complexes show different colours on the basis of wavelength absorbed.</p> <p>a) What is crystal field splitting energy. Draw the crystal field splitting diagram to show the electron distribution of the 3d-electrons in <math>[\text{CoF}_6]^{3-}</math> ?</p>
	<p>b) Why do they show color in their solutions?</p> <p style="text-align: center;"><b>OR</b></p> <p>What is spectrochemical series?</p> <p>c) The complex which would be colourless  <math>[\text{Ti}(\text{H}_2\text{O})_6]^{4+}</math> , <math>[\text{Fe}(\text{CN})_6]^{3-}</math> , <math>[\text{V}(\text{H}_2\text{O})_6]^{2+}</math> , <math>[\text{Mn}(\text{H}_2\text{O})_6]^{2+}</math></p>
Q.30	<p><b>CASE STUDY-2:</b> <i>Faraday's Law of Electrolysis</i> proposed by Michael Faraday deals with the quantitative analysis of Electrolysis. It relates the mass deposited at any electrode and the amount of charge passed through them. Electrolysis is a process in which an electric current stimulates a non-spontaneous chemical reaction. In this process, metal electrodes are dipped in an electrolytic solution and a flow of ions is created through the passage of current by connecting wires to the electrodes. This flow of ions causes a chemical reaction that results in mass deposition at one electrode and the dissolution of the other. The mass deposited at the electrode depends on the amount of charge passed through the solution.</p> <p>a) A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes <math>\text{FeSO}_4</math> and <math>\text{ZnSO}_4</math> until 2.8g of Fe deposited at the cathode of cell X. How long did the current flow? Calculate the mass of Zn deposited at the cathode of cell Y. (Molar mass: Fe=56 g mol<sup>-1</sup>, Zn=65.3 g mol<sup>-1</sup>, 1 F=96500 C mol<sup>-1</sup>)</p> <p>b) How many Faradays required to produce 20.0 g of Ca from molten <math>\text{CaCl}_2</math>?</p> <p>c) State Faraday's Second law of electrolysis.</p> <p style="text-align: center;"><b>OR</b></p> <p>What are the products of electrolysis of aqueous solution of <math>\text{CuSO}_4</math> using Pt electrodes.</p>
	<p style="text-align: center;"><b>SECTION E</b></p> <p><i>The following questions are long answer types and carry 5 marks each. All questions have an internal choice.</i></p>

Q.31	<p>a) A solution containing 15g urea (molar mass = <math>60 \text{ g mol}^{-1}</math>) per litre of solution in water is isotonic with a solution of glucose (molar mass = <math>180 \text{ g mol}^{-1}</math>) in water. Calculate the mass of glucose present in one litre of its solution.</p> <p>b) Define the term 'osmotic pressure'. What are the advantages of using osmotic pressure as compared to other colligative properties for the determination of Molar masses of solutes in solutions?</p> <p style="text-align: center;"><b>OR</b></p> <p>a) 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of 1.62 K. Calculate the Van't Hoff factor and predict the nature of solute (associated or dissociated). (Given: Molar mass of benzoic acid = <math>122 \text{ g mol}^{-1}</math>, <math>K_f</math> for benzene = <math>4.9 \text{ K kg mol}^{-1}</math>)</p> <p>b) Out of 0.1 molal aqueous solution of glucose and 0.1 molal aqueous solution of KCl, which one will have higher boiling point and why?</p>
Q.32	<p>a) Arrange the following compounds in the increasing order of reactivity towards nucleophilic addition reactions: <math>\text{CH}_3\text{CHO}</math>, <math>\text{CH}_3\text{CH}_2\text{CHO}</math>, <math>\text{CH}_3\text{COCH}_3</math></p> <p>b) Give reasons:</p> <ol style="list-style-type: none"> <li>(i) Electrophilic substitution in Benzoic acid takes place at meta position.</li> <li>(ii) Carboxylic acids do not give characteristic reactions of carbonyl group.</li> </ol> <p>c) An organic compound with molecular formula <math>\text{C}_9\text{H}_{10}\text{O}</math> forms 2, 4, – DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1, 2-benzene-di- carboxylic acid. Identify the compound and give equation for any one of the above reactions.</p> <p style="text-align: center;"><b>OR</b></p> <p>a) Propanone is less reactive than ethanal towards addition of HCN. Why?</p> <p>b) Write the structure of product formed by acetone with 2,4-DNP.</p> <p>c) Write the reaction involved in Clemmensen reduction.</p> <p>d) Out of formic acid and acetic acid, which one will give the HVZ reaction? Give a suitable reason in support of your answer and write the chemical reaction involved.</p>

- Q.33
- a) Why actinoids shows large number of oxidation state than lanthanoids?
  - b) Which is a stronger reducing agent  $\text{Cr}^{2+}$  or  $\text{Fe}^{2+}$  and why?
  - c) How does acidified potassium dichromate solution react with iodide ions? Write balanced ionic equation.
  - d) Transition metals and their compounds act as catalyst. Why?
  - e) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

**OR**

- a) When Pyrolusite ore is fused with KOH in the presence of air, a green-coloured compound (A) is obtained which undergoes a disproportionation reaction in acidic medium to give a purple-coloured compound (B). Write the formulae of the compounds (A) and (B) and the equations involved. What happens when compound (B) is heated?
- b) Which metal in the first transition series (3d-series) exhibits +1 oxidation state most frequently and why? Give reason
- c) Transition metals have a high enthalpy of atomization. Why?

\*\*\*\*\*END OF PAPER\*\*\*\*\*