

KENDRIYA VIDYALAYA SANGATHAN ERNAKULAM REGION

PREBOARD EXAMINATION 2025-26

SUBJECT: CHEMISTRY (043)

Max. Marks: 70

Time : 3 Hrs

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

1. There are 33 questions in this question paper with internal choice
2. **SECTION A** consists of 16 multiple-choice questions carrying 1 mark each
3. **SECTION B** consists of 5 short answer questions carrying 2 marks each.
4. **SECTION C** consists of 7 short answer questions carrying 3 marks each.
5. **SECTION D** consists of 2 case-based questions carrying 4 marks each.
6. **SECTION E** consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.

Use of log tables and calculators is not allowed.

SECTION A

Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1	Which of the following compounds has the highest boiling point? a. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ b. $\text{CH}_3\text{CH}_2\text{CH}_3$ c. $\text{CH}_3\text{CH}_2\text{COOH}$ d. CH_3COCH_3	1
2	Zinc is coated over iron to prevent rusting of Iron because a. $E^0_{\text{Zn}^{2+}/\text{Zn}} = E^0_{\text{Fe}^{2+}/\text{Fe}}$ b. $E^0_{\text{Zn}^{2+}/\text{Zn}} < E^0_{\text{Fe}^{2+}/\text{Fe}}$ c. $E^0_{\text{Zn}^{2+}/\text{Zn}} > E^0_{\text{Fe}^{2+}/\text{Fe}}$ d. None of these	1
3	Observe the following reaction: $\text{CH}_3-\text{CH}_2-\text{Br} \xrightarrow{\text{KOH (aq)}} \text{A}$ $\text{CH}_3-\text{CH}_2-\text{Br} \xrightarrow{\text{KOH (alc.)}} \text{B}$ Which of the following is correct? a. Both A and B are alcohols b. A = Ethanol; B = Ethene c. A = Ethene; B = Ethanol d. Both A and B are halo compounds	1

4	The geometry of $[\text{Ni}(\text{CN})_4]$ and $[\text{NiCl}_4]$ are a. Both square planar b. Both tetrahedral c. Tetrahedral and square planar respectively d. Square planar and Tetrahedral respectively	1
5	Which is the correct increasing order of reactivity towards S_{N}^2 displacement of the following compounds 1-bromo-2,2-dimethyl propane (I) , 1-bromo-2-methyl butane (II) , 1-bromo-3-methyl butane (III) , 1-bromobutane (IV) a. $\text{IV} < \text{III} < \text{II} < \text{I}$ b. $\text{IV} < \text{I} < \text{II} < \text{III}$ c. $\text{II} < \text{III} < \text{I} < \text{IV}$ d. $\text{I} < \text{II} < \text{III} < \text{IV}$	1
6	When MnO_2 is fused with KOH , a coloured compound is formed . The product and its colour is a. K_2MnO_4 , Green b. KMnO_4 , Purple c. Mn_2O_3 , Brown d. Mn_2O_4 , Black	1
7	In Williamson's synthesis, which combination will give ethyl tert-butyl ether? a. $\text{CH}_3\text{CH}_2\text{ONa} + (\text{CH}_3)_3\text{CCl}$ b. $(\text{CH}_3)_3\text{CONa} + \text{CH}_3\text{CH}_2\text{Cl}$ c. $(\text{CH}_3)_3\text{CONa} + (\text{CH}_3)_3\text{CCl}$ d. $\text{CH}_3\text{CH}_2\text{ONa} + \text{CH}_3\text{CH}_2\text{Cl}$	1
8	Which of the following aqueous solutions should have the highest boiling point a. 1.0 M NaOH b. 1.0M Na_2SO_4 c. 1.0 M NH_4NO_3 d. 1.0 M KNO_3	1
9	Which of the following compound is hydrolysed by $\text{S}_{\text{N}}1$ mechanism a. $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ b. $\text{CH}_3\text{CH}_2\text{Br}$ c. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{Br}$ d. $(\text{CH}_3)_3\text{C-CH}_2\text{Br}$	1
10	$\text{CH}_3\text{CH}_2\text{Br} + \text{KCN} \longrightarrow \text{A} \xrightarrow{\text{H}_2/\text{Ni}} \text{B}$ The compound B is a. Ethylamine b. Propylamine c. Butylamine d. Methylamine	1
11	When aniline is treated with NaNO_2/HCl at 0°C followed by β -naphthol, a colored compound is obtained. The reaction is known as: a. Kolbe's reaction b. Reimer-Tiemann reaction c. Diazotization followed by coupling reaction d. Gattermann reaction	1
12	When glucose is oxidized with bromine water, the product is: a. Gluconic acid b. Glucuronic acid c. Saccharic acid d. Formic acid	1
13	Assertion(A) :The solution of 68% HNO_3 and 32% water by mass form maximum boiling azeotrope	1

19	<p>a) One mole of Complex compound $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ gives 3 moles of ions on dissociation in water . One mole of the same complex react with two moles of AgNO_3 solution to yield two moles of $\text{AgCl}(\text{s})$.Write the structure of the compound</p> <p>b) Write the IUPAC name of the isomer of the following complex $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$</p>	2x1
20	<p>Write the reactions involved in the following</p> <p>a) Reimer Tiemann reaction</p> <p>b) Williamson synthesis</p>	2x 1
21	<p>Identify A and B in the following reaction</p> $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{CrO}_3} \text{A} \xrightarrow{\text{dil NaOH}} \text{B}$	2x1
Section C		
Question No. 22 to 28 are short answer questions, carrying 3 marks each.		
22	<p>The cell in which the following reaction occurs</p> $2 \text{Fe}^{3+} + 2 \text{I}^- \rightarrow 2 \text{Fe}^{2+} + \text{I}_2$ <p>has $E^0_{\text{cell}} = 0.236 \text{ V}$ at 298 K . Calculate the standard Gibbs energy and Equilibrium constant of the cell reaction.</p>	3x1
23	<p>Compound 'A' with the molecular formula $\text{C}_4\text{H}_9\text{Br}$ is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq.KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.</p> <p>(i) Write down the structural formula of both compounds 'A' and 'B'.</p> <p>(ii) Out of these two compounds, which one will be converted to the product with inverted configuration?</p>	3x1
24	<p>(a) State Henry's Law and give its mathematical expression.</p> <p>(b) Name two factors that affect the solubility of a gas in a liquid.</p> <p>(c) Explain why soda water bottle fizzes when opened.</p>	3x1
25	<p>An Organic compound A having molecular formula $\text{C}_6\text{H}_6\text{O}$ gives a characteristic colour with aq.FeCl_3 solution. When A is treated with CO_2 and NaOH at 400K under pressure B is formed .The compound B on acidification gives C which reacts with acetyl chloride to form D which is popular pain killer.</p> <p>a) Write the structure of A, B, C and D</p> <p>b) Write the chemical equation involved in the formation of D</p>	3x1
26	Attempt any Three	3x1

	<p>Answer the following:</p> <p>a) Why is the highest oxidation state is exhibited in oxo-anions of transition metals?</p> <p>b) Why the transition elements show high melting points?</p> <p>c) Why is Scandium (Sc^{3+}) colourless and diamagnetic?</p> <p>d) Why are transition metals good catalysts?</p>	
27	<p>(a) Arrange the increasing order of pK_b values of aniline, p-toluidine & p-nitroaniline.</p> <p>(b) Give a chemical test to identify between $\text{C}_2\text{H}_5\text{NH}_2$ & $\text{C}_2\text{H}_5\text{NHCH}_3$</p> <p>(c) Although amino group is o and p – directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of m- nitroaniline.</p>	3x1
28	<p>Answer the following:</p> <p>a) Write the chemical equation involved in the preparation of Potassium permanganate.</p> <p>b) Complete the equation</p> $\text{MnO}_4^- + \text{Fe}^{2+} + \text{H}^+ \rightarrow$ <p>c) What is the effect of increasing pH on a solution of potassium dichromate ?</p>	3x1
Section D		
Question No. 29 & 30 are case-based/data -based questions carrying 4 marks each.		
29	<p>The lead–acid battery is a type of rechargeable battery. First invented in 1859 by French physicist Gaston Planté, it was the first type of rechargeable battery ever created. Compared to the more modern rechargeable batteries, lead–acid batteries have relatively low energy density and heavier weight. Despite this, they are able to supply high surge currents. These features, along with their low cost, make them useful for motor vehicles in order to provide the high current required by starter motors. Lead–acid batteries suffer from relatively short cycle lifespan</p>	1+1+2

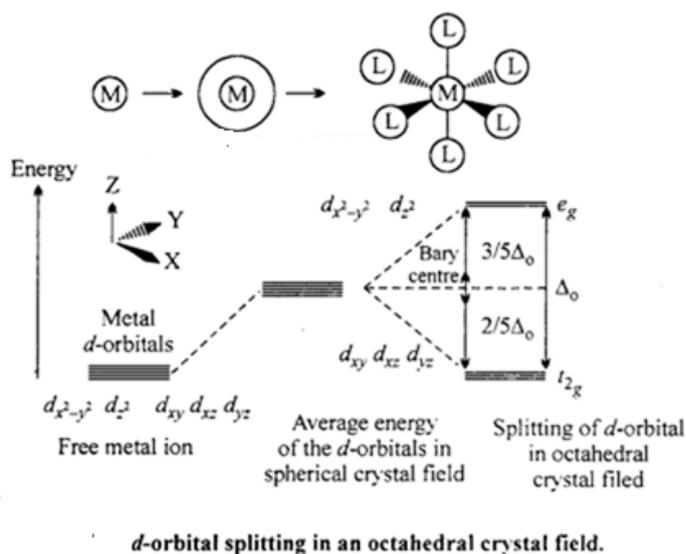
(usually less than 500 deep cycles) and overall lifespan (due to the *double sulfation* in the discharged state), as well as long charging times.



- Write the overall cell reaction that takes place during the discharge of a lead–acid battery.
- Why is the lead–acid battery considered a secondary cell?
- Explain what changes occur in the composition of the electrolyte during charging and discharging.

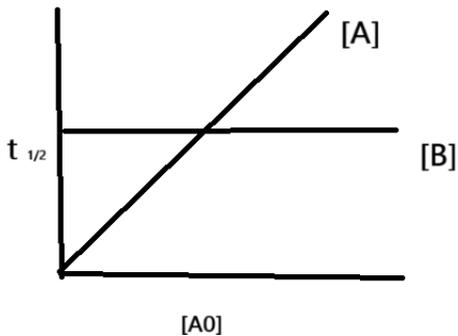
30

1+1+2



Crystal field theory (CFT) describes the breaking of orbital degeneracy in transition metal complexes due to the presence of ligands. CFT qualitatively describes the strength of the metal-ligand bonds. Based on the strength of the metal-ligand bonds, the energy of the system is altered. This may lead to a change in magnetic properties as well as colour. This theory was developed by Hans Bethe and John Hasbrouck van Vleck.

- How is Δ_o related to the strength of ligand?
- Arrange the following in the increasing order of Δ_o value

	<p>$[\text{Cu}(\text{NH}_3)_4]^{2+}$, $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$, $[\text{Cu}(\text{en})_2]^{2+}$, $[\text{Cu}(\text{CN})_4]^{2+}$</p> <p>c) A metal ion Mn^{n+} of the transition series having d^5 configuration combines with three didentate ligands. Assuming $\Delta_o < P$</p> <p>i) Write the electronic configuration using t_{2g} and e_g orbital</p> <p>ii) What is the hybridisation of Mn^{n+} in this complex</p>	
Section-E		
Question No. 31 to 33 are long answer type questions carrying 5 marks each.		
31	<p>Attempt either A or B</p> <p>A Answer the following questions</p> <p>I. The decomposition of A into product has values of k as $4.5 \times 10^3 \text{ s}^{-1}$ at 10^0c and energy of activation 60kJmol^{-1}. At what temperature would k be $1.5 \times 10^4\text{s}^{-1}$? (Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$, $\log 3.33 = 0.5224$)</p> <p>II. Consider the following graph showing the variation of half life $t_{1/2}$ with initial concentration $[\text{A}_0]$ for two reactions A and B</p>  <p>a) Identify the order of reaction for A and B from the graph</p> <p>b) Name the reactions which follow first order kinetics but are actually of higher order.</p> <p style="text-align: center;">OR</p> <p>B.</p> <p>I. A reaction is first order in A and second order in B</p>	3+2

	<p>a) Write the differential rate equation</p> <p>b) How is rate the rate affected on increasing the concentration of B three times ?</p> <p>c) How is the rate affected when the concentration of both A and B are doubled.</p> <p>II A first order reaction takes 30 min for 75 % decomposition . Calculate $t_{1/2}$. ($\log 4 = 0.6020$)</p>	
32	<p>Attempt either A or B</p> <p>A. Answer the following questions:</p> <p>I. Differentiate between peptide linkage and glycosidic linkage .</p> <p>II. Define anomers .</p> <p>III. Write the structure of product when D -Glucose reacts with HI</p> <p>IV. The melting point and solubility in water of amino acids are generally higher than that of the corresponding halo acids . Explain</p> <p>V. Why cannot vitamin C be stored in our body?</p> <p style="text-align: center;">OR</p> <p>B. Answer the following questions:</p> <p>I. Identify and give any one point of difference between DNA and RNA.</p> <p>II. What happens when protein is denatured?</p> <p>III. Sketch the zwitter ion formation of amino acetic acid (Glycine)</p> <p>III. What are Vitamins ? Which vitamin deficiency causes Nightblindness.</p> <p>V . Name the two major molecular shapes formed due to the folding of secondary structure of protein</p>	3+2
33	A Answer the following	3+2

- I. Arrange the following compounds in increasing order of their property as indicated
- a) Acetaldehyde , Acetone , Di-tert-butyl ketone , Methyl tert-butyl ketone (Reactivity towards HCN)
 - b) Benzoic acid , 4-Nitrobenzoic acid , 3,4-Dinitrobenzoic acid , 4-Methoxybenzoic acid (Acidity)
 - c) CH_3CHO , $\text{CH}_3\text{CH}_2\text{OH}$, CH_3OCH_3 , $\text{CH}_3\text{CH}_2\text{CH}_3$ (Boiling point)
- II. Write the IUPAC name of $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CH}_2\text{CHO}$
- III. Convert Ethanal to Butan -1,3-diol

OR

B Answer the following questions:

I .An organic compound (A) with molecular formula $\text{C}_8\text{H}_8\text{O}$ forms an orange-red precipitate with 2,4-DNP reagent and gives yellow precipitate on heating with iodine in the presence of sodium hydroxide. It neither reduces Tollens' or Fehlings' reagent, nor does it decolourise bromine water or Baeyer's reagent. On drastic oxidation with chromic acid, it gives a carboxylic acid (B) having molecular formula $\text{C}_7\text{H}_6\text{O}_2$. Identify the compounds (A) and (B) and explain the reactions involved.

II Give a chemical test to distinguish between Pentan-2-one and Pentan-3-one

III. Write the chemical equation involved in the Cannizaro's reaction of HCHO