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**PREBOARD EXAMINATION 2024 - 25**

**CLASS XII**

CHEMISTRY THEORY (043)

**Max. Marks:70** **Time: 3:00 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.

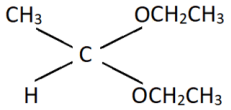
**(f)** SECTION E consists of 3 long answer questions carrying 5 marks each.

(g) All questions are compulsory.

(h) Use of log tables and calculators is not allowed.

## SECTION A

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

| S.N. | QUESTIONS: | MARKS |
|---|---|---|
| 1. | Which of the following solutions of KCl will have the highest value of conductivity?<br>a) 0.5 M b) 0.01M c) 0.1M d) 1.0 M | 1 |
| 2. |  <br>Above shown Acetal is formed by the reaction between A &B in the presence of dry HCl. Identify A and B.<br>a) A is Methanal, B is Methanol b) A is Methanal, B is Ethanol<br>c) A is Ethanal, B is Methanol d) A is Ethanal, B is Ethanol | 1 |
| 3. | Which one of the following is caused due to the deficiency of Vitamin $B_1$?<br>a) Convulsions b) Beri-Beri c) Cheilosis d) Sterility | 1 |
| 4. | What is the IUPAC name of the Ketone A, which undergoes Clemmensen reduction to form Ethyl benzene?<br>a) Propan-2-one b) 1-Phenylethanone<br>c) 3-Methylbut-2-en-one d) Butan-2-one | 1 |
| 5. | Which one of the following has the highest dipole moment ?<br>a) $CH_3F$ b) $CH_3Cl$ | 1 |

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| | c) $CH_3Br$ | d) $CH_3I$ | |

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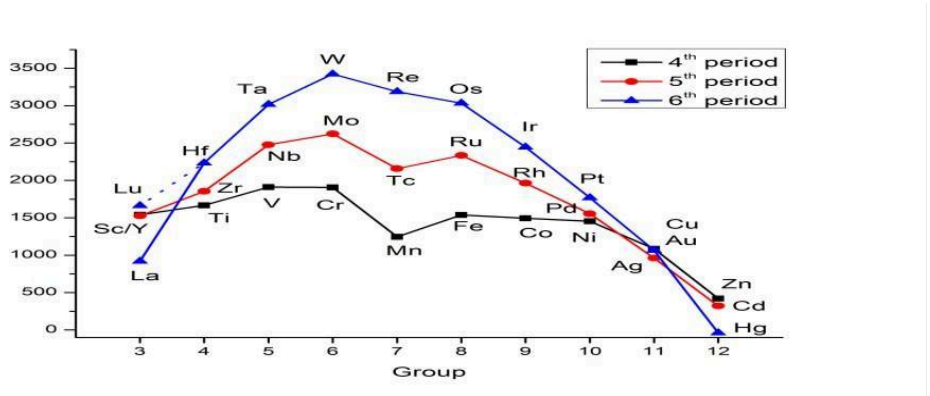
| 6. | Match the properties with the elements of 3d series:<br>(i)Element with highest M.P. (p)$Cr^{3+}$<br>(ii)Element showing +3 oxidation state (q)Cr<br>(iii)Most stable ion in aqueous solution (r) Fe<br>(s) Sc<br>(a) (i) (q), (ii) (s),(iii) (p) (b) (i) (s),(ii) (q),(iii) (r)<br>(c ) (i) (q), (ii) (p), (iii) (r) (d) (i) (p),(ii) (q),(iii) (r) | 1 |
| 7. | Which of the following is not correct about the order of a reaction:<br>(a) The order of a reaction can be a fractional number.<br>(b) Order of reaction is experimentally determined quantity.<br>(c ) The order of a reaction is always equal to sum of the stoichiometric coefficients of reactant in the balanced chemical equation for a reaction.<br>(d) The order of a reaction is the sum of the powers of molar concentrations of the reactants in the rate law expression. | 1 |
| 8. | Which of the following will be most stable diazonium salt $RN_2^+X^{--}$?<br>(a) $CH_3CH_2N_2^+X^{--}$ (b) $C_6H_5N_2^+X^-$<br>(c ) $CH_3N_2^+X^{--}$ (d) $C_6H_5CH_2N_2^+X^{--}$ | 1 |
| 9 | The aromatic compounds having formula $C_7H_8O$ which are easily identifiable by $FeCl_3$ solution test are:<br>(a) o-cresol &benzyl alcohol (b) m-cresol & p-cresol<br>(c ) o-cresol & p- cresol (d) methyl phenyl ether and benzyl alcohol | 1 |
| 10. | The decomposition of $NH_3$ on platinum surface is zero order reaction. What is the rate of production of $H_2$ If k = $2.5 \times 10^{-4}$ mol/L/Sec?<br>(a) $7.5 \times 10^{-4}$ mol/L/Sec (b) $6.5 \times 10^{-4}$ mol/L/Sec<br>(c ) $5.7 \times 10^{-4}$ mol/L/Sec (d)$7.1 \times 10^{-4}$ mol/L/Sec | 1 |
| 11. | Why ortho- nitrophenol is less soluble in water than p—and m—nitrophenol?<br>(a) Due to intramolecular H- bonding (b) Due to intermolecular H-bonding<br>(c ) M.P. of o-nitrophenol lower than p- and m- nitrophenol<br>(d) o- nitrophenol is more steam volatile. | 1 |
| 12. | The trend of which property is represented by the following graph?<br>  <br><br>(a) Ionization enthalpy (b) Atomic radii<br>(c ) Melting point (d) Enthalpy of atomization | 1 |

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| 13. | **Given below are two statements labelled as Assertion (A) and Reason (R): Assertion**: Ethers behave as bases in the presence of Mineral acids.<br>**Reason**: Due to the presence of Lone pairs of electrons on Oxygen.<br>**Select the most appropriate answer from the options given below**:<br>(a) Both A and R are true and R is the correct explanation of A<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true but R is false.<br>(d) A is false but R is true. | 1 |

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| 14. | **Given below are two statements labelled as Assertion (A) and Reason (R): Assertion**: Carboxylic acids are more acidic than phenol.<br>**Reason**: Phenols are ortho and para directing.<br>**Select the most appropriate answer from the options given below**:<br>(a) Both A and R are true and R is the correct explanation of A<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true but R is false.<br>(d) A is false but R is true | 1 |
| 15. | **Given below are two statements labelled as Assertion (A) and Reason (R): Assertion**: Albumin is globular protein.<br>**Reason**: Polypeptide chain coils around to give a straight chain.<br>**Select the most appropriate answer from the options given below**:<br>(a) Both A and R are true and R is the correct explanation of A<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true but R is false.<br>(d) A is false but R is true | 1 |
| 16 | **Given below are two statements labelled as Assertion (A) and Reason (R): Assertion**: Electrolysis of NaCl solution gives chlorine at anode instead of $O_2$. **Reason**: Formation of oxygen at anode requires overvoltage.<br>**Select the most appropriate answer from the options given below**:<br>(a) Both A and R are true and R is the correct explanation of A<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true but R is false.<br>(d) A is false but R is true | 1 |
| | **SECTION: B**<br>**This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.** | |
| 17. | (i) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of $K_H$ (Henry's constant) and why?<br>(ii) What happens when we place the blood cell in water (hypotonic solution) ? give reason. | 1<br><br><br><br>1 |
| 18. | A first order reaction takes 69.3 minutes for 50% completion. How much time will it take for 80% completion? (log 2 = 0.3010, log 5 = 0.6990, log 8 = 0.9030) | 2 |
| 19. | a) Arrange the following compounds in order of decreasing boiling point.<br>Bromomethane, bromoform, chloromethane, dibromomethane<br>b) The treatment of alkyl chloride with aq. KOH leads to formation of alcohol but in presence of alcoholic KOH, alkenes are the major products. Explain why? | 1<br><br><br>1 |
| 20. | a) Propanone is less reactive than ethanal towards addition of HCN. Why?<br>b) Give Chemical test to distinguish between acetophenone and benzophenone<br>(OR)<br>a) Convert Ethylbenzene into benzoic acid<br>b) Convert Propanone to propene | 1<br><br>1<br><br>1<br>1 |

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| 21. | Answer the following :<br>(a) What type of linkage is responsible for the formation of proteins?<br>(a) Write the product formed when glucose is treated with HI and red P. | <br>1<br>1 |
| | **SECTION: C**<br>**This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each**. | |
| 22. | Answer any three?<br>a) Write the formula for the following coordination compound: Amminebromidochloridonitrito-N-platinate(II)<br>b) $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1:1 molar ratio gives the test of $Fe^{2+}$ but $CuSO_4$ solution mixed with aqueous ammonia in 1:4 ratio does not give test of $Cu^{2+}$ ion. Explain why?<br>c) Define Ambidentate ligand with suitable example?<br>d) $[NiCl_4]^{2-}$ is paramagnetic, while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral. Why? | 1<br><br><br><br>1<br><br><br>1 |
| 23. | a) What is necessity to use a salt- bridge in a Galvanic cell.<br>b) Calculate $\Lambda m^o$ for CaCl2 from the following data:<br>$\Lambda m^o (Ca^{2+}) = 119.0$ S cm$^2$ mol$^{-1}$, $\Lambda m^o (Cl^-) = 76.3$ S cm$^2$ mol$^{-1}$<br>c) The electrical resistance of a column of .05 M NaOH solution of diameter 1 cm and length 50 cm, is $5.55 \times 10^3$ Ohm. Calculate its conductivity. | 1<br><br>1<br><br>1 |
| 24. | Write the structure and IUPAC name of product formed when<br>(a) Phenol is treated with NaOH followed by heating with $CO_2$ at 400 K at 4 to 7 atmospheres.<br>(b) Sodium ethoxide reacts with Bromomethane.<br>(c) Phenol reacts with concentrated nitric acid and conc. $H_2SO_4$. | <br>1<br>1<br>1 |
| 25. | An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Write equations for the reactions involved. | 3 |
| 26. | (a) Differentiate between the following:<br>(i) Essential and non-essential amino acids.<br>(ii) Fibrous and globular proteins.<br>(b) Which one of the following is a polysaccharide:<br>Starch, Maltose, Fructose, Glucose | 1<br><br>1<br>1 |
| 27. | A) Write the mechanism of the following reaction:<br>  <br>B) Grignard reagents should be prepared under anhydrous condition. Explain | 2<br><br><br>1 |
| 28 | (a) Define order of reaction<br>(b) A reaction is first order with respect to A & second order with respect to B<br>(i)How is the rate affected on increasing Concentration of B three times.<br>(ii)How is the rate affected when concentration of A is reduced to half & that of B is doubled. | 1<br><br>1<br>1 |

**SECTION: D**

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

29. The stability of complex in solution refers to degree of association between the two species involved in the state of equilibrium. The magnitude of the equilibrium constant (stability or formation) for the association, quantitatively expresses the stability. If complex is formed in steps, then the stepwise and overall stability constant is related as follows—

$$\beta_n = k_1 \times k_2 \times k_3 \times k_4 ... k_n$$

The addition of four amine groups to copper shows a pattern found for most formation constants, in which the successive stability constant decreases. The instability constant or the dissociation constant of coordination compound is defined as reciprocal of
formation constant β 4.

**Table : Stability Constants of Some Complexes**

| | **Complex** | **Stability Constant** $(\beta)$ |
|---|---|---|
| 1. | $[Cu(NH_3)_4]^{2+}$ | $4.5 \times 10^{11}$ |
| 2. | $[Cu(CN)_4]^{2-}$ | $2.0 \times 10^{27}$ |
| 3. | $[Ag(NH_3)_2]^{+}$ | $1.6 \times 10^{7}$ |
| 4. | $[Co(NH_3)_6]^{3+}$ | $5.0 \times 10^{33}$ |
| 5. | $[Ag(CN_2)^{-}$ | $5.4 \times 10^{18}$ |
| 6. | $[Ni(NH_3)_6]^{2+}$ | $6.1 \times 10^{18}$ |
| 7. | $[Ni(en)_3]^{2+}$ | $4.6 \times 10^{18}$ |
| 8. | $[Fe(CN)_6]^{3-}$ | $1.2 \times 10^{31}$ |
| 9. | $[Fe\ (CN)_6]^{4-}$ | $1.8 \times 10^{6}$ |
| 10. | $[Cd(NH_3)_4]^{2+}$ | $1.0 \times 10^{7}$ |

According to the given paragraph, answer the following questions:

(a) Why is stability constants of cyanides are higher than complexes with $NH_3$ as a ligand?

(b) Which of the complexes given in table is least stable? Why?

(c) (i) Why is $[Fe(CN)_6]^{3-}$ is more stable than $[Fe(CN)_6]^{4-}$?

(ii) Why is $[Ag(NH_3)_2]^{+}$ is less stable than $[Cu(NH_3)_4]^{2+}$?

OR

(d) Calculate the overall complex dissociation equilibrium constant for the $[Cu(NH_3)_4]^{2+}$ ion, given that for this complex $\beta 4 = 2 \times 10^{13}$ .

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| 30. | The standard electrode potentials are very important and we can extract a lot of useful information from them. If the standard electrode potential of an electrode is greater than zero then its reduced form is more stable compared to hydrogen gas. Similarly, if the standard electrode potential is negative then hydrogen gas is more stable than the reduced form of the species. It can be seen that the standard | |

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| | electrode potential for fluorine is the highest in the electrochemical series indicating that fluorine gas ($F_2$) has the maximum tendency to get reduced to fluoride ions ($F^-$) and therefore fluorine gas is the strongest oxidising agent and fluoride ion is the weakest reducing agent. Lithium has the lowest electrode potential indicating that lithium ion is the weakest oxidising agent while lithium metal is the most powerful reducing agent in an aqueous solution. It may be seen that as we go from top to bottom in in electrochemical series the standard electrode potential decreases and with this, decreases the oxidising power of the species on the left and increases the reducing power of the species on the right-hand side of the reaction.<br>(a) Write cell reaction of Zn and Cu cell.<br>(b) $E^0$ reduction of three metals A, B, C are respectively + 0.5 V, - 3.0 V, -1.2 V write the decreasing order of reducing power of these metals.<br>(c) A student prepared 1 molar aqueous solution of silver nitrate and stirred the solution with copper spoon. Point out if he has committed any mistake.<br>(OR)<br>Silver articles gets tarnished gradually due to the formation of $Ag_2S$ layer. In order to remove the tarnish a student placed the silverware in aqueous solution of sodium chloride taken in aluminum vessel. Will he succeed or not? Justify.<br>$E^0$ $Al^{+3}/Al$ = - 1.66 V and $E^0$ $Ag_2S(s)/Ag(s)$ = - 0.71 V | 1<br>1<br>2 |
| | **SECTION: E**<br>**The following questions are long answer type and carry 5 marks each.**<br>**All questions have an internal choice.** | |
| 31. | ANSWER THE FOLLOWING:<br>(a) The $d^4$ species, $Cr^{2+}$ is strongly reducing whereas manganese (III) is strongly oxidising. Why?<br>(b) How would you account for the following: Zr (Z = 40) and Hf (Z = 72) have almost identical radii.<br>(c) What are different oxidation states exhibited by lanthanoids?<br>(d) Which of following cations are colored in aqueous solutions and why? $Sc^{3+}$, $V^{3+}$, $Ti^{4+}$, $Mn^{2+}$ (At. No. Sc = 21, V = 23, Ti = 22, Mn = 25)<br>(e) State reasons for the Cu (I) ion is not stable in an aqueous solution.<br>OR<br>(a) How do you prepare $K_2MnO_4$ from $MnO_2$?<br>(b) Complete the following chemical equation: $Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow$<br>(c) Account for the following :<br>(i) Zn is considered as non transition element<br>(ii) Chemistry of all lanthanoids is quite similar<br>(iii) Transition element form alloys | 1 x 5 = 5 |
| 32. | (i) Calculate the amount of KCl which must be added to 1kg of water so that the freezing point is depressed by 2 K (the Kf for water = 1.86 K kg $mol^{-1}$).<br>(ii) Define azeotropes. What type of azeotrope is formed by negative deviation from Raoult's law? Give an example.<br>**Or** | **3+2=5** |

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| | (i) A solution containing15g urea (molarmass= 60gmol$^{-1}$) per litre of solution in water has the same osmotic pressure (isotonic)as a solution of glucose(molar mass = 180 g mol$^{-1}$) in water. Calculate the mass of glucose present in one litre of its solution.<br>(ii) Define the term 'osmotic pressure'. What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of Molar masses of solutes in solutions ? | |
| 33 | (a) An aromatic compound 'A' on treatment with aqueous ammonia and heating, forms compound 'B' which on heating with $Br_2$ and KOH forms a compound 'C' of molecular formula $C_6H_7N$. Write the structures and IUPAC names of compound A, B and C<br>(b) Arrange the following: (i) In decreasing order of the pKb values:<br>$C_2H_5NH_2$ , $C_6H_5NHCH_3$ , $(C_2H_5)2NH$ and $C_6H_5NH_2$<br>(ii) In increasing order of basic strength:<br>Aniline, p-nitroaniline and p-toluidine<br>OR<br>(a) Complete the following reactions:<br>(i) $C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow$<br>(ii) $C_2H_5NH_2 + Br_2(aq) \rightarrow$<br>) (b) Account for the following<br>(i) pkb of aniline is more than that of methyl amine<br>(ii) Aniline does not undergo friedel craft reaction<br>(iii) Ethyl amine is soluble in water whereas aniline is not. | **3+2=5**<br>**2+1+1+1=5** |