

GYAN BHARATI SCHOOL
 PRE BOARD EXAMINATION (2023-24)
 Class – SS2
 Subject – Chemistry-043 (SET A)



Time: 3 Hours

Maximum Marks: 70

General Instructions: Read the following instructions carefully.

- There are 33 questions in this question paper with internal choice.
 - SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
 - SECTION B consists of 5 short answer questions carrying 2 marks each.
 - SECTION C consists of 7 short answer questions carrying 3 marks each.
 - SECTION D consists of 2 case-based questions carrying 4 marks each.
 - SECTION E consists of 3 long answer questions carrying 5 marks each.
 - All questions are compulsory.
 - Use of log tables and calculators is not allowed.
- $R = 8.314 \text{ JK}^{-1}\text{Mol}^{-1}$, Atomic number: Ti = 22, Cr = 24, Fe = 26, Co = 27, Ni = 28, Zn = 30

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.

- If the E°_{cell} for a given reaction has a negative value, which of the following gives the correct relationships for the values of ΔG° and K_{eq} ? 1
 - $\Delta G^{\circ} > 0$; $K_{\text{eq}} < 1$
 - $\Delta G^{\circ} > 0$; $K_{\text{eq}} > 1$
 - $\Delta G^{\circ} < 0$; $K_{\text{eq}} > 1$
 - $\Delta G^{\circ} < 0$; $K_{\text{eq}} < 1$
- In the Arrhenius plot of $\ln k$ vs $1/T$ a linear plot is obtained with a slope of $-2 \times 10^4 \text{ K}$. The energy of activation of the reaction (in kJ mole^{-1}) is (R value is $8.3 \text{ J K}^{-1} \text{ mol}^{-1}$) 1
 - 83
 - 166
 - 249
 - 332
- Reactivity order of halides for dehydrohalogenation is: 1
 - $R-F > R-Cl > R-Br > R-I$
 - $R-I > R-Br > R-Cl > R-F$
 - $R-I > R-Cl > R-Br > R-F$
 - $R-F > R-I > R-Br > R-Cl$
- In Williamson synthesis if tertiary alkyl halide is used than: 1
 - Ether is obtained in good yield
 - Ether is obtained in poor yield
 - Alkene is the only reaction product
 - A mixture of alkene as a major product and ether as a minor product forms.
- Which of the following statements are correct? 1
 - Chromium has the highest melting point among the 3d series elements.

- (ii) Number of unpaired electrons is greater in Cr than other elements of series 1.
(iii) In any row the melting point of transition metal increases as the atomic number increases.

(a) (i) and (iii) (b) (i) and (ii) (c) (ii) and (iii) (d) (i), (ii) and (iii)

- 6 The rate law for the reaction $2X + Y \rightarrow Z$ is $\text{Rate} = k[X][Y]$. The correct statement with regard to this relation is: 1
(a) The rate of the reaction is independent of $[X]$ and $[Y]$.
(b) For this reaction $t_{1/2}$ is independent of initial concentrations of reactant.
(c) The rate of formation of Z is half the rate of disappearance of X .
(d) The rate of disappearance of X is equal to rate of disappearance of Y .
- 7 Which of the following conversions can be carried out by Clemmensen Reduction? 1
(i) Benzaldehyde into benzyl alcohol
(ii) Cyclohexanone into cyclohexane
(iii) Benzoyl chloride into benzaldehyde
(iv) Benzophenone into diphenyl methane.
(a) (ii) and (iv) (b) (i) and (iv) (c) (i) and (iii) (d) (iii) and (iv)
- 8 Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being: 1
(a) $4f$ orbitals more diffused than the $5f$ orbitals.
(b) Lesser energy difference between $5f$ and $6d$ than between $4f$ and $5d$ orbitals.
(c) More energy difference between $5f$ and $6d$ than between $4f$ and $5d$ orbitals
(d) More reactive nature of the actinoids than the lanthanoids.
- 9 Aldehydes are generally more reactive than ketones in nucleophilic addition reactions. Which of the following statements accounts for this? 1
(i) Sterically, the presence of two relatively large substituents in ketones hinders the approach of nucleophile to carbonyl carbon.
(ii) Aldehydes show resonance whereas ketones do not.
(iii) Electronically, the presence of two alkyl groups, reduce the electrophilicity of the carbonyl carbon more effectively.
(iv) Electronically carbonyl carbon atom in ketones is more electrophilic than in aldehydes.
(a) (i) and (iii) (b) (i) and (iv) (c) (ii) and (iii) (d) (ii) and (iv)
- 10 The correct statement regarding RNA and DNA, respectively is 1
(a) The sugar component in RNA is arabinose and the sugar component in DNA is ribose.
(b) The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.
(c) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.
(d) The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.

- 11 Which of the following factors affect the basic strength of amine? 1
(i) Inductive effect
(ii) Steric hindrance
(iii) Solvation effect
(iv) Solubility in organic solvents.
- (a) (i) and (iv) (b) (i), (ii) and (iii) (c) (ii) and (iii) (d) (ii) and (iv)

- 12 Which one of the following will show the highest pH value? 1
(a) *m*-nitrophenol. (b) *p*-nitrophenol. (c) *o*-nitrophenol. (d) Both (b) and (c).

Q. Nos. 13-16 consist of two statements, one is Assertion and the other is Reason. Select the most appropriate answer from the options given below: 1

- 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: The bond angle in alcohols is slightly less than the tetrahedral angle. 1
Reason: In alcohols, the oxygen of -OH group is attached to sp^3 hybridized carbon atom.

- 14 Assertion: The boiling points of aldehydes and ketones are lesser than alcohols of comparable molecular masses. 1
Reason: There is a weak molecular association in aldehydes and ketones arising out of the dipole-dipole interactions.

- 15 Assertion (A): During electrolysis of aqueous copper sulphate solution using copper electrodes hydrogen gas is released at the cathode. 1
Reason (R): The electrode potential of Cu^{2+}/Cu is greater than that of H^+/H_2

- 16 Assertion: Only a small amount of HCl is required in the reduction of nitro compounds with iron scrap and HCl in the presence of steam. 1
Reason: $FeCl_2$ formed gets hydrolysed to release HCl.

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.

- 17 What is meant by negative deviation from ideal behaviour? Draw the vapour pressure diagram for the same with an example. 2
- 18 For the reaction $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$, the rate of formation of $NO_2(g)$ is $2.8 \times 10^{-3} M s^{-1}$. Calculate the rate of disappearance of $N_2O_5(g)$ and rate of appearance of $O_2(g)$. 2

- (ii) Number of unpaired electrons is greater in Cr than other elements of series 1.
 (iii) In any row the melting point of transition metal increases as the atomic number increases.
- (a) (i) and (iii) (b) (i) and (ii) (c) (ii) and (iii) (d) (i), (ii) and (iii)
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- 19 (a) How will you convert toluene to 2-phenylethanoic acid? 1
 (b) Why is the dipole moment of chlorobenzene lower than that of cyclohexyl chloride? 1
- 20 Give reasons for the following: 1
 (a). The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. 1
 (b) Despite having an aldehyde group Glucose does not form DNP derivative. 1
- 21 How would you distinguish between the following pairs of compounds? 1
 (a) Benzoic acid and Ethyl benzoate. 1
 (b) Ethanal and Propanal. 1

OR

An organic compound with the molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro reaction. It gave benzene-1,2-dicarboxylic acid on vigorous oxidation. Identify the compound and write the reaction involved. 2

SECTION C

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

- 22 (a) Identify the major product formed when 2-Chloro-2-methylbutane undergoes dehydrohalogenation reaction. Name the reagent which is used to carry out the reaction. 1
 (b) Write IUPAC name of the compound: $CH_3CH=CHC(Br)(CH_3)_2$. 1
 (c) The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols, but in the presence of alcoholic KOH, alkenes are major products. Explain. 1
- OR
- (a) Name the possible alkenes which will yield 1-chloro-1-methylcyclohexane as major product on their reaction with HCl. Write the reactions involved. 1
 (b) Allyl chloride is hydrolyzed more readily than n-propyl chloride. Why? 1
 (c) Write the structure of following compound: 1-Bromo-4-sec-butyl-2-methylbenzene. 1
- 23 (a) On the basis of crystal field theory explain why $[Fe(H_2O)_6]^{3+}$ has a magnetic moment value of 5.92 BM whereas $[Fe(CN)_6]^{3-}$ has a value of only 1.74 BM? 2
 (b) What is the coordination entity formed when aqueous KCN is added to copper sulphate solution? Will it form a ppt if H_2S is passed in the same mixture? 1
- 24 (a) Calculate the electrode potential of silver electrode dipped in a 0.1 M $AgNO_3$ at 298 K assuming $AgNO_3$ to be completely dissociated. The reduction potential of Ag^+/Ag is 0.8 V. 2
 (b) What products are obtained when aqueous solution of $AgNO_3$ is electrolysed using Platinum Electrodes? 1
- 25 (a) Write the reaction when Anisole is treated with CH_3COCl in the presence of $AlCl_3$. Write the name of the major product. 1
 (b) How do you distinguish between? 1

- (i) Propan-1-ol and propan-2-ol.
 (ii) Phenol and cyclohexanol.

1

OR

- (a) Name the reagents used in the following reactions:
 (i) Oxidation of a primary alcohol to aldehyde.
 (ii) Bromination of phenol to 2, 4, 6-tribromophenol.

½
 x2

- (b) Give the major products that are formed by heating each of the following ethers with HI.
 a. $\text{CH}_3\text{-CH}_2\text{-CH(CH}_3\text{)-CH}_2\text{-O-CH}_2\text{-CH}_3$.
 b. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-C(CH}_3\text{)}_2\text{-CH}_2\text{-CH}_3$.

1
 1

- 25 (a) How is primary structure of a protein different from its secondary structure?
 (b) Vitamin C cannot be stored in the body. Justify.
 (c) Write the equation for what happens when glucose is reacted with Bromine water.

1
 1
 1

26 For first order decomposition : $\text{SO}_2\text{Cl}_2(\text{g}) \rightarrow \text{SO}_2(\text{g}) + \text{Cl}_2(\text{g})$

3

EXPT	TIME(s)	TOTAL PRESSURE (atm)
1.	0	0.5
2.	100	0.6

Calculate the rate of the reaction when total pressure is 0.65 atm.

- 28 (a) What compound will be formed when cyclohexanecarbaldehyde reacts with excess ethanol?
 (b) How do you convert?
 (i) Ethanal into But-2-enoic acid.
 (ii) Benzoic acid to m- Nitrobenzyl alcohol.

1
 1
 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 Metallic conductance involves movement of electrons whereas electrolytic conductance involves movement of ions. Specific conductance increases with increase in concentration whereas same is not true with molar conductance. Electrochemical cells convert chemical energy into electrical energy. Dry cell and mercury cell are primary cells, whereas lead storage battery and Ni- Cd cell are secondary ones. Fuel cells are special type of electrochemical cells with a number of advantages.

- (a) When does an electrochemical cell behave as electrolytic cell?
 (b) How is fuel cell advantageous over other cells? Mention two of its uses.
 (c) Write the anode and cathode reactions in lead storage battery. Write the reaction when lead storage battery is recharged.
 (d) The molar conductivity of HCl increases with dilution. Can you suggest what may be the reason for this?

1
 1
 1
 1

OR

Write an expression for calculating molar conductance at infinite dilution for water.

1

- 30 Most distinctive properties of transition metal complexes is their wide range of colours. The colour of complex is complementary to that which is absorbed. The complementary colour is the colour generated from the wavelength left over. The following table gives the relationship of the different wavelength absorbed and the colour observed.

Coordination Entity	Wavelength absorbed (nm)	Colour of light absorbed	Colour of complex entity
$[\text{CoCl}(\text{NH}_3)_5]$	635	Yellow	Violet
$[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}$	500	Blue green	Red
$[\text{Co}(\text{NH}_3)_6]^{3+}$	475	Blue	Yellow orange
$[\text{Co}(\text{CN})_6]^{3-}$	310	Ultraviolet	Pale yellow
$[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$	600	Red	Blue
$[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$	480	Blue Green	Violet

- (a) Why does $[\text{Co}(\text{CN})_6]^{3-}$ absorb in U.V. light and not in the visible range? 1
(b) A solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green but a solution of $[\text{Ni}(\text{CN})_4]^{2-}$ is colourless. Why? 1
(c) Why is $[\text{Ti}(\text{H}_2\text{O})_6]^{4+}$ colourless? 1
(d) Arrange CN^- , NH_3 and Cl in order of splitting they produce. 1

OR

What will be the correct order of wavelength absorption for the following complexes: $[\text{Co}(\text{CN})_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoCl}_6]^{3-}$. Give reasons for your answer. 1

SECTION E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

- 31 (a) What is the effect of temperature on the solubility of glucose in water? 1
(b) Prakhar collected a 10 mL each of fresh water and ocean water. He observed that one sample labeled "P" froze at 0°C while the other "Q" at -1.3°C , but forgot which of the two, "P" or "Q" was ocean water. Help him identify which container contains ocean water, give reason for your answer. 1
(c) Calculate Van't Hoff factor for an aqueous solution of $\text{K}_3[\text{Fe}(\text{CN})_6]$ if the degree of dissociation (α) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ($K_b = 0.52 \text{ K kg/mol}$) 3

OR

- (a) Why do substances show abnormal molecular masses. Support your answer with examples. 2
(b) The vapour pressure of pure water at a certain temperature is 23.80 mm Hg. If 1 mole of a non-volatile non-electrolytic solute is dissolved in 100 g water, Calculate the resultant vapour pressure of the solution. 3

- 32 Attempt any five of the following:
- (a) Which of the following ions will have a magnetic moment value of 1.73 BM?
 Sc^{3+} , Ti^{3+} , Ti^{2+} , Cu^{2+} , Zn^{2+} 1
- (b) The second ionization enthalpies of chromium and manganese are 1592 and 1509 kJ/mol respectively. Explain the lower value of Mn. 1
- (c) Give two similarities in the properties of Sc and Zn. 1
- (d) What is actinoid contraction? What causes actinoid contraction? 1
- (e) What is the oxidation state of chromium in chromate ion and dichromate ion? 1
- (f) Write the ionic equation for reaction of KI with acidified KMnO_4 . 1

- 33 An organic compound 'A' ($\text{C}_7\text{H}_7\text{NO}_2$) exists in three isomeric forms. On reduction gives compound 'B' with molecular formula $\text{C}_7\text{H}_9\text{N}$. 'B' on treatment with NaNO_2/HCl at $0-5^\circ\text{C}$ to form compound 'C'. On treating C with H_3PO_2 , it gets converted to D with formula C_7H_8 , which on further reaction with CrO_2Cl_2 followed by hydrolysis forms 'E' $\text{C}_7\text{H}_6\text{O}$ which does not undergo aldol condensation. Write the structure of compounds A to E. Write the chemical equations involved. 5

OR

- (a) Account for the following:
- (i) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide. 1
- (ii) Although amino group is *o*- and *p*- directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of *m*-nitroaniline. 1
- (b) Arrange the following in increasing order of solubility in water: $\text{C}_2\text{H}_5\text{Cl}$, $\text{C}_2\text{H}_5\text{NH}_2$, $\text{C}_2\text{H}_5\text{OH}$ 1
- (a) How would you convert :
- (i) Nitrobenzene to benzoic acid. 1
- (j) Aniline to *p*-Bromoaniline. 1
