केन्द्रीय विद्यालय संगठन

देहरादून संभाग

KENDRIYA VIDYALAYA SANGATHAN

DEHRADUN REGION

रसायन विज्ञान विषय हेतु संवर्धन कार्यशाला

SUBJECT ENRICHMENT WORKSHOP FOR CHEMISTRY

सत्र/SESSION – 2023-24

कक्षा 12 हेतु प्रतिदर्श प्रश्नपत्र संग्रह

COMPILATION OF MODEL QUESTION PAPERS OF CLASS XII

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CONTENTS

CLASS XI SESSION ENDING MODEL QUESTION PAPERS

CLASS XII

MODEL QUESTION PAPERS

SET-1

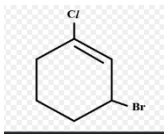
BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

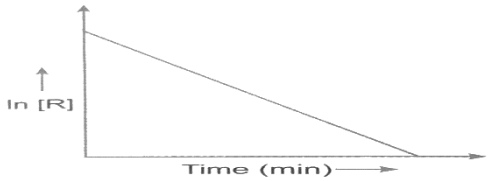
General Instructions:

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 very 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 calculator is not allowed

	SECTION-A	
1	Rate law for the reaction A + 2B→ C is found to be Rate = k [A][B] Concentration of reactant 'B' is doubled, keeping the concentration of 'A' constant, the value of rate constant will be..... . (a) the same (b) doubled (c) quadrupled (d) halved	1
2	Value of Henry's constant K_H ..... . (a) increases with increase in temperature (b) decreases with increase in temperature (c) remains constant (d) first increases then decreases	1
3	2 Molecules whose mirror image is non-superimposable over them are known as chiral. Which of the following molecules is chiral in nature? (a) 2-bromobutane (b) 1-bromobutane (c)2-bromopropane (d) 2-bromopropan-2-ol	1
4	Which of the following is not a characteristic of a catalyst? a) It changes the equilibrium constant. b) It alters the reaction path. c) It increases the rate of reaction. d) It does not alter the Gibbs energy.	1
5	The cell used in Apollo Space programme: a) Electrolytic Cell b) H_2-O_2 Fuel Cell c) Lead storage cell d) Dry Cell	1
6	The IUPAC name of the compound shown below is 	1

	a) 2-Bromo-6-chlorocyclohexene b) 6-Bromo-2-chlorocyclohexene c) 3-Bromo-1-chlorocyclohexene d) 1-Bromo-3-chlorocyclohexene	
7	The correct increasing order of basic strength for the following compounds is I) Aniline II) 4-Nitroaniline III) 4-Methylaniline a) II < III < I b) III < I < II c) III < II < I d) II < I < III	1
8	The reagent which is used to differentiate between primary, secondary and tertiary amine a) Lucasreagent b) Hinsberg's reagent c) Both d) None	1
9	Which of the following compounds will give butanone on oxidation with alkaline KMnO4 solution? (a) Butan-1-ol (b) Butan-2-ol (c) Both (a) and (b) (d) None of these	1
10	Arrange the following compounds in increasing order of boiling point. Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol (a) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol (b) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol (c) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol (d) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol	1
11	The reagent which does not react with both, acetone and benzaldehyde? (a) Sodium hydrogen sulphite (b) Phenyl hydrazine (c) Fehling's solution (d) Grignard reagent	1
12	Which of the following compounds will react with sodium hydroxide solution in water? (a) C_6H_5OH (b) $C_6H_5CH_2OH$ (c) $(CH_3)_3C\text{-}OH$ (d) CH_3CH_2OH	
	In the following questions a statement of assertion (A) followed by a statement of reason is given. Choose the correct answer out of the following choices. (a) Both assertion and reason are true, and reason is the correct explanation of the assertion. (b) Both assertion and reason are true but reason is not the correct explanation of assertion. (c) Assertion is not true but reason is true. (d) Both assertion and reason are false.	
13	Assertion: Molarity of a solution in liquid state changes with temperature Reason: The volume of a solution changes with change in temperature	1
14	Assertion (A): Aldehydes and ketones, both react with Tollen's reagent to form silver mirror. Reason (R): Both, aldehydes and ketones contain a carbonyl group.	1
15	Assertion: It is difficult to replace chlorine by -OH in chlorobenzene in comparison to that in chloroethane.	1

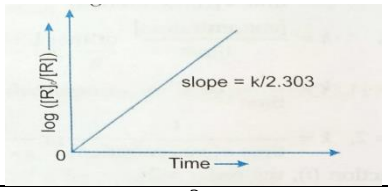
	Reason: Chlorine-Carbon(C-Cl) bond in chlorobenzene has partial double bond character due to resonance.	
16	Assertion: Acetanilide is less basic than aniline. Reason: Acetylation of aniline results in decrease of electron density on nitrogen.	1
	SECTION-B	
17	a. Why are low spin tetrahedral complexes not formed b. Name a co-ordination compound of platinum which is used to inhibit growth of tumours.	2
18	Which of the following solutions has higher freezing point? 0.05M Al_2SO_4, 0.1M $K_3[Fe(CN)_6]$. Justify.	2
19	For a chemical reaction variation in concentration, [R] v/s time(min.) plot shown below  I. What is the order of reaction? II. What are the units of rate constant for the reaction? III. If initial conc. of the reactant is half of the original conc. how will $t_{1/2}$ change? IV. Draw a plot of log $[R]_0/[R]$ v/s time (s)	2
20	In the following ions: Mn^{3+}, $V^{3+,}$ Cr^{3+}, Ti^{4+} a) Which ion is the strongest oxidising agent? b) Which ion is most stable in aqueous solution? c) Which ion is colourless? d) Which ion has the highest number of unpaired electrons?	2
21	When a co-ordination compound $COCl_3.4NH_3$ is mixed with $AgNO_3$ 1 mole of AgCl is precipitated per mole of the compound. Write a) Structural formula of a complex. b) IUPAC name of the complex. OR a)What type of isomerism is exhibited by the complex $[Co(en)_3]^{3+}$? b) Why is $[NiCl_4]^{2-}$ paramagnetic but $[Ni(CO)_4]$ is diamagnetic ?	2
	SECTION-C	
22.	Define the followings term: a) Peptide linkage b) Glycosidic linkage c) Denaturation OR Sucrose is dextrorotatory but the mixture obtained after hydrolysis is laevorotatory. Explain with the help of chemical equation.	3
23	a) Which compound in each of the following pairs will react faster in SN2 reaction with -OH and why? i) CH_3Br or CH_3I ii) $(CH_3)_3CCl$ or CH_3Cl iii) C_6H_5Cl or $C_6H_5CH_2Cl$	3
24	Calculate the boiling point of solution when 4g of $MgSO_4$ (Molar mass: 120 g/mol) was dissolved in 100g of water, assuming $MgSO_4$ undergoes complete ionization. [K_b for water =0.52 Kkg mol^{-1}]	3

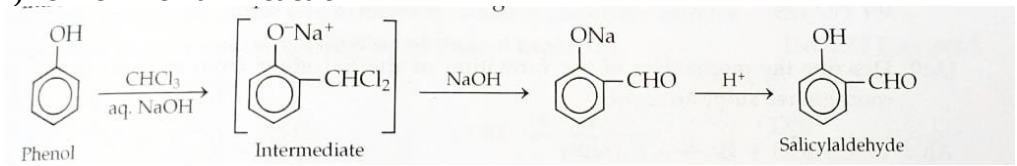
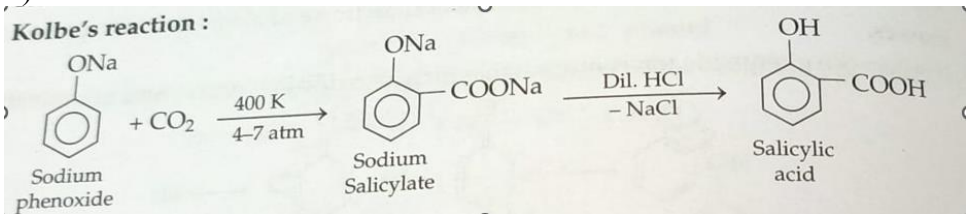
25	(i) From the given cells: Lead storage cell, Mercury cell, Fuel cell and Dry cell Answer the following: a) Which cell is used in hearing aids? b) Which cell was used in Apollo Space Programme? c) Which cell is used in automobiles and invertors? d) Which cell does not have long life? (ii) In an aqueous solution, how does specific conductivity of electrolytes changes with addition of water?	3
26	a) Write down any two differences between order of reaction and molecularity of reaction. b) A first order reaction has a rate constant $1.15 \times 10^{-3} s^{-1}$. How long will 5 g of this reactant take to reduce to 3g?	3
27	Write the IUPAC name of the following compounds. a) $[Ag(NH_3)_2][Ag(CN)_2]$ b) $[CoCl_2(en)_2]Cl$ c) $K_3[Al(C_2O_4)_3]$	3
28	a) Explain the following giving one example for each: i) Reimer-Tiemann reaction ii) Kolbe's reaction b) Write the products obtained when benzyl phenyl ether is heated with HI. **OR** a) Give chemical test to distinguish between: i. Isopropyl alcohol and n-Propyl alcohol ii. Phenol and alcohol b) Name the reagent which is used to convert Butan-2-one to butan-2-ol	3
	SECTION-D	
29	**Read the passage given below and answer the following questions:-** Carbohydrates are primary produced by plants and form a very large group of naturally occurring organic compounds. Some common examples of carbohydrates are cane sugar, glucose, starch etc. Most of them have general formulas $C_x(H_2O)_y$ and were considered as hydrates of carbon from where the name of carbohydrates was derived. For example, the molecular formula of glucose fits into this general formula($C_6H_{12}O_6$).But all the compounds which fit into this formula, may not be classified as carbohydrate. For example, acetic acid CH_3COOH fits into the general formula $C_2(H_20)_2$ but is not a carbohydrate. Similarly, rhamnose($C_6H_{12}O_6$) is a carbohydrate but does not fit in this definition. A large no of their reactions has shown that they contain specific function group. Chemically the carbohydrate me define as optically active polyhydroxy aldehyde or ketone or the compounds which produce such units on hydrolysis. Some of the carbohydrates, which are sweet in taste, are also called sugars. The most common sugar used in our homes is named as sucrose whereas the sugar present in milk is known as lactose. Carbohydrates are also called saccharides. **The following question are multiple choice question. Choose the most appropriate answer:** **i.** Which of the following is a carbohydrates? (a) CH_3CONH_2 (b) $C_{12}H_{22}O_{11}$ (c) $CH_3CH(CH_3)NH_2$ (d) CH_3COOH **II.** Glucose does not react with	4

	(a) Br_2/H_2O (b) H_2NOH (c) HI (d) $NaHSO_3$ III. The carbohydrates that does not fit into the general formula $C_x(H_2O)_y$ (a) Fructose (b) Galactose (c) Cellulose (d) Rhamnose iv. The carbohydrates present in milk is a) Glucose b) Fructose c) Lactose d) Galactose OR v. What do you mean by carbohydrates?	
30	**Read the passage given below and answer the following questions:-** Amines are derivatives of ammonia in which one or more of the hydrogens has been replaced by an alkyl or aryl group. For the naming of Amines in the IUPAC system: the "e" ending of the alkane name for the longest chain is replaced with –amine. The amine group is located by the position number. Groups that are attached to the nitrogen atom are located using "N" as the position number. More complex primary amines are named with —NH2 as the amino substituent. Aromatic amines: named as derivatives of the parent compound aniline. Substituents attached to the nitrogen are indicated by using "N-" as the location number. **The following question are multiple choice question. Choose the most appropriate answer:** (i) Which of the following is the correct IUPAC name of $(CH_3)_3N$? a) Trimethylamine b)N-Methylethanamine c) N,N-Dimethylmethanamine d)N,N,N-Trimethylamine (ii) What is the correct IUPAC name of $H_2N\text{-}(CH_2)_5\text{-}NH_2$? a) Pentan-1,5-diamine b) 1,5-Diaminopentane c) Pentamethylenediamine d) Pentane-1,5-diamine (iii) Identify the correct IUPAC name a) $(CH_3CH_2)_2NCH_3$ = N-Ethyl-N-methylethanamine b) $(CH_3)_3CNH_2$ = 2-methylpropan-2-amine c) $CH_3NHCH(CH_3)_2$ = N-Methylpropan-2-amine d) $(CH3)_2CHNH_2$ = 2,2-Dimethyl-N-propanamine (iv) IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride a) N,N-Dimethylethanamine b) N,N-Diethylmethanamine c) N-Methyl ethanamine d) N-Ethyl – N-methylethanamine **OR** (v) How many structural isomers are possible for C_3H_9N? a) 4 b) 2 c) 5 d) 3	4
	SECTION-E	
31	a) Represent the cell in which the following reaction takes place. The value of E^0 for the cell is 1.260V. What is the value of E_{cell} ? $2Al(s) + 3Cd^{2+}(0.1M) \rightarrow 3Cd(s) + 2Al^{3+}(0.01M)$ b) The conductivity of 0.20M solution of KCl at 298K is 0.025 S cm-1. Calculate its molar conductivity. **OR**	5

	a) Consider the following reaction: Cu (s) + 2 Ag+(aq.) $\rightarrow$2 Ag (s) + Cu+(aq.) i. Depict the galvanic cell in which the given reaction takes place. ii. Give the direction of flow of current. iii. Write the half cell reactions taking place at cathode and anode. b) Give an example of a fuel cell and write the cathode and anode reactions.	
32	a) Out of Ag_2SO_4, CuF_2, MgF_2 and CuCl, which compound will be coloured and why? b) Explain: i. CrO_4^{2-} is a strong oxidising agent while MnO_4^{2-} is not. ii. Zr and Hf have identical sizes. iii. The lowest oxidation state of manganese is basic while the highest is acidic. iv. Mn(II) shows maximum paramagnetic character amongst the divalent ions of the first transition series. **OR** a) Complete the following chemical equations: i) $MnO^{4-}(aq.) + S_2O_3^{2-}(aq.) + H_2O(l) \rightarrow$ ii) $Cr_2O_7^{2-}(aq.) + Fe^{2+}(aq.) + H^{+} \rightarrow$ b) Write down the equations involve during preparation of Potassium Dichromate	5
33	a) Write the structure of A, B, C and D in the following reactions: i. CH_3COOH with PCl_5 gives A ii. A with H_2/Pd-$BaSO_4$ gives B iii. B with $LiAlH_4$ gives D and with CH_3MgBr gives C b) $(CH_3)_3C$-CHO does not undergo aldol condensation. Comment. OR a) Write down the equations involved in the following reactions: i. Wolff Kishner Reduction ii. Etard Reaction iii. Stephen Reduction b) How do you convert the following: i. Ethanal to Propanone ii. Toluene to Benzoic acid	5

MARKING SCHEME

	SECTION-A	
1	b.	1
2	a.	1
3	a.	1
4	a)	1
5	b)	1
6	c)	1
7	b)	1
8	b)	1
9	b.	1
10	a.	1
11	c.	1
12	a	1
13	a.	1
14	d.	1
15	a.	1
16	d.	1
	SECTION-B	
17	a. For tetrahedral complexes, the crystal field stabilisation energy is lower the pairing energy. b.cis-Platin	1+1
18	0.05M Al_2SO_4 because gives a lower depression in freezing point. Hence it will freeze at high temperature.	1 1
19	I. First order reaction II. $time^{-1}$ or min^{-1} III. $t_{1/2}$ is independent of $[R]_0$ IV. 	 ½ ½ ½ ½
20	a) Cr^{3+} b) Mn^{3+} c) Ti^{4+} d) Mn^{3+}	½ ½ ½ ½
21	a) $[Co(NH_3)_4Cl_2]Cl$ b) Tetraamminechloridocobalt (III)chloride. **OR** a) Geometrical isomerism b) In $[NiCl_4]^{2-}$, Nickel undergo sp3 hybridisation and have two unpaired electrons because chloride ion (Weak field ligand) does not cause pairing of electron, hence paramagnetic. In $[NI(CO)_4]$, Nickel undergo sp3 hybridisation and have two unpaired electron because CO (Strong field ligand) cause pairing of electron, Hence diamagnetic.	1 1 1 1
	SECTION-C	
22	a) Protein are polymers of amino acid connected to each other by peptide linkage (-CO-NH-)	1

	b) Two monosaccharide units are joined together by an oxide linkage formed by the loss of water molecule. c) Loss of biological activity of protein **OR** Sucrose is dextrorotatory. On hydrolysis, it produces a mixture of glucose and fructose having specific rotation + 52.5°. and -92.4°. Thus, the respectively net resultant mixture become laevorotatory. Hence, the mixture is laevorotatory and product is known as invert sugar. $C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$	1 1 3
23	i) CH_3I Iodine is better leaving group because of larger size than Bromine ii) CH_3Cl Because primary halides have lesser steric hindrance. iii) $C_6H_5CH_2Cl$	1 1 1
24	$\Delta Tb = i \times Kb \times m$ For $MgSO_4$ i=2 Molality of solution=4/120 x 10 =1/3m ΔTb= 2 x 0.52 x 1/3 = 0.347 Boiling point of solution= $100+0.347=100.347^0C$	½ ½ 1 ½ ½
25	a) Mercury cell is used in hearing aids. b) Fuel cell was used in Apollo Space Programme. c) Lead storage cell is used in automobiles and invertors. d) Dry cell does not have long life. (ii) Specific conductivity decreases because the number of ions per unit volume decrease.	½ ½ ½ ½ 1
26	a) Any two correct difference. b) $t=2.302/k \log [A]_0/[A]=2.032/1.15x10^{-3} \log 5/3$ $=2 \times 10^{-3} \times 0.2219 = 443.8$ s	2 ½ ½
27	a) diamminesilver(I)dicyanoargentate(I) b) dicloridobis(ethane-1,2-diamine) cobalt (III)chloride c)Potassiumtrioxalatoaluminate (III)	1 1 1
28	i)Reimer-Tiemann reaction  ii) Kolbe's reaction  b) Phenol and Benzyl Chloride **OR** i) On adding NaOH/I2 and heating Isopropyl alcohol form a yellow ppt. of iodoform but n-Propyl alcohol does not give this test. ii) On adding neutral FeCl3solution, Phenol form red-violet complexbut alcohol does not gives this test b) $NaBH_4$ (Sodium borohydride)	1 1 1 1 1 1
	SECTION-D	
29	i) b) $C_{12}H_{22}O_{11}$ ii) d) $NaHSO_3$	1 1

	iii) d)Rhamnose iv) c) Lactose **OR** The carbohydrates are optically active polyhydroxy aldehyde or ketone	1 1
30	i) c ii) d iii) a iv) b **OR** v) a	1 1 1 1
	SECTION-E	
31	a) $2Al(s) + 3Cd^{2+}(0.1M) \rightarrow 3Cd(s) + 2Al^{3+}(0.01M)$ n=6 $E_{cell}=E^0_{cell} - 0.059/n \log [Al^{3+}]^2/ [Cd^{2+}]^3$ $= 1.26 - 0.059/6 \log (0.01)^2/(0.1)^3$ $= 1.26 - 0.059/6 \times (-1)$ $= 1.26 + 0.009$ $= 1.269$ V b) Given that k= 0.025 S cm^{-1} Molarity = 0.2 M Λm = k /Molarity x 1000 $= 0.025/0.2 \times 1000$ $= 125$ S cm^2 mol^{-1} **OR** a) i. Cu (s)/ Cu^{2+}(aq.) || Ag^+(aq.) / Ag (s) ii. Current will flow from sliver to copper electrode in the external circuit. iii. At Cathode : $2 Ag^+(aq.) + 2 e^- \rightarrow 2 Ag$ (s) At Anode : Cu (s) $\rightarrow Cu^{2+}(aq.) + + 2 e^-$ b) H_2-O_2 Fuel Cell At Cathode : $O_2(g) + 2H_2O(l) + 4 e^- \rightarrow 4OH^-(aq.)$ At Anode : $2H_2(g) + 4OH^-(aq.) \rightarrow +4H_2O(l) + 4 e^-$	½ ½ 1 ½ ½ 1 ½ ½ 1 ½ ½
32	a) $CuF_2$is coloured due to presence of unpaired electron (Cu^{2+}ion) b) Explain: i. Cr in CrO_4^{2-}has oxidation state +6. It can reduce its oxidation to +3 (in Cr^{3+} ,t_{2g}^3 stable state) and act as strong oxidising agent while Mn in MnO_4^{2-} has oxidation state +6.But its most stable state is +7,Hence it does not act as oxidising agent. ii. Due to lanthanoid contraction. iii. Because higher oxide are ionic in nature but lower oxide are covalent in nature iv. Because it have maximum five unpaired electron. OR a) Complete the following chemical equations: i) $8MnO_2 + (s) + 6SO_4^{2-}(aq.) + 2OH^-(aq.)$ ii) $2Cr^{3+}(aq.) + 6Fe^{3+}(aq.) + 7H_2O(l)$ b) $4FeCrO_4+8Na_2CO_3+7O_2 \rightarrow 8Na_2CrO_4+2Fe_2O_3+ 8CO_2$ $4Na_2CrO_4+ 2H^+ \rightarrow Na_2Cr_2O_7+2Na^+ +H2O$ $Na_2Cr_2O_7+ KCl \rightarrow K_2Cr_2O_7 + NaCl$	1 1 1 1 1 1 1 1 1 1
33	a) Write the structure of A, B, C and D in the following reactions: i. A = CH_3COCl ii. B = CH_3CHO	4+1

iii. C= $CH_3CH(OH)CH_3$ and D= CH_3CH_2OH

b) Due to absence of alpha hydrogen.

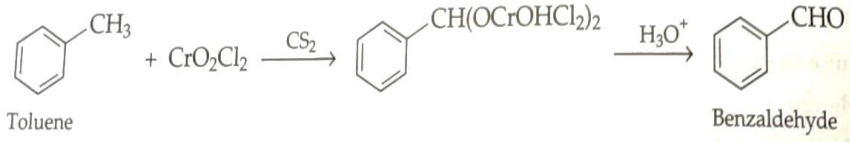
OR

a) Write down the equations involved in the following reactions: 3+2

(i) **Wolff-Kishner reduction :**

$$>C=O \xrightarrow[-H_2O]{NH_2NH_2} >C=NNH_2 \xrightarrow[\text{Heat}]{\text{KOH/Ethylene glycol}} >CH_2 + N_2$$

(ii) **Etard reaction :**



Toluene Benzaldehyde

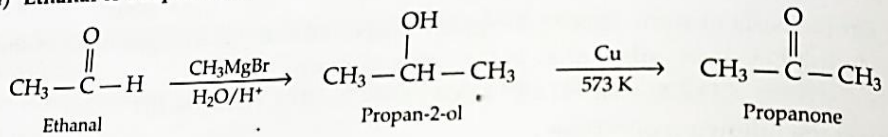
iii)

$$RCN + SnCl_2 + HCl \longrightarrow RCH = NH \xrightarrow{H_3\overset{+}{O}} RCHO$$

This reaction is called **Stephen** reaction.

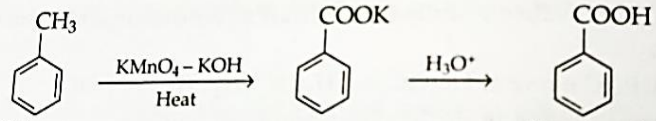
b) How do you convert the following:

s. (a) **Ethanal to Propanone :**



Ethanal Propan-2-ol Propanone

(b) **Toluene to Benzoic acid :**



Toluene Benzoic acid

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Unit No.	Name of Unit	Sec-A		Sec- B	Sec- C	Sec- D	Sec- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions	1(1)	1(1)	1 (2)	1 (3)			4 (7)
II	Electrochemistry	1 (1)			1 (3)		1 (5)	3 (9)
III	Chemical Kinetics	2 (2)		1 (2)	1 (3)			4 (7)
IV	d -and f -Block Elements			1 (2)			1 (5)	2 (7)
V	Coordination Compounds			2(4)	1 (3)			3 (7)
VI	Haloalkanes and Haloarenes	2 (2)	1(1)		1 (3)			4(6)
VII	Alcohols, Phenols and ethers	3 (3)			1 (3)			4 (6)
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)				1 (5)	4 (8)
IX	Amines	1 (1)	1 (1)			1 (4)		3(6)
X	Biomolecules				1 (3)	1 (4)		2 (7)
Total		12 (12)	4 (4)	5 (10)	7 (21)	2 (8)	3 (15)	33 (70)

SET-2

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

General Instructions:

Read the following instructions carefully.

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g) All questions are compulsory.
h) h) Use of log tables and calculator 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.

1.Choose the compound which is more acidic than phenol :

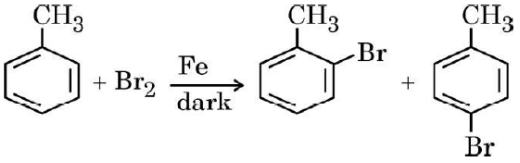
(a) o-nitrophenol (b) ethanol
(c) o-methylphenol (d) o-methoxyphenol

2. Which of the following reactions is a halogen exchange reaction :

(a) $>C=C< + HX \longrightarrow >\underset{H}{\underset{|}{C}}-\underset{X}{\underset{|}{C}}<$

(b) $R-X + NaI \xrightarrow{\text{Dry acetone}} R-I + NaX$

(c) $R-OH + HCl \xrightarrow{ZnCl_2} R-Cl + H_2O$

(d) 

3. Which of the following is the reason for Zinc not exhibiting variable oxidation state

a) inert pair effect b) completely filled 3d subshell
c) completely filled 4s subshell d) common ion effect

4.

For the reaction $A + 2B \longrightarrow 3C + D$, $d[C]/dt$ is equal to :

(a) $-\frac{d[A]}{dt}$ (b) $-\frac{d[B]}{dt}$

(c) $+\frac{3d[A]}{dt}$ (d) $\frac{-3}{2}\frac{d[B]}{dt}$

.

5. How many Faradays are required to reduce one mole of Sn^{4+} to Sn^{2+}?

(a)2.0 (b)4.0 (c)1.0 (d)6.0

6. The unit of rate constant and rate of reaction are identical for a :

(a)zero order reaction (b)first order reaction

(c)second order reaction (d)third order reaction

7. The Gabriel phthalimide synthesis is used for the preparation of :

(a)primary aromatic amines (b)primary aliphatic amines

(c)secondary amines (d)tertiary amines

8. Acetyl chloride is treated with H_2 in the presence of Pd- $BaSO_4$.

The product formed is :

(a)CH_3CH_2OH (b)CH_3CHO

(c)CH_3COOH (d) CH_3COCH_3

9.In the reaction R OH + HCl $\xrightarrow{ZnCl2}$ RCl + H_2O, what is the correct order of reactivity of alcohol?

(a) $1^o < 2^o < 3^o$ (b) $1^o > 3^o > 2^o$

(c) $1^o > 2^o > 3^o$ (d) $3^o > 1^o > 2^o$

10. Deficiency of which of the following vitamins causes Pernicious anaemia ?

(a) Vitamin B_1 (b) Vitamin B_2

(c) Vitamin B_6 (d) Vitamin B_{12}

11.The reactivities of the carbonyl compounds HCHO (I), CH_3CHO (II) and CH_3COCH_3 (III) towards nucleophilic addition reaction decreases in the order :

(a) III > II > I (b) I > II > III

(c) II > III > I (d) I > III > II

12. In the two tetrahedral structures of dichromate ion

(a) 4 Cr – O bonds are equivalent in length.

(b) 6 Cr – O bonds are equivalent in length.

(c) All Cr – O bonds are equivalent in length.

(d) All Cr – O bonds are non-equivalent.

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below:

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) :* ***p***-nitro phenol is a stronger acid than ***p***-cresol.

Reason (R) : NO_2 group is an electron releasing group while – CH_3 group is electron withdrawing in nature.

14. *Assertion:* The two strands of DNA are complementary to each other.

Reason: The hydrogen bonds are formed between specific pairs of bases.

15. Assertion (A) : Acetic acid but not formic acid can be halogenated in presence of red P and Cl2.

Reason (R) : Acetic acid is a weaker acid than formic acid.

16. Assertion (A) : Conductivity decreases with decrease in concentration of electrolyte.

Reason (R) : Number of ions per unit volume that carry the current in a solution decreases on dilution.

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. Define the following terms :

(i) Oligosaccharides (ii) Invert sugar

OR

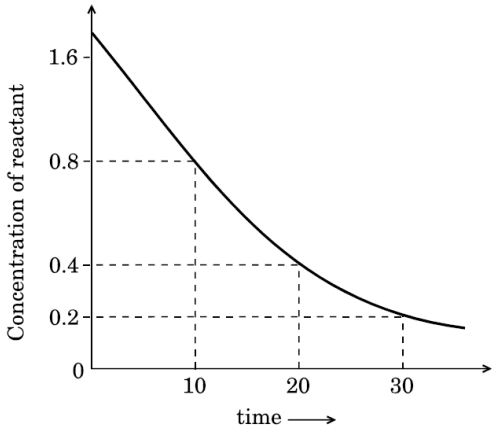
(i)What is the difference between glycosidic linkage and peptide linkage ?

(ii) What is the effect of denaturation on the structures of protein ?

18. Analyse the given graph, drawn between concentration of reactant vs.time.

(a) Predict the order of reaction.

(b) Theoretically, can the concentration of the reactant reduce to zero after infinite time ? Explain.



19. What happens when

(a) Propanone is treated with methylmagnesium iodide and then hydrolysed, and

(b) Benzene is treated with CH_3COCl in presence of anhydrous $AlCl_3$?

20.Why is boiling point of o-dichlorobenzene higher than p-dichlorobenzene but melting point of para isomer is higher than ortho isomer ?

21. The vapour pressure of pure liquid X and pure liquid Y at 25^oC are 120 mm Hg and 160 mm Hg respectively. If equal moles of X and Y are mixed to form an ideal solution, calculate the vapour pressure of the solution.

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.

22. Write the chemical equation for the following :

(a) Hydration of propene in presence of an acid.

(b) Reaction between Ethyl bromide and C_2H_5ONa.

(c) Reaction between Dimethyl ether and Hydrogen iodide.

23.(i) Using crystal field theory, write the electronic configuration of iron ion in the following complex ion. Also predict its magnetic behaviour : $[Fe(H_2O)_6]^{2+}$

(ii)Write the IUPAC name of the coordination complex: $[CoCl_2(en)_2]NO_3$

(iii) Give the formula of Potassium tetrahydroxidozincate (II)

24.(a) Electrophilic reactions in haloarenes occur slowly. Why ?

(b) Primary alkyl halide (A), C_4H_9Br reacted with alcoholic KOH to give compound (B). Compound (B) when reacted with HBr gives (C) which is an isomer of (A). When (A) was reacted with sodium metal it gave a compound (D), C_8H_{18} that was different from the compound obtained when n-butyl bromide was reacted with sodium metal. Give the structures of A, B, C and D.

OR

24(a) (i) Write the structure of 1-chloro-4-ethylcyclohexane.
(ii) Why is sulphuric acid not used during the reactions of alcohols with KI ?
(b) What is an ambident nucleophile ? Give one example.
25.The electrical resistance of a column of 0·05 mol L^{-1} NaOH solution of diameter 1 cm and length 50 cm is 5·55 x10^3 ohms. Calculate the resistivity, conductivity and molar conductivity. Given : $\pi = 3{\cdot}14$
26. If half-life period for a first order reaction in A is 2 minutes, how long will it take [A]0 to reach 10% of its initial concentration ?
27. Differentiate between following :
(i) Amylose and Amylopectin
(ii) Globular protein and Fibrous protein
(iii) Nucleotide and Nucleoside
28. Write the products formed when benzaldehyde reacts with the following reagents :
(i) CH_3CHO in presence of dilute NaOH
(ii) $H_2N - NH\text{-}C_6H_5$
(iii) Conc. NaOH

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. Electrochemistry concerns chemical phenomena associated with charge separation, usually in liquid media, such as solutions. The separation of charge is often associated with charge transfer, which can occur homogeneously in solution between different chemical species, or heterogeneously on electrode surfaces. It can thus be seen immediately that its applications are extremely wide .

In order to ensure electroneutrality, two or more charge transfer half-reactions take place simultaneously, in opposite directions: oxidation (loss of electrons or increase in oxidation state) and reduction (gain of electrons or decrease in oxidation state).

On electrode surfaces, the oxidation and reduction half-reactions are separated in space, usually occurring at different electrodes immersed in solution in a single cell or in separate cell compartments. The electrodes are linked by conducting paths both in solution (via ionic transport) and externally (via electric wires etc.) so that charge can be transported and the electrical circuit completed. When the sum of the Gibbs energy changes at both electrodes is negative the electrical energy released can be harnessed (batteries, fuel cells). If it is positive, external electrical energy can be supplied to overcome the positive Gibbs energy difference and oblige electrode reactions to take place and convert chemical substances (electrolysis).

Answer the following questions

(a) What is the use of a salt bridge in an electrochemical process ?.

OR

When can a galvanic cell behave as an electrolytic cell?

(b) Which reference electrode is used to measure the electrode potential of other electrodes?

(c)What is the relationship between Gibbs energy and cell potential?

What will be the sign Δ G and E^{o} cell for a spontaneous reaction?

30. Coordination compounds have been studied extensively because of what they reveal about molecular structure and chemical bonding, as well as because of the unusual chemical nature and useful properties of certain coordination compounds. The general class of coordination compounds—or complexes, as they are sometimes called—is extensive and diverse. The substances

in the class may be composed of electrically neutral molecules or of positively or negatively charged species (ions). The central metal atom in a coordination compound itself may be neutral or charged (ionic). The coordinated groups—or ligands—may be neutral molecules such as water (in the above example), ammonia (NH_3), or carbon monoxide (CO); negatively charged ions (anions) such as the fluoride (in the first example above) or cyanide ion (CN^-); or, occasionally, positively charged ions such as the hydrazinium ($N_2H_5^+$) or nitrosonium (NO^+) ion.

Coordination number is the term proposed by Werner to denote the total number of bonds from the ligands to the metal atom. Coordination numbers generally range between 2 and 12, with 4 (tetracoordinate) and 6 (hexacoordinate) being the most common.

The oxidation number, designated by an Arabic number with an appropriate sign (or, sometimes, by a Roman numeral in parentheses), is an index derived from a simple and formal set of rules and is not a direct indicator of electron distribution or of the charge on the central metal ion or compound as a whole.

Answer the following questions

(a) Specify the oxidation numbers of the metals in the following coordination entities:

(i) $[Co(H_2O)(CN)(en)_2]^{2+}$ (ii) $[PtCl_4]^{2-}$

(b)Write coordination number of Fe in $[Fe(C_2O_4)_3]^{3-}$ and $K_4[Fe(CN)_6]$.

(c)What are homoleptic and hetroleptic complexes?

OR

(c) (i)Predict the geometry of $[Ni(CN)_4]^{2-}$

(ii)Calculate the spin only magnetic moment of $[Cu(NH_3)_4]^{2+}$ ion.

SECTION E

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

31. Attempt **any five** of the following:

(a) Why there are greater horizontal similarities in the properties of the transition elements?

(b) On what ground can you say that scandium (Z = 21) is a transition element but zinc (Z = 30) is not?

(c)Transition elements have high melting points. Why?

(d) Why the metals of the second and third series have greater enthalpies of atomisation than the corresponding elements of the first series?

(e) The radii of the second (4d) series of the elements are virtually the same as the third (5d) series. Why?

(f) In the series Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomisation of zinc is the lowest, i.e., 126 kJ mol–1. Why?

(g) Why actinoid contraction is greater from element to element than lanthanoid contraction?

32. (a)How will you convert the following :

(i) Benzoic acid to aniline

(ii) Aniline to p-bromoaniline

(b)Why does aniline not give Friedel-Crafts reaction ?

(c)Arrange the following in the increasing order of their pKb values :

$C_6H_5NH_2$, NH_3, $C_2H_5NH_2$, $(CH_3)_3N$

(d) How can you distinguish between $CH_3CH_2NH_2$ and $(CH_3CH_2)_2NH$ by Hinsberg test ?

or

32. (a)Write reasons for the following :

(i) Ethylamine is soluble in water whereas aniline is insoluble.

(ii) Amino group is o- and p-directing in aromatic electrophilic substitution reactions, but aniline on nitration gives a substantial amount of m-nitroaniline.

(iii) Amines behave as nucleophiles.

(b) How will you carry out the following conversions :

(i) Nitrobenzene to Aniline

(ii) Ethanamide to Methanamine

33. (a)Why does a solution containing non-volatile solutes have a higher boiling point than pure solvents ? Why is elevation in boiling point a colligative property ?

(b)Calculate the amount of calcium chloride (Molar mass =111 g mol–1) which must be added to 500 g of water to lower its freezing point by 2 K, assuming calcium chloride is completely dissociated. [Kf for water = 1·86 K kg mol^{-1}]

OR

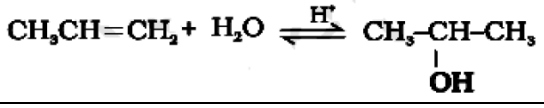
33(a)When fruits and vegetables that have dried up are placed in water, they slowly swell and return to original form. Why ? Will a temperature increase accelerate the process ? Explain

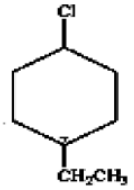
(b) A solution was prepared by dissolving 5 g of non-volatile solute in 95 g of water. It has a vapour pressure of 23·375 mm Hg at 298 K. Calculate the molar mass of the solute. [Vapour pressure of pure water at 298 K is 23·75 mm Hg]

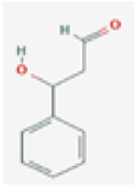
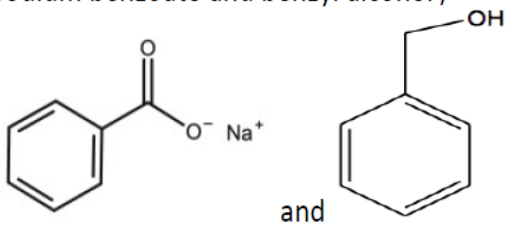
MARKING SCHEME

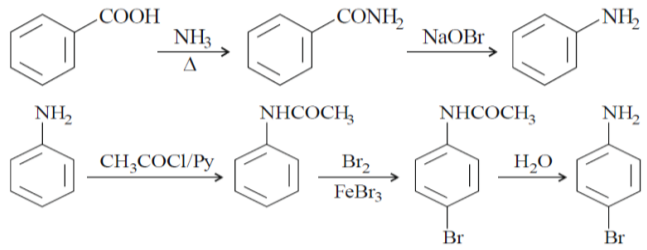
MODEL QUESTION PAPER (2023-24)

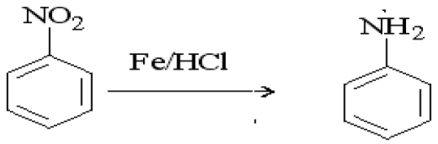
CHEMISTRY THEORY (043)

Q	**SECTION-A**	M
1	(a)	1
2	(b)	1
3	(b)	1
4	(d)	1
5	(a)	1
6	(a)	1
7	(b)	1
8	(b)	1
9	(a)	1
10	(d)	1
11	(b)	1
12	(b)	1
13	(c)	1
14	(a)	1
15	(b)	1
16	(a)	1
	SECTION-B	
17	i) Carbohydrates that yield two to ten monosaccharides units on hydrolysis. ii) Hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (-) and the product is named as invert sugar. **OR** (i)Peptide linkage is —CONH— formed between two amino acids while glycosidic linkage is an oxide linkage between two monosaccharides. (ii) Secondary and tertiary structures of protein are destroyed.	1 1 1 1
18	(a) 1st order (b) No, due to exponential relation / the curve never touches the x-axis.	1 1
19	a) $(CH_3)_3C$-OH / tertiary butyl alcohol is formed. b) $C_6H_5COCH_3$ / acetophenone is formed [correct equations]	1 1
20	B.P. of o-isomer is higher as it has higher dipole moment or polarity / stronger intermolecular interactions. M.P. of p-isomer is higher as it is symmetric and fits better in the crystal lattice	1 1
21	$p_{Total} = p^{\circ}_X \chi_X + p^{\circ}_Y \chi_B$ $\chi_X = \chi_B = 0.5$ $p_{Total} = (120 \times 0.5) + (160 \times 0.5)$ $= 140$ mm Hg	1 1
	SECTION-C	
22	(a) 	1

	(b) $C_2H_5Br + C_2H_5ONa \longrightarrow C_2H_5OC_2H_5 + NaBr$ (c) $CH_3OCH_3 + HI \longrightarrow CH_3OH + CH_3I$	1 1
23	(i)t2g4eg 2 Paramagentic (ii)Dichloridobis(ethane-1,2-diamine)cobalt(III)nitrate (iii) $K_2[Zn(OH)_4]$	1 1 1
24.	(a) Due to –I effect of halogens. (b) A= $(CH_3)_2CHCH_2Br$ B=$(CH_3)_2C=CH_2$ C=$(CH_3)_3CBr$ D=$(CH_3)_2CHCH_2CH_2CH(CH_3)_2$	1 2
	OR (a) (i)  (ii) Sulphuric acid converts KI to HI and then oxidises HI to I_2. (b)A nucleophile with two nucleophilic centres. CN^- / NO_2^- (or any other suitable example).	1 1 1
25.	(a). Area (A) = $\pi r^2 = 3.14 \times (0.5\ cm)^2 = 0.785\ cm^2$ Length (l) = 50 cm = 0.5 m. $R = \rho . \frac{l}{A}$ or $\rho = \frac{R \times A}{l}$ $= \frac{5.55 \times 10^3 \times 0.785 cm^2}{50\ cm}$ ρ = 87.135 ohm cm. $k = \frac{1}{\rho}$ $= \frac{1}{87.135} Scm^{-1}$ $= 0.01148\ Scm^{-1}$ $\Lambda m = \frac{k \times 1000}{M}$ $= \frac{0.011488\ cm^{-1} \times 1000 cm^3 L^{-1}}{0.05\ mol\ L^{-1}}$ Λm = 229.6 S cm^2 mol^{-1}	1,1 1

26.	$k = \frac{0.693}{t_{\frac{1}{2}}}$ $= \frac{0.693}{2\ min}$ $0.3465 min^{-1}$ $t = \frac{2.303}{K} \log \frac{[A]_0}{[A]}$ $= \frac{2.303}{0.3465} \log \frac{100}{10}$ $t = \frac{2.303}{0.3465\ min^{-1}} \times \log 10$ $= \frac{2.303}{0.3465} \times 1$ $= 6.6$ min	1,1,1
27.	(i) Amylose is water soluble component of starch while amylopectin is insoluble in water (ii) Globular proteins are spherical in shape while fibrous are linear. (iii) Nucleoside consists of a sugar and a base When nucleoside is linked to phosphate group, it forms a nucleotide	1 1 1
28.	(i) 3-hydroxy-3-phenylpropanal /  / $C_6H_5CH(OH)CH_2CHO$ (ii) Phenyl hydrazone of benzaldehyde / $C_6H_5CH{=}N{-}NHC_6H_5$ (iii)Sodium benzoate and benzyl alcohol /  and	1 1 1
	SECTION D	
29.	(a) To complete the circuit so that current can flow. **OR** A galvanic cell can behave as an electrolytic cell when Eext > Ecell. (b) Standard hydrogen electrode is the reference electrode whose electrode potential is taken to be zero. The electrode potential of other electrodes is measured with respect to it. (c) $\Delta rG = -nFE_{(cell)}$ negative and positive respectively.	1 1 2
30	(a)Co(III), Pt (II) (b)6 and 6	1 1

	(c) Complexes in which a metal is bound to only one kind of donor groups, e.g., $[Co(NH_3)_6]^{3+}$, are known as homoleptic. Complexes in which a metal is bound to more than one kind of donor groups, e.g., $[Co(NH_3)_4Cl_2]+$, are known as heteroleptic. **OR** (c) (i)Square planar (ii)$Cu^{2+} = 3d^9$ 1 unpaired electron so $\sqrt{1(3)} = 1.73BM$	2
31	(a) Due to similar outer configuration. (b) incompletely filled 3d orbitals in case of scandium atom completely filled d orbitals ($3d^{10}$) in ground state as well as in its oxidised state in Zn. (c)Due to the involvement of greater number of electrons from (n-1)d in addition to the ns electrons in the interatomic metallic bonding. (d)This is due to the occurrence of much more frequent metal – metal bonding in compounds of the heavy transition metals. (e)Due to lanthanoid contraction. (f) No eletrons from 3d-orbitals are involved in metallic bnding in case of zinc. (g)5f orbitals have poor screening as compared to4f orbitals.	1 1 1 1 1 1 1
32.	(a)  (b) Aniline is a Lewis base and it reacts with $AlCl_3$ to form a salt & N of aniline acquires positive charge with $AlCl_3$ and hence is a deactivating group. (c) $(CH_3)_3N < C_2H_5NH_2 < NH_3 < C_6H_5NH_2$ / $C_2H_5NH_2 < (CH_3)_3N < NH_3 < C_6H_5NH_2$ (d) Add Hinsberg reagent (benzene sulphonyl chloride) to both the compounds. $CH_3CH_2NH_2$ gives ppt. that is soluble in alkali while the ppt. formed by $(CH_3CH_2)_2NH$ is insoluble in alkali.	1 1 1 1 1
	OR (a) *(i)*Ethylamine forms strong hydrogen bonds with water molecules whereas in aniline due to the large hydrocarbon part, the extent of H-bonding decreases. *ii)* Because of protonation of aniline / formation of anilinium ion which deactivates the ring. *iii)* Amines behaves as nucleophiles due to the presence of a lone pair of electrons on the nitrogen atom.	1 1 1

	b) (i)  *ii)* $CH_3CONH_2 \xrightarrow{Br_2/KOH} CH_3NH_2$	1 1
33	(a)Due to lowering of vapour pressure of solution. Because it depends on molality / number of solute particles (b) $\Delta T_f = i\,K_f\,m = \frac{i\,K_f.w_B\times1000}{M_B w_A}$ $i = 3$ $2 = 3 \times 1.86 \times \frac{w_B}{111} \times \frac{1000}{500}$ $w_B = \frac{2\times111\times500}{3\times1.86\times1000} = 19.89g$	1 1 1 1 1
	OR (a)Due to osmosis. / Due to inward movement of water molecules. Yes, osmosis is directly proportional to temperature of solvent. (b) For dilute solutions: $\frac{P_A^O - P_S}{P_A^O} = \frac{w_B}{M_B} \times \frac{M_A}{w_A}$ $\frac{23.75-23.375}{23.75} = \frac{5}{M_B} \times \frac{18}{95}$ $M_B = \frac{5\times18}{95} \times \frac{23.75}{0.375} = 60\ gmol^{-1}$	1 1 1 1 1

BLUE PRINT

Unit No.	Name of Unit	Sec-A		Sec- B	Sec- C	Sec- D	Sec- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions	1(1)	1(1)	1 (2)	1 (3)			4 (7)
II	Electrochemistry	1 (1)			1 (3)		1 (5)	3 (9)
III	Chemical Kinetics	2 (2)		1 (2)	1 (3)			4 (7)
IV	d -and f -Block Elements			1 (2)			1 (5)	2 (7)
V	Coordination Compounds			2(4)	1 (3)			3 (7)
VI	Haloalkanes and Haloarenes	2 (2)	1(1)		1 (3)			4(6)
VII	Alcohols, Phenols and ethers	3 (3)			1 (3)			4 (6)
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)				1 (5)	4 (8)
IX	Amines	1 (1)	1 (1)			1 (4)		3(6)
X	Biomolecules				1 (3)	1 (4)		2 (7)
Total		12 (12)	4 (4)	5 (10)	7 (21)	2 (8)	3 (15)	33 (70)

SET-3

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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) h) Use of log tables and calculator 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.

1. For a chemical reaction A→B, it is found that the rate of reaction doubles when the concentration of A is increased four times. The order of reaction is
   (a) Two
   (b) One
   (c) Half
   (d) Zero
2. The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is
   (a) 1 F
   (b) 3 F
   (c) 5 F
   (d) 6 F
3. What type of reaction is this?
   $RCOOR' + H_2O \xrightarrow{HCl} RCOOH + R'OH$
   (a) Second order
   (b) Unimolecular
   (c) Pseudo-unimolecular
   (d) Third order
4. A cathode and an anode are the most common components of an electrochemical cell. Which of the following claims about the cathode is correct?
   (a) Oxidation occurs at the cathode
   (b) Electrons move into the cathode
   (c) Usually denoted by a negative sign
   (d) Is usually made up of insulating material

5. Which of the following has magnetic moment value of 5.9?
   (a) Fe^{2+}
   (b) Fe^{3+}
   (c) Ni^{2+}
   (d) Cu^{2+}
6. IUPAC name of $CH_3CH_2C(Br) = CH—Cl$ is
   (a) 2-bromo-1-chloro butene
   (b) 1-chloro-2-bromo butene
   (c) 3-chloro-2-bromo butene
   (d) None of the above
7. Which of the following are d-block elements but not regarded as transistion elements?
   (a) Cu, Ag, Au
   (b) Zn, Cd, Hg
   (c) Fe, Co, Ni
   (d) Ru, Rh, Pd
8. Which of the following compounds is formed when benzyl alcohol is oxidised with $KMnO_4$?
   a) CO_2 and H_2O
   b) Benzophenone
   c) Benzaldehyde
   d) Benzoic acid
9. At 287K, which of the following is a gas?
   a) Propanal
   b) Acetaldehyde
   c) Formaldehyde
   d) Acetone
10. Formic acid can reduce
   a) Tollen's reagent
   b) Potassium permanganate
   c) Mercuric chloride
   d) All of the above
11. Which among the following is not a polysaccharide?
   (a) Lactose (b) Glycogen
   (c) Starch (d) Dextrin
12. As a result of Wolff-Kishner reduction, the following conversions can be made:
   a) Benzaldehyde into Benzyl alcohol
   b) Cyclohexanol into Cyclohexane
   c) Cyclohexanone into Cyclohexanol
   d) Benzophenone into Diphenylmethane**.**
13. Given below are two statements labelled as Assertion (A) and Reason (R)
   Assertion : Formaldehyde is a planar molecule.
   Reason : It contains sp^2 hybridised carbon atom.
   (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.

14. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion : In Lucas test, 3º alcohols react immediately.
Reason : An equimolar mixture of anhyd. $ZnCl_2$ and conc. HCl is called Lucas reagent.
(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.

15. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion : Nitration of aniline can be conveniently done by protecting the amino group by acetylation.
Reason : Acetylation increases the electron-density in the benzene ring.
(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.

16. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion : Human diet should compulsorily contain glycine, serine and tyrosine.
Reason : Essential amino acids can not be synthesized in the human body.
(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.

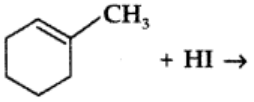
SECTION B

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. a) Some liquids on mixing form 'azeotropes'. What are 'azeotropes'?
b) Explain why aquatic species are more comfortable in cold water rather than in warm water.

18. i) In the first order reaction, the concentration of the reactant is reduced to 1/4th in 60 minutes. What will be its half-life?
ii) The units of rate of reaction and rate constant are same for which kind of reactions ?

19. (a) Draw the structure of major monohalogen product formed in the following reaction :



(b) Predict the order of reactivity of the following compounds in S_N1 reaction :
$C_6H_5CH_2Br$, $C_6H_5C(CH_3)(C_6H_5)Br$, $C_6H_5CH(C_6H_5)Br$, $C_6H_5CH(CH_3)Br$

20. (i) What is Tollen's reagent? Write one usefulness of this reagent.
(ii) Give a chemical test to distinguish between Benzoic acid and Phenol.

21. Name a water soluble vitamin which is a powerful antioxidant. Give its one natural source.

OR

Name one oil soluble vitamin which is a powerful antioxidant and give its one natural source.

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.

22. (a) Why does the conductivity of a solution decrease with dilution?

(b) What is the effect of catalyst on:
(i) Gibbs energy (ΔG) and
(ii) activation energy of a reaction?

23. (i) If the rate constant of a reaction is $k = 3 \times 10^{-4}\ s^{-1}$, then identify the order of the reaction.
(ii) For a reaction R → P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. What is the order of reaction?
(iii) Define Pseudo first order reaction.

24. (a) Give IUPAC name of the ionization isomer of $[Ni(NH_3)_3NO_3]Cl$.
(b) When a co-ordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write
(i) Structural formula of the complex.
(ii) IUPAC name of the complex.

25. (a) How are the following conversions carried out?
(i) Benzyl chloride to benzyl alcohol,
(ii) Methyl magnesium bromide to 2-methyl- propan-2-ol.
(b) Haloalkanes undergo nucleophilic substitution whereas haloarenes undergo electrophilic substitution. Explain.

26. (a) Ortho nitrophenol has lower boiling point than p-nitrophenol. Why ?
(b) Which of the following isomers is more volatile : o-nitrophenol or p-nitrophenol?
(c) What happens when phenol is oxidized by $Na_2Cr_2O_7/H_2SO_4$?

27. (a) Arrange the following compounds in an increasing order of their acidic strength:
(i) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid
(b) Write the equations involved in the following reactions:
(i) Wolff-Kishner reduction
(ii) Etard reaction

28. a) What is meant by a peptide linkage?
b) What are essential and non-essential amino acids in human food? Give one example of each type.

OR

a) What is a glycosidic linkage?
b) Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain.
c) Which component of starch is a branched polymer of a-glucose and insoluble in water?

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. Electricity can be produced when electrons move from one element to another in certain types of reactions (such as redox reactions). Typically, electrochemistry deals with the overall reactions when multiple redox reactions occur simultaneously, connected via some external electric current and a suitable electrolyte. In other words, electrochemistry is also concerned with chemical phenomena that involve charge separation (as seen commonly in liquids such as solutions). The dissociation of charge often involves charge transfer that

occurs homogeneously or heterogeneously between different chemical species. A spontaneous chemical process is one which can take place on its own, and in such a process, the Gibbs free energy of a system decreases. In electrochemistry, spontaneous reaction (redox reaction) results in the conversion of chemical energy into electrical energy. The reverse process is also possible where a non-spontaneous chemical reaction occurs by supplying electricity. These interconversions are carried out in equipment called an electrochemical cell.

Answer the following questions:

a) Write the name of the cell which is generally used in hearing aids.

b) Under what conditions is $E^0_{cell} = 0$ and $\Delta_r G^0 = 0$?

OR

What does the negative sign in the expression $E^0_{Zn2+/Zn} = -0.76$ V means?

c) The standard electrode potential for Daniell cell is 1.1 V. Calculate the standard Gibbs energy for the cell reaction. ($F = 96{,}500$ C mol^{-1})

30. Many coordination compounds contain a metallic element as the central atom and are therefore referred to as metal complexes. These types of coordination complexes generally consist of a transition element as the central atom. It can be noted that the central atom in these complexes is called the coordination centre. A chemical compound in which the central ion or atom (or the coordination centre) is bound to a set number of atoms, molecules, or ions is called a **coordination entity.** Some examples of such coordination entities include $[CoCl_3(NH_3)_3]$ and $[Fe(CN)_6]^{4-}$.

As discussed earlier, the atoms and ions to which a set number of atoms, molecules, or ions are bound are referred to as the **central atoms** and the **central ions.** In coordination compounds, the central atoms or ions are typically Lewis Acids and can, therefore, act as electron-pair acceptors. The atoms, molecules, or ions that are bound to the coordination centre or the central atom/ion are referred to as **ligands.** These ligands can either be a simple ion or molecule, such as Cl– or NH3 or in the form of relatively large molecules, such as ethane-1,2-diamine (NH2-CH2-CH2-NH2). The coordination sphere is the non-ionizable part of a complex compound, which consists of a central transition metal ion surrounded by neighbouring atoms or groups enclosed in a square bracket. The coordination centre, the ligands attached to the coordination centre, and the net charge of the chemical compound as a whole form the **coordination sphere** when written together. This coordination sphere is usually accompanied by a counter ion (the ionizable groups that attach to charged coordination complexes).

For example, $[Co(NH_3)_6]Cl_3$ – coordination sphere

Answer the following questions:

a) Write down the formula of: Tetraamineaquachloridocobalt(III) chloride.

b) Which of the following is more stable complex and why?
$[Co(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$

c) Give two examples of ligands which form coordination compounds useful in analytical chemistry.

OR

Describe the shape and magnetic behaviour of following complex $[CO(NH_3)_6]^{3+}$

SECTION E

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

31. **Answer any five-**

i) What type of intermolecular attractive interaction exists in the pair of methanol and acetone?

ii) Mention two important applications of Henry's law

iii) What is meant by positive deviations from Raoult's law?

iv) 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)

v) How does sprinkling of salt help in clearing the snow-covered roads in hilly areas?

vi) The vapour pressure of solvent gets lowered, when a non- volatile solute is added to it. Why?

vii) What happens when red blood cells are placed in 0.1% NaCl solution?

32. a) Why do transition elements show variable oxidation states?

b) Generally there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements. Why?

c) Transition elements and their compounds are generally found to be good catalysts in chemical reactions. Explain.

d) Complete the following chemical equations :

(i) MnO_4 (aq) + $S_2O_3^{2-}$ (aq) + H_2O (1) →

(ii) $Cr_2O_7^{2-}$ (aq) + Fe_{2+} (aq) + H_+ (aq) →

OR

a) Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequency and why?

b) Which of the following cations are coloured in aqueous solutions and why?
SC^{3+}, V^{3+}, Ti^{4+}, Mn^{2+}.
(At. nos. Sc = 21, V = 23, Ti = 22, Mn = 25)

c) The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling points.Why?

d) State reasons for the following :
(i) Cu (I) ion is not stable in an aqueous solution.
(ii) Unlike Cr^{3+}, Mn^{2+}, Fe^{3+} and the subsequent other M^{2+} ions of the 3d series of elements, the 4d and the 5d series metals generally do not form stable cationic species.

33. a) Why is an alkylamine more basic than ammonia?

b) Arrange the following compounds in an increasing order of basic strengths in their aqueous solutions : NH_3, CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$

c) Give a chemical test to distinguish between ethylamine and aniline.

d) Write the structure of n-methylethanamine.

e) Arrange the following compounds in increasing order of solubility in water :
$C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$

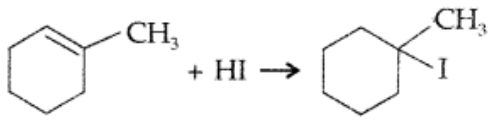
OR

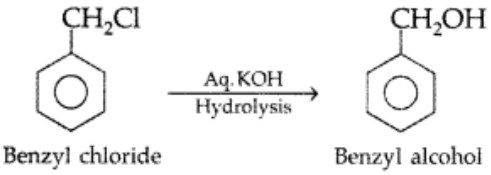
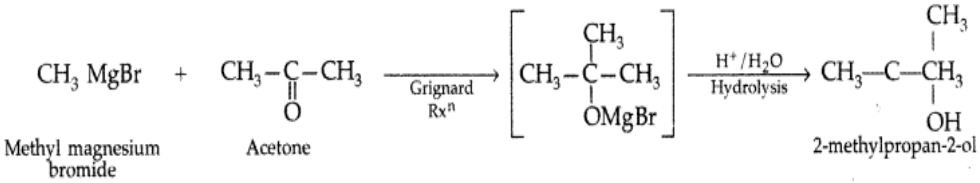
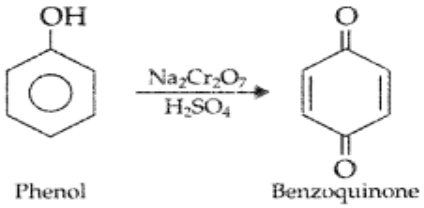
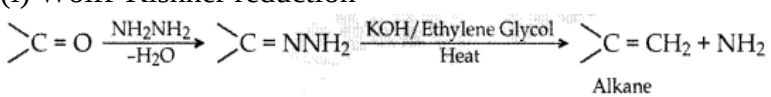
a) Why is the NH_2 group of aniline acetylated before carrying out nitration?

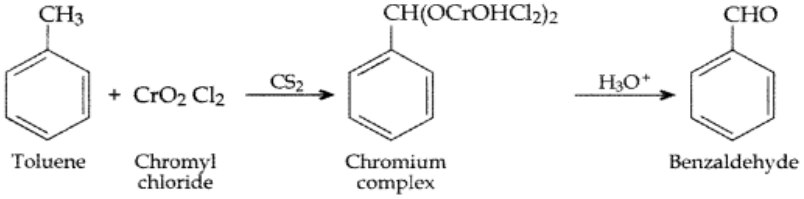
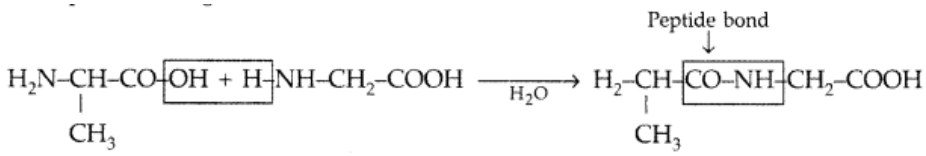
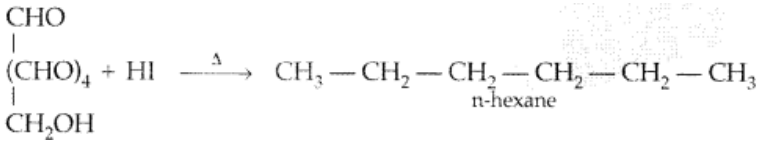
b) What is the product when $C_6H_5CH_2NH_2$ reacts with HNO_2?

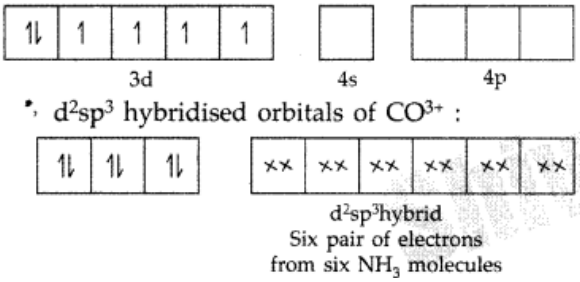
c) Why is benzene diazonium chloride not stored and used immediately after its preparation?
d) A compound Z with molecular formula C_3H_9N reacts with $C_6H_5SO_2Cl$ to give a solid, insoluble in alkali. Identify Z.
e) Why is aniline soluble in aqueous HCI?

MARKING SCHEME

1	c	1
2	b	1
3	C	1
4	b	1
5	b	1
6	a	1
7	b	1
8	d	1
9	c	1
10	d	1
11	a	1
12	d	1
13	a	1
14	b	1
15	c	1
16	d	1
17	a) The liquid mixture having a definite composition and boiling like a pure liquid without change in composition is called as azeotrope. b) Aquatic species need dissolved oxygen for breathing. As solubility of gases decreases with increase of temperature, less oxygen is available in summer in the lake. Hence the aquatic species feel more comfortable in winter (low temperature) when the solubility of oxygen is higher.	1 1
18	i) 30 min. ii) Zero order reaction.	1 1
19	a)  b) $C_6H_5C(CH_3)(C_6H_5)Br > C_6H_5CH(C_6H_5)Br > C_6H_5CH(CH_3)Br > C_6H_5CH_2Br$	1 1
20	i) Ammonical silver nitrate solution is called Tollen's reagent. Uses: It is used to test aldehydes. Both aliphatic and aromatic aldehydes reduce Tollen's reagent to shining silver mirror. It is also used to distinguish aldehydes from ketones. ii) Benzoic acid forms a brisk effervescence with $NaHCO_3$ solution but phenol does not respond to this test.	1 1
21	Water soluble vitamin : Vitamin C Natural source : Amla or any other. **OR** Oil soluble Vitamine : Vitamin D Natural source : Fish liver oil, butter, milk, eggs etc.	1 1
22	a) Conductivity of a solution is the conductance of ions present in a unit volume of the solution. On dilution, the number of ions per unit volume decreases. Hence the conductivity decreases.	1

	b) (i) There will be no effect of catalyst on Gibbs .energy. (ii) The catalyst provides an alternative pathway by decreasing the activation energy of a reaction.	1 1
23	i) S^{-1} is the unit for rate constant of first order reaction. ii) The $t_{1/2}$ of a first order reaction is independent of initial concentration of reactants. iii) Those reactions which are not truly of the first order but under certain conditions become first order reactions are called pseudo first order reaction.	1 1 1
24	a) Triammine chlorido nickel (II) nitrate b) (i) The complex formed on mixing a coordination compound $CrCl_3.6H_2O$ with $AgNO_3$ is as follows $CrCl_3.6H_2O + AgNO_3 \rightarrow [Cr(H_2O_5)Cl]Cl_2.H_2O$ (ii) Pentaaquachloridochromium (III) chloride monohydrate	1 1 1
25	a) (i) aBenzyl chloride to benzyl alcohol  (ii) Methyl magnesium bromide to 2-methylpropan-2-ol  b) Resonance leads to lowering of energy and hence greater stability. On the other hand, no such resonance is possible in haloalkanes. Halogens directly attached to benzene ring are o, p-directing in electrophilic subsitution reactions. This is due to greater electron density at these positions in resonance.	1 1 1
26	a) Ortho-nitrophenol has lower boiling point due to formation of intramolecular H-bonding whereas p-nitrophenol forms intermoleeular H-bonding. b) o-nitrophenol is more volatile than p-nitrophenol due to intramolecular hydrogen bonding. c)  	1 1 1
27	a) 4-Methoxy benzoic acid < Benzoic acid < 4-Nitrobenzoic acid < 3, 4-Dinitrobenzoic acid. b) (i) Wolff-Kishner reduction  (ii) Etard reaction	1 1

		1
28	a) Peptide linkage: A peptide linkage is an amide linkage formed between – COOH group of one α-amino acid and NH_2 group of the other a-amino acid by loss of a molecule of water. 	1
	b) Essential amino acids: Amino acids which the body cannot synthesize are called essential amino acids. Example: Valine, leucine etc. Therefore they must be supplied in diet. Non-essential amino acids: Amino acids which the body can synthesize are called non-essential amino acids. Therefore, they may or may not be present in diet. Example: Glycine, alanine etc.	1 1
	OR	
	a) The two monosaccharide units are joined together through an etheral or oxide linkage formed by loss of a molecule of water. Such a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage.	1
	b) 	1
	c) Amylopectin.	1
29	a) Mercury cells	1
	b) At the condition of equilibrium, $E^0_{cell} = 0$ and $\Delta_r G^0 = 0$	1
	OR	
	It implies that Zn is more reactive than hydrogen or it is a stronger reducing agent. In a cell containing zinc electrode and standard hydrogen electrode present in two half cells, zinc will be oxidised to Zn^{2+} ions while H^+ ions will get reduced to hydrogen.	
	c) Given : E° = 1.1V, F = 96,500 C mol^{-5}, n = 2 $Zn + Cu^2 \rightleftharpoons Cu + Zn^{2+}$ Using $\Delta G° = -nFE° = -2 \times 96500 \times 1.1$ $= 212{,}300$ CV mol^{-1}	2
30	a) $[Co(NH_3)_4(H_2O)Cl]Cl_2$	1
	b) $[Co(en)_3]^{3+}$ is more stable complex than $[CO(NH_3)_6]^{3+}$ because of chelate effect.	1
	c) (i) EDTA (Ethylene diamine tetra-acetic acid) (ii) Dimethyl glyoxime (DMG)	2
	OR	

	$[CO(NH_3)_6]^{3+}$: Orbitals of CO^{3+} ion :  d^2sp^3 hybridised orbitals of CO^{3+} : d^2sp^3hybrid Six pair of electrons from six NH_3 molecules Hybridization : d^2sp^3 Shape : Octahedral Magnetic behaviour : Diamagnetic (absence of unpaired electrons)	
31	i) Solute-solvent dipolar interactions exist in the pair of methanol and acetone. ii) * To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure. * To avoid a dangerous medical condition called bends, scuba divers use oxygen diluted with less soluble helium gas. iii) In positive deviations, the partial vapour pressure of each component A and B of a solution and the total pressure of the solution is higher than the vapour pressure calculated from Raoult's law. For example, Water and Ethanol. iv) Gas (B) will have higher value of K_H (Henry's constant) than Gas (A) at the same temperature v) The phenomenon involved in the melting of snow on snow-covered roads is the depression in the freezing point which is caused by the addition of non-volatile impurities to a liquid. The addition of salt (sodium chloride) lowers the freezing point temperature of the water and thus, helps in the melting of snow. vi) When a non-volatile solute is added to a solvent, the surface area for escape of solvent molecules decreases and vapour pressure gets lowered. vii) Water from NaCl solution passes into cells &they swell. Finally they will burst.	1 each (any five)
32	a) The variability of oxidation state of transition elements is due to incompletely filled d-orbitals and presence of unpaired electrons, i.e. (ns) and (n -1) d electrons have approximate equal energies. b) From titanium to copper the atomic size of elements decreases and mass increases as a result of which density increases. c) The catalytic properties of the transition elements are due to the presence of unpaired electrons in their incomplete d- orbitals and variable oxidation states. d) (*i*) $8MnO_4^- (aq) + 3S_2O_3^{2-} (aq) + H_2O (l) \rightarrow 8MnO_2 (s) + 6SO_4^{2-} (aq) + 2OH^- (aq)$ (*ii*) $Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$ **OR** a) Copper exhibits + 1 oxidation state more frequently i.e., Cu^{+1} because of its electronic configuration $3d^{10}4s^1$. It can easily lose $4s^1$ electron to give stable $3d^{10}$ configuration.	1 1 1 2

	b) $SC^{3+} = 4S^0\ 3d^{3+}$ = no unpaired electron $V^{3+} = 3d^2\ 4s^0$ = 2 unpaired electron $Ti^{4+} = 3d^0\ 4s^0$ = no unpaired electron $Mn^{2+} = 3d^5\ 4s^0$ = 5 unpaired electron Thus V^{3+} and Mn^{2+} are coloured in their aqueous solution due to presence of unpaired electron.	1 1
	c) Because of stronger metallic bonding and high enthalpies of atomization.	1
	d) (i) $Cu^{2+}(aq)$ is much more stable than $Cu^{+}(aq)$. This is because although second ionization enthalpy of copper is large but Δ_{hyd} (hydration enthalpy) for $Cu^{2+}(aq)$ is much more negative than that for $Cu^{+}(aq)$ and hence it more than compensates for the second ionization enthalpy of copper. Therefore, many copper (I) compounds are unstable in aqueous solution and undergo disproportionation as follows : $2Cu^{+} \rightarrow Cu^{2+} + Cu$ (ii) Because high enthalpies of atomisation of 4d and 5d series and high ionization enthalpies, the M.P. and B.P. of heavier transition elements are greater than those of first transition series which is due to stronger intermetallic bonding. Hence 4d and 5d series metals generally do not form stable cationic species.	1 1
33	a) Due to electron releasing inductive effect (+1) of alkyl group, the electron density on the nitrogen atom increases and thus, it can donate the lone pair of electrons more easily than ammonia.	1
	b) $(CH_3)_2\ NH > CH_3NH_2 > (CH_3)_3\ N > NH_3$	1
	c) By Azo dye test: It involves the reaction of any aromatic primary amine with $HNO_2(NaNO_2$ + dil. HCl) at 273-278 K followed by treatment with an alkaline solution of 2-naphthol when a brilliant yellow, orange or red coloured dye is obtained.	1
	d) $H_3C—H_2C—NH—CH_3$	1
	e) $C_6H_5NH_2 < (C_2H_5)_2NH < C_2H_5NH_2$	1
	OR	
	a) NH_2 group of aniline is acetylated first so that controlled nitration can occur at the para position. If the NH_2 group of aniline is not acetylated, then a mixture of ortho, meta and para products will form.	1
	b) $C_6H_5CH_2OH$ is formed.	1
	c) Benzene diazonium chloride cannot be stored and is used immediately after its preparation because of its unstable nature. With a slight increase in temperature, it dissociates to give nitrogen gas.	1
	d) C_3H_9N reacts with $C_6H_5SO_2Cl$ or Hinsberg's reagent to give a solid, insoluble in alkali, which means that C_3H_9N is a secondary amine. C_2H_5-NH-CH_3	1
	e) Aniline forms the salt anilinium chloride, which is water-soluble. $C_6H_5NH_2 + HCl \rightarrow [C_6H_5NH_3]^+Cl^-$	1

Blue Print

U		Sec- A	Sec-B	Sec-C	Sec-D	Sec- E	Total marks
	Name of Unit	MCQ 1 mark	2 marks	3 marks	4 marks	5 marks	
I	Solutions		1 (2)			1(5)	7
II	Electrochemistry	2 (2)		1 (3)	1 (4)		9
III	Chemical Kinetics	2 (2)	1 (2)	1 (3)			7
IV	d -and f -Block Elements	2 (2)				1(5)	7
V	Coordination Compounds			1(3)	1(4)		7
VI	Haloalkanes and Haloarenes	1 (1)	1 (2)	1 (3)			6
VII	Alcohols, Phenols and ethers	3(3)		1 (3)			6
VIII	Aldehydes, Ketones and carboxylic acids	3 (3)	1 (2)	1 (3)			8
IX	Amines	1 (1)				1(5)	6
X	Biomolecules	2(2)	1 (2)	1 (3)			7
Total Q.	**12 (12) 4 (4)**	**5 (10)**	**7 (21)**	**2 (8)**	2 **3 (15)** 3		**33 (70)**

SET-4

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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) h) Use of log tables and calculator is not allowed.

SECTION A

1. . What will be the fraction of molecules having energy equal to or greater than activation energy, Ea?

(a) K (b) A
(c) $Ae^{-Ea/Rt}$ (d) $e^{-Ea/Rt}$

2 . Transition elements form alloys easily because they have

(a) Same atomic number (b) Same electronic configuration
(c) Nearly same atomic size (d) None of the above

3 . Anomalous electronic configuration in the 3d series are of

(a) Cr and Fe (b) Cu and Zn
(c) Fe and Cu (d) Cr and Cu

4. Phenol reacts with Br_2 in CS_2 at low temperature to give

(a) o-Bromophenol (b) o-and p-Bromophenol
(c) p-Bromophenol (d) 2, 4, 6-Tribromophenol

5. In the lead storage battery during charging ,the cathode reaction is

(a) Formation of PbO_2 (b) Formation of $PbSO_4$
(c) Reduction of Pb^{2+} to Pb (d) Decomposition of Pb at the anode

6. Which of the following condition is not satisfied by an ideal solution?

(a) $\Delta H_{mixing} = 0$ (b) $\Delta V_{mixing} = 0$
(c) Raoult's Law is obeyed (d) Formation of an azeotropic mixture

7. The compound which gives the most stable carbonium ion on dehydration is

(a) $(CH_3)_2CHCH_2OH$ (b) $(CH_3)_3COH$
(c) $CH_3CH_2CH_2CH_2OH$ (d) $CH_3CH\ OH\ CH_2\ CH_3$

8. Molar conductivity of 0.15 M solution of KCl at 298 K, if its conductivity of 0.0152 S cm^{-1} will be

(a) 124 Ω^{-1} cm^2 mol^{-1} (b) 204 Ω^{-1} cm^2 mol^{-1}
(c) 101 Ω^{-1} cm^2 mol^{-1} (d) 300 Ω^{-1} cm^2 mol^{-1}

9. How much electricity in in terms of Faraday is required to produce 100 g of Ca from molten $CaCl_2$?

(a) 1F (b) 2F

(c) 3F (d) 5F

10.Equilibrium constant K is related to E^0cell and not Ecell because

(a) E^0cell is easier to measure than Ecell

(b) Ecell becomes zero at equilibrium point but E^0cell remains constant under all conditions

(c) at a given temperature, Ecell changes hence value of K can't be measured.

(d) any of the terms Ecell or E^0cell can be used

11. The correct order of increasing acidic strength is

(a) Phenol < Ethanol < Chloroacetic acid < Acetic acid

(b) Ethanol < Phenol < Chloroacetic acid < Acetic acid

(c) Ethanol < Phenol <Acetic acid < Chloroacetic acid

(d) Chloroacetic acid < Acetic acid < Phenol < Ethanol

12.Osmotic pressure is proportional to

(a) Molality (b) Molarity

(c) Mole fraction (d) Vapour pressure

13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): For complex reaction the order of overall reaction is equal to the molecularity of the slowest step of the reaction.

Reason (R): The rate of the complex reaction is controlled by the slowest step of the reaction

Select the most appropriate answer from the options given below:

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.

14. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion -Compounds containing —CHO group are easily oxidised to corresponding carboxylic acids.

Reason : Carboxylic acids can be reduced to alcohols by treatment with LiAlH4.

Select the most appropriate answer from the options given below:

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.

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion-Tetrahedral complex will not show any geometrical isomerism.

Reason-The relative positions of unidentate ligands attached to Central metal ion are same with respect to each other.

Select the most appropriate answer from the options given below:

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.

16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion: The α- H atom in carbonyl compounds is acidic

Reason: The anion formed after the loss of α - H atom is resonance stablized

Select the most appropriate answer from the options given below:

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.

SECTION B

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

17. For a first order reaction show that time required for 99.9% completion is10 times the half life of the reaction.

OR

A reaction is first order with respect to A & second order with respect to B

(i) How is the rate affected on increasing Concentration of B three times.

(ii)How is the rate affected when concentration of A is reduced to half & that of B is doubled.

18..(i) Draw optical isomers of $[Pt(en)_2Cl_2]^{2+}$.

(ii) Write IUPAC name of ionisation isomer of $[Co(NH_3)_5Br]SO_4$

19 (i) Mention the condition when Raoult's law becomes special case of Henry's law

(ii) At the same temperature, H_2 is more soluble in water than He, which of them will have higher K_H value and why?

20 Name the suitable reagent to carry out the following conversions

(i) Oxidation of primary alcohol to aldehyde

(ii) Phenol to picric acid

21.Write Equation involved in

(i) Wurtz Fittig Reaction

(ii)Friedal Craft Acylation

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) Give the major products formed when

(i) $CH_3CH_2CH(CH_3)CH_2OCH_2CH_3$ reacts with HI

(ii) $(CH_3)_3CBr$ reacts$NaOCH_3$

(iii) Phenol reacts with Bromine water

23. Identify A,B, C in the following reaction

(i) $CH_3CH_2Cl \xrightarrow{KCN} A \xrightarrow{H_2Ni} B \xrightarrow{CH_3COCl/Base} C$

(ii) $C_6H_5N_2Cl \xrightarrow{HBF_4} A \xrightarrow{NaNO_2/Cu} B \xrightarrow{Sn/HCl} C$

24. In a reaction between A and B the initial rate of reaction (r^0) was measured for different initial concentrations of A and B as Given below

A/molL	0.20	0.20	0.40
B/mol L	0.30	0.10	0.05
r^0/mol L	$5.07x10^{-5}$	$5.07x10^{-5}$	$1.43x10^{-4}$

What is the order of reaction with respect to A & B?

25. Give reason :

(b) RX with KCN gives cyanides but with AgCN forms isocyanides.

(c) Haloarenes are less reactive towards S_N reactions.

(d) Grignard reagents are prepared under anhydrous conditions.

26. The Vapour pressure of water at 20ºC is 17.5 mm Hg. Calculate the vapour pressure of water at 20ºC when 15 g of glucose (Molar mass = 180 g mol-1) is dissolved in 150 g of water.

OR

The boiling point of benzene is 353.23 K. when 1.80g of a non volatile solute was dissolved in 90 g of benzene, the b.p. is raised to 354.11 K. Calculate the molar mass of solute. (K_b= 2.53KKg/mol)

27. Differentiate between

(i) Nucleotides and nucleosides

(ii) Peptide and glycosidic linkage

(iii)amylose and amylopectin

28. Give reason :

(i) Gabriel phthalimide is not the suitable method for preparation of primary aromatic amines.

(ii) Aromatic amines are insoluble in water

(iii) B.P of primary amines is greater than secondary amines.

SECTION D

The following section has two case study -based questions Read the passage carefully and answer the questions that follows

29. Proteins are the polymers of a-amino acids and they are connected to each other by peptide bond or peptide linkage. Chemically, peptide linkage is an amide formed between–COOH group and –NH2 group. The reaction between two molecules of similar or different amino acids, proceeds through the combination of the amino group of one molecule with the carboxyl group of the other. This results in the elimination of a water molecule and formation of a peptide bond –CO–NH–. The product of the reaction is called a dipeptide because it is made up of two amino acids. For example, when carboxyl group of glycine combines with the amino group of alanine we get a dipeptide, glycylalanine. If a third amino acid combines to a dipeptide, the product is called a tripeptide. A tripeptide contains three amino acids linked by two peptide linkages. Similarly when four, five or six amino acids are linked, the respective products are known as tetrapeptide, pentapeptide or hexapeptide, respectively. When the number of such amino acids is more than ten, then the products are called polypeptides. A polypeptide with more than hundred amino acid residues, having molecular mass higher than 10,000u is called a protein. However, the distinction between a polypeptide and a protein is not very sharp. Polypeptides with fewer amino acids are likely to be called

proteins if they ordinarily have a well defined conformation of a protein such as insulin which contains 51 amino acids.

(i) Give an example of a globular and a fibrous protein.

(ii) Name the two forms of secondary structure of protein.

(iii) What are essential and non essential amino acids ?Give one example of each.

30. Below is the table given showing complexes formed from Cobalt(III) chloride and ammonia by Alfred Werner. Observe the table carefully and answer the questions that follow

Compound	Colour	Moles of AgCl formed from 1 mol of compound	Total no. of ions produced
(A) $CoCl_3.4NH_3$	Violet	1	2
(B) $CoCl_3.5NH_3$	Rose	2	3
(C) $CoCl_3.3NH_3$	Blue green	0	0

Write the formula of Compound B

What is the primary and secondary valences of cobalt in compound A

Draw geometrical isomers of compound A

OR

Draw geometrical isomers of compound C

SECTION E

The following questions are long answer type and carry 5 marks each

31. (a) Represent the cell in which the following reaction takes place

Mg(s) + 2Ag+ (0.0001M) Æ Mg2+(0.130M) + 2Ag(s)

Calculate its E(cell) if ( ) o E cell = 3.17 V.

Calculate the equilibrium constant of the reaction:

$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

(b) $E^o_{(cell)} = 0.46$ V

OR

(a) Given the standard electrode potentials,

K + /K = –2.93V, Ag+ /Ag = 0.80V, Hg2+/Hg = 0.79V Mg2+/Mg = –2.37 V, Cr3+/Cr = – 0.74V

Arrange these metals in their increasing order of reducing power.

(b) Three electrolytic cells A,B ,C containing solutions of $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively are connected in series. A steady current of 1.5 ampere was passed through them until 1.45 g of silver deposited at the cathode of cell B. How long did the current flow? What mass of copper & zinc were deposited?

32. (a) Give a chemical test to distinguish between

(i)Acetaldehyde & Acetone

(ii)Benzaldehyde & Formaldehyde

(b) How will you carry out the following conversions

(i)Propanone to Propan-2-ol

(ii Ethanal to 2- Hydroxy propanoic acid

iii) Ethyl benzene to Benzoic acid

OR

(a) Write the product of the following reactions

(i) $CH_3COCH_3 \xrightarrow{Zn-Hg/HCl}$

(ii) $C_6H_5COOH \xrightarrow{Br_2/FeBr_3}$

(iii) $C_6H_5COCl + H_2 \xrightarrow{Pd/BaSO_4}$

(b) Which Acid of each pair shown here would you expect stronger & why

(i)FCH_2COOH Or $ClCH_2COOH$

(ii) C_6H_5OH Or CH_3COOH

33 a) Give reason:

(i) zinc cadmium and mercury are not regarded as transition elements.

(ii) Transition elements form coloured compounds.

(iii) Zr and Hf have similar atomic and ionic radii.

(b) Complete and balance the following equation

(i) $MnO_4^{2-} + H^+ \rightarrow$

(ii) $Fe^{2+} + S_2O_8^{2-} \rightarrow$

OR

a) Give an example of

(i) An alloy made from lanthanoids

(ii) A transition metal which do not show variable oxidation state.

(iii) A inner transition element which shows +4 oxidation state.

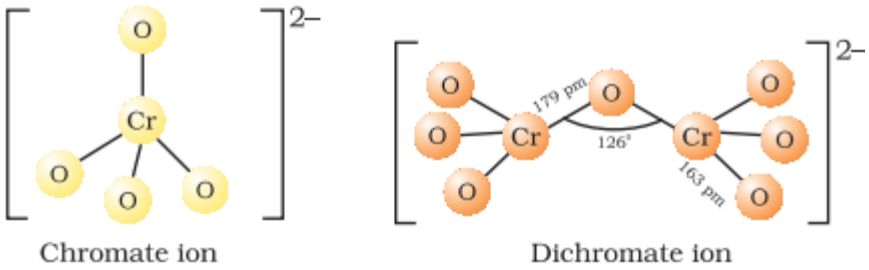
b) Draw the structure of CrO_4^{2-} ion and $Cr_2O_7^{2-}$ ion. What is the hybridisation of chromium in both the ions ?

MARKING SCHEME

Q.No	Answer	Marks
1	D	1
2	C	1
3	D	1
4	D	1
5	A	1
6	D	1
7	B	1
8	C	1
9	D	1
10	B	1
11	C	1
12	B	1
13	A	1
14	B	1
15	A	1
16	B	1
17	When reaction is completed 99.9%, $[R]_n = [R]_0 - 0.999[R]_0$ $k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$ $= \frac{2.303}{t}\log\frac{[R]_0}{[R]_0 - 0.999[R]_0} = \frac{2.303}{t}\log 10^3$ $t = 6.909/k$ For half-life of the reaction $t_{1/2} = 0.693/k$ $\frac{t}{t_{1/2}} = \frac{6.909}{k} \times \frac{k}{0.693} = 10$ **OR** (i) $R_1 = k [A] [B]^2$ $R_2 = k [A] [3B]^2$ $R_2 = K[A] [B]^2$ x9 R_1 $K[A] [B]^2$ $R_2 = 9xR_1$ (9 times) (ii) $R_1 = K[A][B]^2$ $R_2 = K[A] [B]^2$ =½ x 4 R_2=2 R_1 (2times)	2 (1+1)
18	Correct cis + Correct Trans structure Ionisation isomer $[Co(NH_3)_5SO_4]Br$- pentaamminesulphatocobalt(III) bromide	(1/2+1/2) (1)
19	(i) One of the component should be so volatile that it acts as gas (ii) He, higher the K_H, lower the solubility	1 1
20	(i) PCC (ii) Conc.HNO3	1+1

21	(i)C_6H_5 Cl + 2Na+ $CH_3Cl \xrightarrow{THF} C_6H_5CH_3$+ 2NaCl (ii)$C_6H_6$ + $CH_3COCl \xrightarrow{anhydrous\ AlCl_3} C_6H_5COCH_3$+ HCl	1 1
22	(i)CH_3CH_2I + $CH_3CH_2CH(CH_3)CH_2OH$ (ii)$(CH_3)_2C=CH_2$+ CH_3OH+ NaBr (iii) 2,4,6- Tri bromo phenol	1 1 1
23	(i)A=CH_3CH_2CN,B=$CH_3CH_3CH_2NH_2$,C=$CH_3CH_2CH_2NHCOCH_3$ (ii)A=$C_6H_5N_2BF_4$, B=$C_6H_5NO_2$, C=$C_6H_5NH_2$	½x 3 ½x 3
24	L et order of reaction wrt A is x & wrt B is y $R_1=K[A]^x.[B]^y$ $R_1= K(0.20)^x .(0.03)^y=5.07x10^{-5}$ $R_2=K(0.20)^x .(0.10)^y=5.07x10^{-5}$ $R_3=K(0.40)^x.(0.05)^y=14.3x10^{-5}$ $R_2=(0.30)y =1$ R_1 (0.10)y So Y=0 $R_3= (0.40)^x.(0.05)^y=14.3x10^{-5}$ $(0.20)^x.(0.10)^y$ $5.07x10^{-5}$ Since y=0 Taking log on both sides Xlog2= log2.8 X=log2.8/ log2 =1.5 Order wrt A =1.5 Order wrt B=0	1 1
25	(a) KCN is ionic but AgCN is covalent hence only N is available for bonding and isocyanides form. (b) Due to partial double bond characters in C-X bond , substitution of –X is difficult (c)It reacts with traces of water even and forms alkanes	1+1+1
26	$(P^0-P)/P^0 = X_B$ Calculation Answer.17.326mmHg Or ΔTb = Kb. W2x 1000/M2. W1 M2 = 2.53x1.8x1000/.88x90 = 58 g/mol	1 11/2 ½ 1 11/2 ½
27	(i) Nucleotide = Nitrogenous base + pentose sugar + phosphoric acid Nucleoside = Nitrogenous base + pentose sugar (ii) Peptide = Amide linkage between amino acids in proteins Glycosidic linkage = linkage b/w two monosaccharides units through O atom (iii)Amylose =linear polymer of alpha D glucose Amylopectin =branched polymer of alpha D glucose	1 1 1
28	(i)The aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide	1

	(ii)Due to larger hydrophobic part of aromatic ring. (iii)Due to more extensive H bonding in primary amines.	1 1
29	(i) Globular protein – egg albumin Fibrous protein –myosin (ii)alpha helix and beta pleated sheet (iii)Amino acids which can be synthesised by human body and need not to be taken through diet are called non essential amino acids .eg glysine. Amino acids which cannot be synthesised by human body and so need to be taken through diet are called essential amino acids.eg lysine.	1 1 1+1
30	a)[$Co(NH_3)_5Cl]Cl_2$ b) primary valency= 3 , Secondary valency= 6 c)A = cis$[Co(NH_3)_4Cl_2]Cl$, trans$[Co(NH_3)_4Cl_2]Cl$ (Draw Structure)	1 1 1+1
31(a)	The cell can be written as $Mg \mid Mg^{2+}(0.130M) \mid\mid Ag^{+}(0.0001M) \mid Ag$ $E_{(cell)} = E^{o}_{(cell)} - \frac{RT}{2F} \ln \frac{Mg^{2+}}{Ag^{+\ 2}}$ $= 3.17\ V - \frac{0.059V}{2} \log \frac{0.130}{(0.0001)^2} = 3.17\ V - 0.21V = 2.96\ V.$ $E^{o}_{(cell)} = \frac{0.059\ V}{2} \log K_C = 0.46\ V$ or $\log K_C = \frac{0.46\ V \times 2}{0.059\ V} = 15.6$ $K_C = 3.92 \times 10^{15}$ b) or a)Ag<Hg<Cr<Mg<K b)) 108 g Ag is deposited by = 965000C 1.45 g is deposited by =96500 x 1.45/108 =1295.6C Q = I x t 1295.6 = 1.5 x t t= 863s 2 x96500c deposits Zn = 65.3g 1295.6c deposits zn = 65.3 x 1295.6/2 x96500 = 0.436g 2 x96500c deposits Cu= 63.5g 1295.6c deposits Cu = 63.5 x 1295.6/2 x96500 =0.426 g	1+2 2 2 3
32	a)(i)Acetaldehyde gives Tollen/Fehling test,Acetone does not. (ii) Formaldehyde gives Fehling's test, Benzaldehyde does not (or any other test) (b)(i)$CH_3COCH_3 + H_2 \xrightarrow{Ni} CH_3CHOHCH_3$	1 1

	ii)CH_3CHO+ HCN→ $CH_3CH(OH)CN \xrightarrow{Hydronium\ ion} CH_3CHOHCOOH$ (Complete) (iii)$C_6H_5C_2H_5 \xrightarrow{KMnO_{4/H^+}} C_6H_5COOH$ **OR** (a) (I) $CH_3CH_2CH_3$(Clemmensen Reduction) (ii) m-Bromo benzoic acid(Electrophilic Substitution) (iii)C_6H_5CHO(Rosenmund Reaction) (b) (i)FCH_2COOH , high electronegativity (ii)CH3COOH ,more stable carbcation .	1 1 1 1 1 1 1+1
33	a)i)As they have fully filled d subshell both in their ground state as well as in their common oxidation states. ii)As they show d-d transition. iii)Due to lanthanoid contraction b))(i)$3MnO_4^{2-} + 4\ H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$ (ii) $2Fe^{2+} + S_2O_8^{2-} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$ **OR** a) i) Misch metal ii)Scandium iii)Cerium b)  Chromate ion Dichromate ion hybridisation of Cr in both the ions is sp3.	1 1 1 1 1 1 1 1 1 1+1

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-5

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

General Instructions:

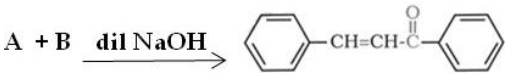
Read the following instructions carefully.

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 very 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 calculator is not allowed.

SECTION A

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

1. The emf of the cell:
Ni / Ni^{2+} (1.0 M) // Au^{3+} (1.0 M) / Au (E° = -0.25 V for Ni^{2+}/Ni; E° = 1.5 V for Au^{3+}/Au) is
(a) 1.25 V (b) -1.25 V
(c) 1.75 V (d) 2.0 V

2. 

Identify A and B:
(a) A = 1-phenylethanal , B = acetophenone (b) A = Benzophenone B = formaldehyde
(c) A= Benzaldehyde , B = Acetophenone (d) A = Benzophenone , B = Acetophenone

3. The vitamins which cannot be stored in our body are:
(a) Vitamin A, B, D and E (d) Vitamin A, C, D and K
(c) Vitamin A, B, C and D (d) Vitamin B & C

4. What is IUPAC name of the ketone A, which undergoes iodoform reaction to give $CH_3CH=C(CH3)COONa$ and yellow precipitate of CHI_3?
(a) 3-Methylpent-3-en-2one (b) 3-Methylbut-2-en- one
(c) 2, 3-Dimethylethanone (d) 3-Methylpent-4-one

5. Which of the following is not correctly matched with its IUPAC name?
(a) $CHF_2CBrClF$: 1-Bromo-1-chIoro-1, 2, 2-trifluoroethane
(b) $(CCl_3)_3CCl$: 2-(Trichloromethyl)-1, 1, 2, 3, 3-heptachloropropane
(c) CH_3C (p-$ClC_6H_4)_2CH(Br)CH_3$: 2-Bromo-3, 3-bis (4- chlorophenyl) butane
(d) o-BrC_6H_4CH (CH_3) CH_2CH_3 : 2-Bromo-l- methylpropylbenzene

6. Match the properties with the elements of 3d series:

(i) lowest enthalpy of atomisation	(p) Sc
(ii) shows maximum number of oxidation states	(q) Mn
(iii) transition metal that does not form coloured compounds	(r) Zn
	(s) Ti

(a) (i) (r), (ii) (q), (iii) (p) (b) (i) (r), (ii) (s), (iii) (p)
(c) (i) (p), (ii) (q), (iii) (r) (d) (i) (s), (ii) (r), (iii) (p)

5. Which of the following statement is true?
(a) molecularity of reaction can be zero or a fraction.
(b) molecularity has no meaning for complex reactions.
(c) molecularity of a reaction is an experimental quantity
(d) reactions with the molecularity three are very rare but are fast.

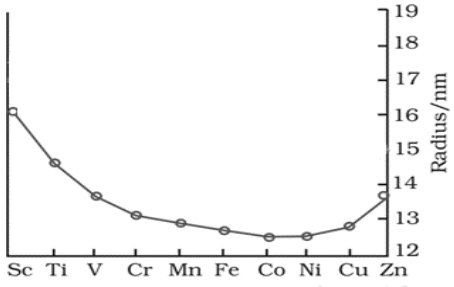
6. In which of the following solvents, the $C_4H_8NH_3^+X^-$ is soluble;
(a) ether (b) acetone (c) water (d) bromine water

7. Which of the following observation is shown by ethanol with Lucas Reagent?
(a) Turbidity will be observed within five minutes
(b) No turbidity will be observed
(c) Turbidity will be observed immediately
(d) Turbidity will be observed at room temperature but will disappear after five minutes.

8. If the initial concentration of substance A is 1.5 M and after 120 seconds the concentration of substance A is 0.75 M, the rate constant for the reaction if it follows zero - order kinetics is:
(a) 0.00625 $molL^{-1}s^{-1}$ (b) 0.00625 s^{-1} (c) 0.00578 $molL^{-1}s^{-1}$ (d) 0.00578 s^{-1}

9. Anisole undergoes bromination with bromine in ethanoic acid even in the absence of iron (III) bromide catalyst
(a) Due to the activation of benzene ring by the methoxy group.
(b) Due to the de-activation of benzene ring by the methoxy group.
(c) Due to the increase in electron density at ortho and para positions
(d) Due to the formation of stable carbocation.

10. The trend of which property is represented by the following graph?



(a) ionization enthalpy (b) atomic radii
(c) enthalpy of atomization (d) melting point

13.Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Alcohols react both as nucleophiles and electrophiles.
Reason (R): The bond between C–O is broken when alcohols react as nucleophiles.Select the most appropriate answer from the options given below:
(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.

14.Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Strong oxidising agents oxidise toluene and its derivatives to benzoic acids.
Reason (R): It is possible to stop the oxidation of toluene at the aldehyde stage with suitable reagents.
Select the most appropriate answer from the options given below:

(e) Both A and R are true and R is the correct explanation of A
(f) Both A and R are true but R is not the correct explanation of A.
(g) A is true but R is false.
(h) A is false but R is true.

15.Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Enzymes are very specific for a particular reaction and for a particular substrate.

Reason (R): Enzymes are biocatalysts.

Select the most appropriate answer from the options given below:

(i) Both A and R are true and R is the correct explanation of A
(j) Both A and R are true but R is not the correct explanation of A.
(k) A is true but R is false.
(l) A is false but R is true.

16.Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): During electrolysis of aqueous copper sulphate solution using copper electrodes hydrogen gas is released at the cathode.

Reason (R): The electrode potential of Cu^{2+}/Cu is greater than that of H^{+}/H_2

Select the most appropriate answer from the options given below:

(m) Both A and R are true and R is the correct explanation of A
(n) Both A and R are true but R is not the correct explanation of A.
(o) A is true but R is false.

A is false but R is true.

SECTION B

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

17. The conversion of molecules X to Y follows second order kinetics. If concentration of X is increased to three times how will it affect the rate of formation of Y ?

18. A 5% solution of $Na_2SO_4.10H_2O$ (MW = 322) is isotonic with 2% solution of non- electrolytic, non volatile substance X. Find out the molecular weight of X.

19. (a) Arrange the isomeric dichlorobenzene in the increasing order of their boiling point and meltingpoints.

(b) Explain why the electrophilic substitution reactions in haloarenes occur slowly and require more drastic conditions as compared to those in benzene.

20. (a) Out of p-tolualdehyde and p-nitrobenzaldehyde, which one is more reactive towards nucleophilic addition reactions, why?

(b) Write the structure of the product formed when acetone reacts with 2,4 DNP reagent.

OR

Convert the following:

(a) Benzene to m-nitrobenzaldehyde
(b) Bromobenzene to benzoic acid

21.(a) DNA fingerprinting is used to determine paternity of an individual. Which property of DNAhelps in the procedure?

(b) What structural change will occur when a native protein is subjected to change in pH?

SECTION C

This section contains 7 questions with internal choice in one question. The following questions areshort

answer type and carry 3 marks each.

22.(a) Write the formula for the following coordination compound Bis(ethane-1,2-diamine) dihydroxidochromium(III) chloride

(b) Does ionization isomer for the following compound exist? Justify your answer.$Hg[Co(SCN)_4]$

(c) Is the central metal atom in coordination complexes a Lewis acid or a Lewis base? Explain.

23.(a) Can we construct an electrochemical cell with two half-cells composed of $ZnSO_4$ solution and zinc electrodes? Explain your answer.

(b) Calculate the λ^0_m for Cl^- ion from the data given below:

Λ^0_m $MgCl_2$ = 258.6 Scm^2mol^{-1} and λ^0_m Mg^{2+} = 106 Scm^2mol^{-1}

(c) The cell constant of a conductivity cell is 0.146 cm^{-1}. What is the conductivity of 0.01 M solutionof an electrolyte at 298 K, if the resistance of the cell is 1000 ohm?

24. Write the name of the reaction, structure and IUPAC name of the product formed when (any 2):

(a) phenol reacts with $CHCl_3$ in the presence of NaOH followed by hydrolysis.

$CH_3CH_2CH(CH_3)CH(CH_3)ONa$ reacts with C_2H_5Br

(b) CH_3CH_2CN reacts with stannous chloride in the presence of hydrochloric acid followed byhydrolysis

25. You are given four organic compounds "A", "B", "C" and "D". The compounds "A", "B" and "C" form an orange- red precipitate with 2,4 DNP reagent. Compounds "A" and "B" reduce Tollen'sreagent while compounds "C" and "D" do not. Both "B" and "C" give a yellow precipitate when heated with iodine in the presence of NaOH. Compound "D" gives brisk effervescence with sodium bicarbonate solution. Identify "A", "B", "C" and "D" given the number of carbon atoms in three of these carbon compounds is three while one has two carbon atoms. Give an explanation for y ouranswer.

26. When sucrose is hydrolysed the optical rotation values are measured using a polarimeter and are given in the following table:

S.No.	Time (hours)	Specific Rotation
1	0	$+66.5^o$
2	∞	-39.9^o

a. Account for the two specific rotation values.

b. What is the specific name given to sucrose based on the above observation?

c. One of the products formed during the hydrolysis of sucrose is a glucose, that reacts with hydroxylamine to give compound A. Identify compound A.

27. An organic compound A with the molecular formula (+)C_4H_9Br undergoes hydrolysis to form (±) C_4H_9OH. Give the structure of A and write the mechanism of the reaction.

28. The rate constants of a reaction at 200K and 500K are 0.02s^{-1} and 0.20s^{-1} respectively. Calculate the value of Ea (Given 2.303R = 19.15 $JK^{-1}mol^{-1}$)

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

29. Coordination compounds are formulated and named according to the IUPAC system.Few rules for naming coordination compounds are:

In ionic complex, the cation is named first and then the anion. In the coordination entity, the ligands are named first and then the central metal ion. When more than one type of ligands are present, they are named in alphabetical order of preference with any consideration of charge

(i)The following questions are multiple choice question. Choose the most appropriate answer:

(i) The IUPAC name of $[Ni(CO)_4]$ is

(a) tetracarbonylnickel(II) (b) tetracarbonylnickel(0)

(c) tetracarbonylnickelate(II) (d) tetracarbonylnickelate(0)

OR

The IUPAC name of the complex $[Pt(NH_3)_3Br(NO_2)Cl]Cl$ is

(a) triamminechlorobromonitroplatinum(IV) chloride

(b) triamminebromonitrochloroplatinum(IV) chloride

(c) triamminebromidochloronitrito_N platinum(IV) chloride

(d) triamminenitrochlorobromoplatinum(IV) chloride

(ii) As per IUPAC nomenclature, the name of the complex $[Co(H_2O)_4(NH_3)_2]Cl_3$ is

(a) tetraaquadiamminecobalt(II) chloride

(b) tetraaquadiamminecobalt(III) chloride

(c) diamminetetraaquacobalt(II) chloride

(d) diamminetetraaquacobalt(III) chloride

{iii} Write the formulas for the following coordination compounds:

(a) Tetraamminediaquacobalt(IlI) chloride

(b) Potassium tetracyanidonickelate(II)

30. The lead-acid battery represents the oldest rechargeable battery technology. Lead acid batteries can be found in a wide variety of applications including small-scale power storage such as UPS systems, ignition power sources for automobiles, along with large, grid-scale power systems. The spongy lead act as the anode and lead dioxide as the cathode. Aqueous sulphuric acid is used as an electrolyte. The half-reactions during discharging of lead storage cells are:

Anode: $Pb(s) + SO^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

Cathode: $PbO_2(s) + 4H^+(aq) + SO^{2-}(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O$

There is no safe way of disposal and these batteries end - up in landfills. Lead and sulphuric acid are extremely hazardous and pollute soil, water as well as air. Irrespective of the environmental challenges it poses, lead-acid batteries have remained an important source of energy.

Designing green and sustainable battery systems as alternatives to conventional meansremains relevant. Fuel cells are seen as the future source of energy. Hydrogen is considered agreen fuel. Problem with fuel cells at present is the storage of hydrogen. Currently, ammonia and methanol are being used as a source of hydrogen for fuel cell. These are obtained industrially, so add to the environmental issues.

If the problem of storage of hydrogen is overcome, is it still a "green fuel?" Despite being the most abundant element in the Universe, hydrogen does not exist on its own so needs to be extracted from the water using electrolysis or separated from carbon fossil fuels. Both of these processes require a significant amount of energy which is currently more than that gained from the hydrogen itself. In addition, this extraction typically requires the use of fossil fuels. More research is being conducted in this field to solve these problems. Despite the problem of no good means to extract Hydrogen, it is a uniquely abundant and renewable source of energy, perfect for our future zero-carbon needs.

Answer the following questions:

a. How many coulombs have been transferred from anode to cathode in order to consume onemole of sulphuric acid during the discharging of lead storage cell?

b. How much work can be extracted by using lead storage cell if each cell delivers about

2.0 V of voltage? (1 F = 96500 C)

Do you agree with the statement – "Hydrogen is a green fuel." Give your comments for andagainst this statement and justify your views.

OR

Imagine you are a member of an agency funding scientific research. Which of the followingprojects will you fund and why?

i. safe recycling of lead batteries

ii. extraction of hydrogen

SECTION E

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

31. 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+}

b. In order to protect iron from corrosion, which one will you prefer as a sacrificial electrode, Ni or Zn? Why? (Given standard electrode potentials of Ni, Fe and Zn are -0.25 V, -0.44 V and -0.76 V respectively.)

c. The second ionization enthalpies of chromium and manganese are 1592 and 1509 kJ/mol respectively. Explain the lower value of Mn.

d. Give two similarities in the properties of Sc and Zn.

e. What is actinoid contraction? What causes actinoid contraction?

f. What is the oxidation state of chromium in chromate ion and dichromate ion?

g. Write the ionic equation for reaction of KI with acidified $KMnO_4$.

32. (a) What is the effect of temperature on the solubility of glucose in water?

(b) Ibrahim collected a 10mL each of fresh water and ocean water. He observed that one samplelabeled "P" froze at 0 ^oC while the other "Q" at -1.3^oC. Ibrahim forgot which of the two, "P" or"Q" was ocean water. Help him identify which container contains ocean water, giving rationalization for your answer.

(c) Calculate Van't Hoff factor for an aqueous solution of $K_3[Fe(CN)_6]$ if the degree of dissociation (α) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? (Kb=0.52 K kg/mol)

(a) What type of deviation from Roult's Law is expected when phenol and aniline are mixed with each other? What change in the net volume of the mixture is expected? Graphically representthe deviation.

(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 100g water, Calculate the resultant vapour pressure of the solution.

33. (a) Give one chemical test to distinguish between the following pairs of compounds:
(i)Methylamine and dimethylamine
(ii) Ethylamine and aniline

(b)Account for the following------

(i) Aniline does not undergo Friedel-Crafts reaction.

(ii) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

(iii) Gabriel phthalimide synthesis is preferred for synthesizing primary amines.

MARKING SCHEME
SECTION A

1. (c)
2. (c) A= Benzaldehyde , B= Acetophenone. This is an example of crossed Aldol condensation.
3. (d)
4. (a) 3-Methylpent-3-en-2-one
5. (b)
6. (a) (i) (r) , (ii) (q), (iii) (p)

   Zinc has no unpaired electrons in 3d or 4s orbitals, so enthalpy of atomization is low

   Mn = $3d^5 4s^2$ shows +2,+3,+4,+5,+6 and+7 oxidation state , maximum number in 3d series
7. (b) molecularity has no meaning for complex reactions.
8. (c) water
9. (b) no turbidity will be observed, given compound is a primary alcohol
10. (a) 0.00625 $molL^{-1}s^{-1}$ for zero order k = [Ro] –[R] / t = 1.5 -0.75 /120
11. (a) Due to the activation of benzene ring by the methoxy group.
12. (b) atomic radii
13. {c} A is true but R is false
14. (b) Both A and R are true but R is not the correct explanation of A
15. (b) Both A and R are true and R is not the correct explanation of A.
16. (d) A is false but R is true.

    Cu will deposit at cathode

SECTION B

17. The reaction is : X—>Y

    According to rate law,

    rate = $k[X]^2$

    If [X] is increased to 3 times, then the new rate is (1)

    rate' = $k[3X]^2$

    rate' = 9 k $[X]^2$ = 9 rate

    Thus, rate of reaction becomes 9 times and hence rate of formation of Y increases 9-times. (1)

18. $\pi 1 = \pi 2$ (1/2)

    $C_1RT = C_2RT$ (1/2)

    $\frac{3 \times 5}{322} = \frac{2}{M}$

    $M = \frac{2 \times 322}{3 \times 5}$

    M = 42.9 g

19.(a) m-dicholrobenzene < o-dicholrobenzene < p-dicholrobenze (1/2)

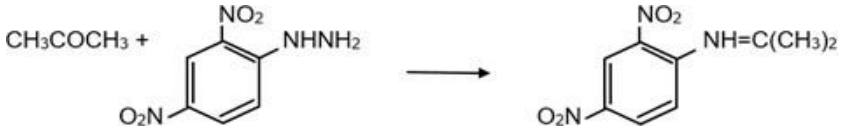
   symmetrical structure and close packing in para isomer

   ortho has a stronger dipole dipole interaction as compared to meta (1/2)

   (b) the halogen atom because of its –I effect has some tendency to withdraw electrons from thebenzene ring. As a result, the ring gets somewhat deactivated as compared to benzene and hence the electrophilic substitution reactions in haloarenes occur slowly and require more drastic conditions as compared to those in benzene. (1)

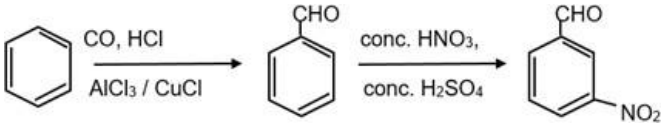
20. (a) p-nitrobenzaldehyde is more reactive towards the nucleophilic addition reaction than p-tolualdehyde as Nitro group is electron withdrawing in nature . Presence of nitro group decrease

electron density, hence facilitates the attack of nucleophile . Presence of -CH 3 leads to +I effect as - CH_3 is electron releasing group. (1)

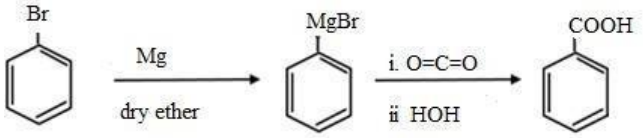
(b) 

OR

(a)



(b)



21.(a) Replication

21. (a) A sequence of bases on DNA is unique for a person and is the genetic material transferred to the individual from the parent which helps in the determination of paternity. (1)

(b) During denaturation secondary and tertiary structures are destroyed but the primary structure remains intact. (1)

SECTION C

22. (a) $[Cr(en)_2(OH)_2]Cl$ or $[Cr(H_2NCH_2CH_2NH_2)_2(OH)_2]Cl$ (1)

(b) No, ionization isomers are possible by exchange of ligand with counter ion only and not byexchange of central metal ion. (1)

(c) The central atom is electron pair acceptor so it is a Lewis acid. (1)

23. (a) Yes, if the concentration of $ZnSO_4$ in the two half cell is different , the electrode potential will be different making the cell possible. (1)

(b) $\Lambda^0_m (MgCl_2) = \lambda^0_m (Mg^{2+}) + 2\ \lambda^0_m (Cl^-)$

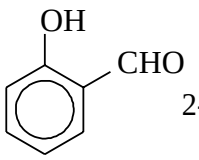
$258.6 = 106 + 2\ \lambda^0_m (Cl^-)$

$\lambda^0_m (Cl^-) = 76.3\ Scm^2mol^{-1}$

(c) cell constant $G^* = k \times R$

$k = G^*/R = 0.146/1000 = 1.46 \times 10^{-4}\ Scm^{-1}$

24.(a) Reimer Tiemann , (1/2)



2-Hydroxybenzaldehyde (1/2+1/2)

(b) Williamson synthesis, $CH_3CH_2CH(CH_3)CH(CH_3)O\ C_2H_5$

2- Ethoxy-3 -methylpentane (1/2+1/2+1/2)

(c) Stephen reaction, CH_3CH_2CHO, Propanal (1/2+1/2 +1/2)

22. A, B and C contain carbonyl group as they give positive 2,4 DNP testA and B are aldehydes as aldehydes reduce Tollen's reagent. C is a ketone, as it contains carbonyl group but does not give positive Tollen's test (1/2)

C is a methyl ketone as it gives positive iodoform test. B is an aldehyde that gives positive iodoform test (1/2)

D is a carboxylic acid Since the number of carbons in the compounds A,B,C and D is three or two B is CH_3CHO as this is only aldehyde which gives a positive iodoform test (1/2)

The remaining compounds A, C and D have three carbons

A is CH_3CH_2CHO, C is CH_3COCH_3 and D is CH_3CH_2COOH (1/2 each)

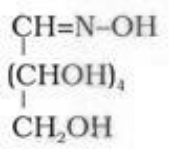
25.(a) The reactant Sucrose is dextrorotatory. On hydrolysis it give glucose dextrorotatory and fructose which is leavoroatatory. The specific rotation of fructose is higher than glucose

Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Since the laevorotation of fructose (–92.4°) is more than dextrorotation of glucose (+ 52.5°), the mixture is laevorotatory. (1)

(b) Invert sugar, The hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (–) and the product is named as invert sugar. (1)

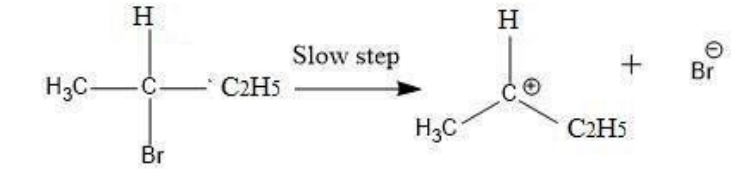
(c)Glucose

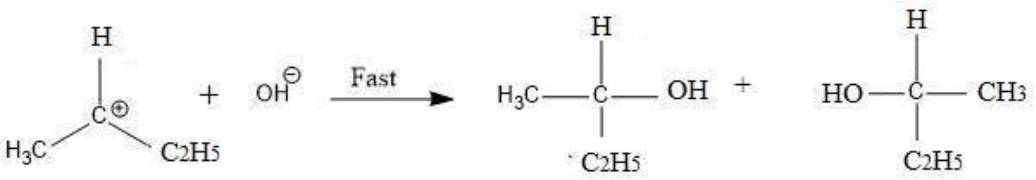
(1)



24. $C_2H_5CHCH_3$
$|$
Br

Mechanism:





28.

$$\log\left(\frac{k_2}{k_1}\right)=\frac{Ea}{2.303R}\left[\frac{1}{T_1}-\frac{1}{T_2}\right]$$

$$\log\frac{0.20}{0.05}=\frac{Ea}{2.303R}\left[\frac{1}{200}-\frac{1}{500}\right]$$

$$\log 10=\frac{Ea}{19.15}\left(\frac{300}{200\times 600}\right)$$

$$Ea=\frac{19.15\times 200\times 500}{300}$$

$$Ea=6383\ J/mol$$

SECTION D

29.{i} b or c

{ii} d

{iii} (i) $[CO(NH_3)_4(H_2O)_2]Cl_3$.

(ii)$K_2[Ni(CN)_4]$

A = Cl^-, B= H_2O, C= NH_3, D= CN^-

30. (a) 2mol e^- (or 2F) have been transferred from anode to cathode to consume 2 mol of H_2SO_4 therefore, one mole H_2SO_4 requires one faraday of electricity or 96500 coulombs. (1)

(b) $w_{max} = -nFE^\circ = -2 \times 96500 \times 2.0 = 386000$ J of work can be extracted using lead storage cell whenthe cell is in use. (1)

(c) Both yes and no should be accepted as correct answers depending upon what explanation is provided.

Yes, Hydrogen is a fuel that on combustion gives water as a byproduct. There are no carbon emissions and no pollutions caused.

However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions.

Inspite of the problems faced today in the extraction of hydrogen, we cannot disagree on the fact th at hydrogen is a clean source of energy. Further research can help in finding solutions and greens ways like using solar energy for extraction of hydrogen. (2)

No. It is true that Hydrogen is a fuel that on combustion gives water as a byproduct. There are no carbon emissions and no pollutions caused.

However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions.

Hydrogen is no doubt a green fuel, but the process of extraction is not green as of today. At present, looking at the process of extraction, hydrogen is not a green fuel. (2)

OR

Both answers will be treated as correct

(i) Lead batteries are currently the most important and widely used batteries. These are rechargeable. The problem is waste management which needs research and awareness. Currently, these are being thrown into landfills and there is no safe method of disposal or recycling. Research into safer method of disposal will reduce the pollution and health hazardscaused to a great extent.

(1 mark for importance, 1 for need for the research)

(ii) Fuel cell is a clen source of energy. Hydrogen undergoes combustion to produce water. Theneed of the hour is green fuel and hydrogen is a clean fuel. The current problem is obtaining hydrogen. Research that goes into this area will help solve the problem of pollution and will bea sustainable solution.

(1 mark for importance, 1 for need for the research)

SECTION E

31.(a) Both Ti^{3+} and Cu^{2+} have 1 unpaired electron, so the magnetic moment for both will be 1.73 BM

(b) Zn, it has a more negative electrode potential so will corrode itself in place of iron.

(c) Mn^+ has $3d^5 4s^1$ configuration and configuration of Cr^+ is $3d^5$, therefore, ionisation enthalpy ofMn^+ is lower than Cr^+ .

Sc and Zn both form colourless compound and are diamagnetic.

(d) (The decrease in the atomic and ionic radii with increase in atomic number of actinoids due topoor shielding effect of 5f electron.

(e) In both chromate and dichromate ion the oxidation state of Cr is +6

(g) $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$ (1 each, any 5)

32. (a) Addition of glucose to water is an endothermic reaction. According to Le Chat elier's principle, on increase in temperature, solubility will increase. (1)

(b) Q is ocean water, due to the presence of salts it freezes at lower temperature (depression infreezing point) (1)

(c) $K_3[Fe(CN)_6]$ gives 4 ions in aqueous solution (1/2)

$i = 1+(n-1)\alpha$ (1/2)

$i = 1+(4-1)\times 0.0.852$

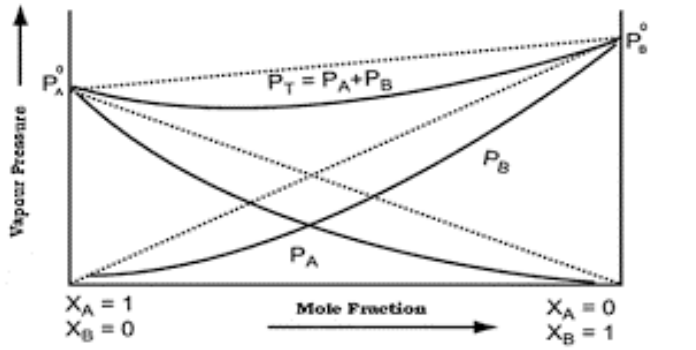
$i = 3.556$ 1/2)

$\Delta T_b = iK_b\, m = 3.556 \times 0.52 \times 1 = 1.85$ (1)

$T_b = 101.85^oC$ (1/2)

OR

(a) Negative Deviation is expected when phenol and aniline are mixed with each other. The net volume of the mixture will decrease, $\Delta V < 0$ due to stronger intermolecular interactions. (1)



P-X Diagram for Solutions Showing Negative Deviation from Raoult's Law

(1)

(b) Relative lowering of vapour pressure = $(P^\circ - P) / P^\circ = x_2$ (1/2)

$x_2 = n_2 / n_1$

$n_2 = 0.1$

$n_1 = 100/18$

$x_2 = 0.1/ 5.55 + 0.1 = 0.1/ 5.65 = 0.018$ (1/2)

$P^\circ = 23.8$ mm Hg

Relative lowering of vapour pressure = $(23.80 - P) / 23.80 = 0.018$ (1/2)

$23.80 - P = 0.428$ (1/2)

$P = 23.80 - 0.428 = 23.37$ mm Hg (1)

33. (a) {i] Methylamine (being an aliphatic primary amine) gives a positive carbylamine test, but dimethylamine does not.

$$CH_3NH_2 + CHCl_3 + 3KOH \longrightarrow \Delta CH_3NC + 2KCl + 3H_2O$$

$$(CH_3)_2NH \xrightarrow{CHCl_3 - KOH\ (alc)} \text{No reaction}$$

{ii| Ethylamine and aniline can be distinguished by azo test:

$$C_2H_5NH_2 + HONO + HCl \xrightarrow{273-278\ k} C_2H_5OH + CH_2{=}CH_2 + CH_3CH_2Cl + N_2$$

{b} {i} Aniline being a Lewis base reacts with Lewis acid $AlCl_3$ to form a salt.

$C_6H_5NH_2 + AlCl_3 \rightarrow C_6H_5NH_2 + AlCl_3$

As a result, N of aniline acquires positive charge and hence it acts as a strong deactivating group for electrophilic substitution reactions. Consequently, aniline does not undergo Friedel Crafts reaction.

[ii} The diazonium salts of aromatic amines are more stable than those of aliphatic amines due to dispersal of the positive charge on benzene ring as a result of resonance.

{iii} Gabriel phthalimide reaction gives pure primary amines without any contamination of secondary and tertiary amines. Therefore, it is preferred for synthesizing primary amines.

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-6

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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.

Q1. Which of the following statement is not true about glucose?

(a) It is an aldohexose (b) On heating with HI it forms n-hexane
(c) It is present in furanose form (d)It does not give 2,4-D N P test

Q2. The position of Br in the compound CH_3=CHC(Br)$(CH_3)_2$ can be classified as

(a) Allyl (b) Aryl (c) Vinyl (d) Secondary

Q3. Methylamine react with HNO_2 to form

(a) CH_3-O-N=O (b) CH_3OH (c) $(C_2H_5)_2NH$ (d) $C_6H_5NHC_6H_5$

Q4. Addition of water to alkynes occur in acidic medium in the presence of Hg^{2+} ions as catalyst. Which of the following product will be formed on addition of water to but-1-yne under these conditions?

(a) CH_3-CH_2CH_2CHO (b) $CH_3CH_2COCH_3$
(c) $CH_3CH_2COOH + CO_2$ (d) $CH_3COOH + HCO$

Q5. The acid formed when propyl magnesium bromide is treated with CO_2 is

(a) C_3H_7COOH (b) C_2H_5COOH
(c) Both (a) & (b) (d) None of these

Q6. Which of the following set of ions exhibit specific colours:

(a) Sc^{3+}, Ti^{4+}, Mn^{3+} (b) Sc^{3+}, Zn^{2+}, Ni^{2+}
(c) V^{3+}, $V2^{+}$,Fe^{3+} (d) Ti^{3+}, Ti^{4+}, Ni^{2+}

Q7. Actinoids exhibit greater number of oxidation states than lanthanoids. The main reason being

(a) More energy difference between 5f & 6d than between 4f & 5f orbitals.
(b) 4f – orbitals are more diffused than the 5f- orbitals.
(c) Lesser energy difference between 5f and 6d than between 4f and 5d orbitals.
(d) More reactive nature of actinoids than the Lanthanoids.

Q8. The rate of a gaseous reaction is given by the expression, rate= k[A] [B]. If volume of the reaction vessel is suddenly reduced to ¼ of the initial volume, the reaction rate related to original rate will be

(a) 1/16 (b) 1/8 (c) 8 (d) 16

Q9. Match the following and choose the correct option.

Column-1	Column-2
(i) Half life of I^{st} order reaction	A. Order = 1
(ii) $k.[A]^{1/2}[B]^{1/2}$	B. Molecularity = 1
(iii) Zero order reaction	C. 0.693/k
(iv) $NH_4NO_2 \rightarrow N_2 + 2H_2O$	D. $k = [R]_0 - [R]/t$

(a) (i) – A, (ii) – D, (iii) – C, (iv) – B (b) (i) – B, (ii) – A, (iii) – C, (iv) – D

(c) (i) – A, (ii) – C, (iii) – D, (iv) – B (d) (i) – C, (ii) – A, (iii) – D, (iv) – B

Q10. Monochlorination of toluene in sunlight followed by hydrolysis with aq. NaOH gives

(a) o-cresol (b) m-cresol

(c) 2,4 –Dihydroxy toluene (d) Benzyl alcohol

Q11. Phenol is less acidic than

(a) ethanol (b) o-nitrophenol

(c) o-methyl phenol (d) o- methoxy phenol

Q12. The correct IUPAC name for $CH_2=CHCH_2NHCH_3$ is

(a) Allyl methylamine (b) 2- amino-pent-4-ene

(c) 4-amino pent-1-ene (d) N-methyl prop-2-en-1amine

Q13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): The two strands of DNA are complementary to each other.

Reason (R): The hydrogen bonds are formed between specific base pairs.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q14. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Reactivity of ketone is more than aldehyde towards nucleophilic addition.

Reason (R): Carbonyl carbon of ketone is less electrophilic as compared to aldehydes.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): In Lucas test, 3 alcohols react immediately.

Reason (R): A mixture of anhyd $ZnCl_2$ and conc. HCl is Lucas reagent.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A) : Electrolysis of NaCl solution gives chlorine at anode instead of O_2.

Reason (R) : Formation of oxygen at anode requires over voltage

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

SECTION B

Q17. The rate constant for first order decomposition of N_2O_5 is given by the following equation:
Log k = 23.6 – 2 x 10^4 k/T
Calculate E_a for this reaction [R =8.314$JK^{-1}mol^{-}$

OR

For the reaction
$2N_2O_5$ (g) → $4NO_2$ (g) + O_2 (g)
Calculate the rate of reaction if rate of disappearance of N_2O_5 (g) is 1.4 x 10^{-3} ms^{-1}

Q18 (a) What is the difference between native protein and denatured protein.
(b) Write the name of vitamin responsible for coagulation of blood.

Q19. (a) Why is osmotic pressure of 1M NaCl higher than 1M glucose solution?
(b) Blood cells are isotonic with 0.9 % sodium chloride solution. What happens if we place blood cells in a solution containing: i) 1.2 % NaCl solution ii) 0.4% NaCl solution.

Q20. Among all the isomers of C_4H_9Br, identify
(a) the one isomer which is optically active
(b) the one isomer which is highly reactive towards SN^2 reaction.

Q21. Convert the following
(a) Benzoic acid to Benzaldehyde
(b) Ethanol to 3- hydroxyl butanal

SECTION C

Q22. An alkene 'A' (C_5H_{10}) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also reacts with iodine and NaOH solution. Compound 'C' does not give Fehling's test but forms iodoform. Identify 'A', 'B' and 'C' giving suitable explanation and write reactions of ozonolysis and iodoform formation.

Q23. In a coordination entity, the electronic configuration of central metal ion is $t_2g^3eg^1$
(a) Is the coordination compound high spin or low spin. Identify the nature of ligand.
(b) Draw crystal field splitting diagram for the above complex.

Q24. Conductivity of 2.5 x 10^{-4} M Methanoic acid is 5.25 x 10^{-5} Scm^{-1}. Calculate its molar conductivity and degree of dissociation. (Given $\lambda^{\circ}_{(H+)}$ = 349.5 $Scm^2mol^{-1}$and $\lambda^{\circ}_{(HCOO-)}$ = 50.5 Scm^2mol^{-1}.

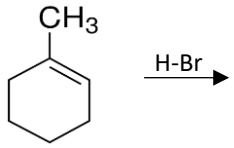
Q25. (a) A non-reducing disaccharide 'A' on hydrolysis with dilute acids gives an equimolar mixture of D-(+) glucose and D-(-) fructose.

$A + H_2O \xrightarrow{HCl} C_6H_{12}O_6 + C_6H_{12}O_6$

Identify A. What is the mixture of D- (+) glucose and D- (-) fructose called?
(b) What is the difference between
(i) α – form of glucose and β-form of glucose.
(ii) Nucleoside and Nucleotide

Q26. (a) Give reason for the following
(i) aryl halides are less reactive towards nucleophilic substitution reaction.
(ii) Thionyl chloride method is preferred for preparing alkyl chloride from alcohol.

(b) Write the major product



Q27. (a) Give equation for the following and write name of the reaction.

(i) Sodium t-butoxide is treated with CH_3Cl.

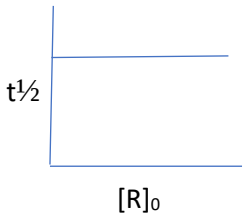
(ii) Treating phenol with chloroform in the presence of aq. NaOH

(b) How will you distinguish between Phenol and ethanol?

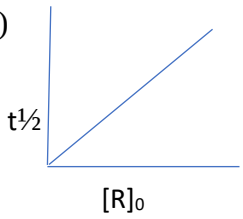
Q28. (a) A first order reaction is 75% completed in 40 min. Calculate $t_{½}$.

(b) Predict order of reaction

(i)



(ii)



Given log 2 = 0.3010 log 4 = 0.6021

SECTION D

Read the following paragraph and answer the question that follows:

Q29. In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes.

(a) When a coordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated. Write structure of the compound.

(b) What is secondary valency of $[Co\ (en)_3\ ]^{3+}$

(c)- (i) Write formula of Iron (III) hexa cyanido ferrate (II)

(ii) Write the IUPAC name $[Co\ (H_2O)\ (CN)\ (en)_2]^{2+}$

OR

Write hybridization and magnetic behavior of $[Ni\ (CN)_4]^{2-}$

Q30. Read the following paragraph and answer the question that follows:

Amines are usually formed from nitro compounds, halides, amides, imides, etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines a combination of electron releasing, steric and hydrogen bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Presence of amino group in aromatic ring enhances reactivity of the aromatic amines. Aryl diazonium salts provide advantageous methods for producing aryl halides, cyanides, phenols and arenes by reductive removal of the diazo group.

Answer the following questions:

(a) Arrange the following in the increasing order of their pkb, values in aqueous solution:

$C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$

(b) Aniline on nitration gives a substantial amount of m-nitroaniline, though amino group is o/p directing. why?

(c) An aromatic compound 'A' of molecular 'Formula $C_7H_6O_2$ on treatment with aqueous ammonia and heating forms compound 'B'. Compound B' on heating with Br_2 and aqueous KOH gives a compound 'C' of molecular formula C_6H_7N. Write the structures of A, B and C.

OR

Complete the following reactions giving main products:

(a) $C_6H_5NH_2 + Br_2\,(aq) \rightarrow$

(b) $C_6H_5N_2^+Cl^- \xrightarrow{(i)HBF_4 \;\; (ii)NaNO_2-Cu \;\; \Delta}$

SECTION E

Q31) (a) Represent the cell in which following reaction takes place:

$2Al\,(s) + 3Ni^{2+}\,(0.1M) \text{------} > 2Al^{3+}(0.01M) + 3Ni(s)$

Calculate emf of cell if E^0 cell = 1.41 V

(b) How does molar conductivity increase with increase in concentration for strong and weak electrolyte? How can you obtain limiting molar conductivity for weak electrolyte.

(c) Name the cell which:

(i) was used in Apollo Space programme. (ii) is suitable for hearing aids and watches.

Q32) (a) In the ions: Mn^{3+}, V^{3+},Cr^{3+}, Ti^{4+}

(i) Which ion is most stable in aqueous solution?

(ii) Which ion is colourless?

(iii) Which ion is strongest oxidizing agent?

(iv) Which ion has highest magnetic moment?

(b) Account for the following:

(i) Orange colour of dichromate ion changes to yellow in alkaline medium.

(ii) E^0 (Mn^{2+}/Mn) value highly negative as compared to other elements.

(iii) Transition metals show variable oxidation state.

OR

(a) How does Potassium dichromate reacts with:

(i) Iron(II) ions (ii) Oxalic acid

(b) Name oxo metal anion of the transition metal in which metal exhibits the oxidation state equal to group number.

(c) Account for the following:

(i) Scandium is regarded as transition element but zinc is not.

(ii) Zr and Hf have almost similar radii.

Q33) (a)Define the following terms: (i) Azeotropes (ii) Molal elevation Constant

(b) A solution containing 15 g Urea (Molar mass = 60 g/mol) per litre of solution in water is isotonic with a solution of glucose in water. Calculate the mass of glucose present in one litre of solution.

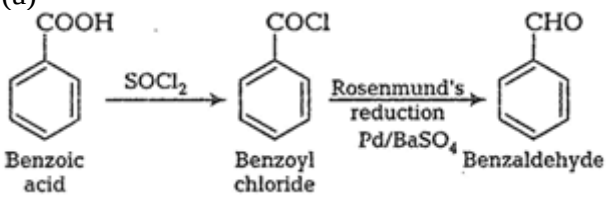
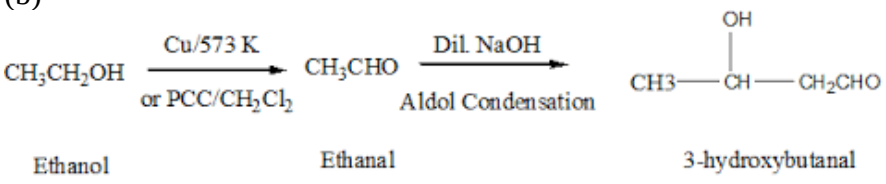
OR

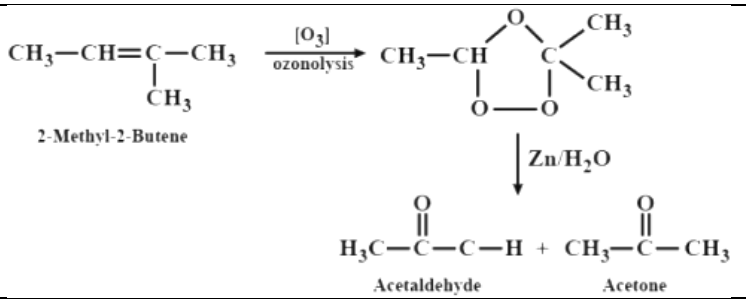
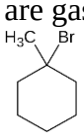
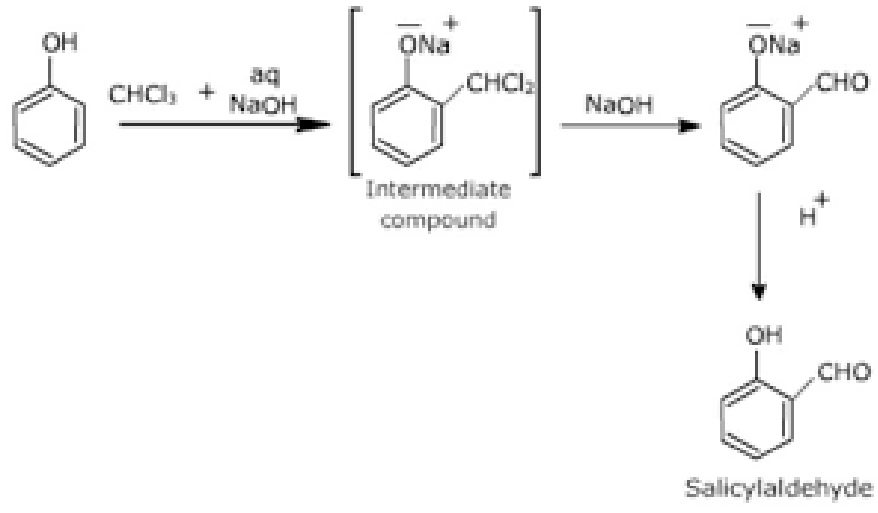
(a) On mixing liquid A and liquid B volume of resulting solution decreases. What type of deviation from Raoult's law is shown by the mixture.

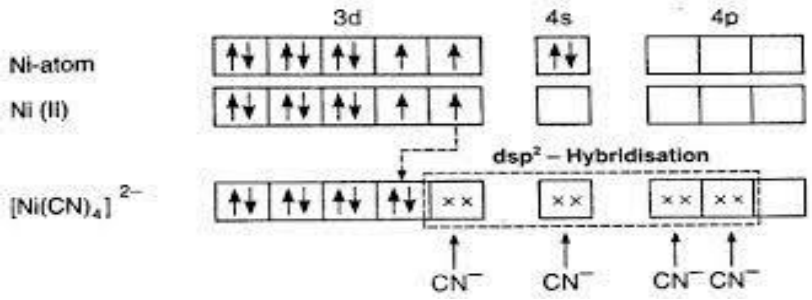
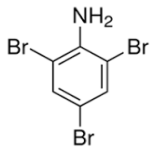
(b) Which colligative property is considered best for determining molar mass of proteins.

(c) A solution of glucose (M = 180 g/mol) in water has a boiling point of 100.20 ^{0}C. Calculate the freezing point of same solution. Molar constant for water $\mathbf{K_f}$ and $\mathbf{K_b}$ are **1.86 K kg mol^{-1}** and **0.512K kg mol^{-1}** respectively

MARKING SCHEME

Q No.	Expected Answers	Marks
1	c	1
2	a	1
3	b	1
4	b	1
5	a	1
6	c	1
7	c	1
8	d	1
9	d	1
10	d	1
11	b	1
12	d	1
13	a	1
14	d	1
15	b	1
16	a	1
17	log K = logA – Ea/2.303RT Ea/2.303RT = 2 x 10^4 Ea= 3.3294 x 10^5 **OR** Rate = -1/2 d[N_2O_5]/dt Rate = 1/2 x 1.4 x 10^{-3} Rate = 7 x 10^{-4} $molL^{-1}s^{-1}$	½ ½ 1 ½ ½ 1
18	(a)Native protein: Protein found in biological system with unique 3D structure and biological activity. Denatured Protein: Protein in which secondary and tertiary structure are destroyed and it loses its biological activity. (b) Vitamin K	1 1
19	(a)The number of particles in 1M NaCl(i=2) is higher than 1M Glucose(i=1) and osmotic pressure depends upon number of particles. (b) i) Blood cells will shrink 2) Blood cells will swell	1 ½ +1/2
20	(a) $CH_3CH(Br)C_2H_5$ (b) $CH_3CH_2CH_2CH_2Br$	1 1
21	(a)  (b)  	1 1
22	A= CH_3-CH=C(CH_3)$_2$ B= CH_3CHO(an aldehyde as it gives Fehling test) C= CH_3COCH_3(a ketone as it does not give Fehling test. Both B and C give iodoform test as they contain -COCH3 group	2

		1
23	(a) High Spin and weak field ligand. (b) Correct diagram	½ +1/2 2
24	$\Lambda_m = \frac{1000 \times K}{M} S\ cm^2\ mol^{-1}$ $\Lambda_m = \frac{1000 \times 5.25 \times 10^{-5}}{2.5 \times 10^{-4}} S\ cm^2 mol^{-1}$ $= 210\ S\ cm^2 mol^{-1}$ $\wedge^0_m\ HCOOH = \lambda^o HCOO^- + \lambda^o H^+$ $= (50.5 + 349.5)\ S\ cm^2 mol^{-1}$ $= 400\ S\ cm^2 mol^{-1}$ $\alpha = \Lambda_m / \Lambda^\circ_m$ =210/400 = 0.525	½ 1 ½ ½ ½
25	(a)A= Sucrose, Invert sugar (b) i) They differ in the orientation of –OH group at anomeric carbon ii) The main difference lies in their molecular composition as Nucleosides contain only sugar and a nitrogenous base whereas Nucleotides contain sugar, nitrogenous base and a phosphate group.	½+1/2 1 1
26	(i) Due to partial double bond character in C- X bond due to resonance. (ii) R-OH + $SOCl_2$--> R-Cl +SO2(g) + HCl(g) , both side products are gases hence we get almost pure alkyl chloride. (iii) 	1 1 1
27	(a) (i) $(CH_3)_3CONa + CH_3Cl \rightarrow (CH_3)_3CO\ CH_3$ Williamson's synthesis (ii)  Riemer Tiemann reaction	1 1

	(b) Phenol reacts with neutral $FeCl_3$ to give violet colour. Ethanol reacts with I_2/NaOH to give yellow ppt of iodoform.	1
28	(a) $k = \frac{2.303}{t}\log\frac{[A]_0}{[A]}$ $= \frac{2.303}{40}\log\frac{100}{25}$ $= \frac{2.303}{40}\log 4$ $= \frac{2.303}{40}\times 0.6021$ $k = 0.0347\ \text{min}^{-1}$ $t_{1/2} = \frac{0.693}{k}$ $t_{1/2} = \frac{0.693}{0.0347\,\text{min}^{-1}}$ = 20 min. (b) (i) first order (ii) zero order	1 ½ ½ ½ + 1/2
29	(a) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (b) 6 (c) i) Fe4[Fe(CN)6]3 ii) aquacyanidobisethylenediamminecobalt(III)ion **OR**  Diamagnetic in nature.	1 1 1 1
30	(a) $(C_2H_5)_2NH_2 < (C_2H_5)_3N < C_2H_5NH_2$ (b) Aniline in acidic medium gets protonated to form anilinium ion which is meta directing. (c) A= C_6H_5COOH B= $C_6H_5CONH_2$ C= $C_6H_5NH_2$ OR (a)  (b) $C_6H_5NO_2$	1 1 2 1 1
31	(a) $2Al(s) + 3Ni^{2+}(0.1M) \rightarrow 2Al^{3+}(0.001M) + 3Ni(s)$ Cell Repn: $Al(s) \mid Al^{3+}(0.01M) \parallel Ni^{2+}(0.1M) \mid Ni(s)$ $E_{cell} = E^0cell - \frac{0.0591}{n}\log\frac{[Al^{3+}]^2}{[Ni^{2+}]^3}$	½ 1

	$= 1.41 - \frac{0.0591}{6} \log \frac{[10^{-2}]^2}{[10^{-1}]^3}$ = 1.42V (b) With increase in concentration the molar conductivity decrease in case of both strong and weak electrolytes. The limiting molar conductivity (Λ_m^o) for weak electrolyte can be calculated by using Kohlrausch's Law. (c) i) H_2-O_2 Fuel cell (b) Mercury Cell	½ 1 1 ½ +1/2
32	(a) i) Cr^{3+} (b) Ti^{4+} (c) Mn^{3+} (d) Mn^{3+} (b)i) In alkaline medium dichromate ion changes to chromate ion. ii) Due to stable d5 configuration of Mn^{2+} iii) Due to unpaired d electron/ both (n-1)d and ns electrons are involved in bonding. **OR** (a) i)$K_2Cr_2O_7$+ $14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 7H^2O + 6Fe^{3+}$ ii)$K_2Cr_2O_7 + 3H_2C_2O_4 + 8H+ \rightarrow 2Cr3+ + 6CO2 + 7H2O$ (b) MnO_4^- **(c) i)**Scandium is regarded as a transition element because it has a partly filled d-subshell (3d1). Zinc, on the other hand, has a filled d-subshell ($3d^{10}$) in its ground and common oxidation state and is not considered a transition element. **ii)** due to lanthanoid contraction	1/2x4 1 1 1 1+1 1 1 1
33	(a) (i) Azeotropes: Azeotropes are mixtures of two liquids that have a constant boiling point and cannot be separated by distillation. (ii) Molal elevation constant: The molal elevation constant (Kb) is defined as the change in boiling point per molal of solute added to the solvent. (b) Mass of urea, WB = 15 g Molar mass of urea, Mb = 60 g The solution of urea in water is isotonic to that of glucose solution. So, $\pi_{urea} = \pi_{Glucose}$ $C_{urea}\,RT = C_{Glucose}\,RT$ $\frac{n_{urea}}{V} RT = \frac{n_{Glucose}}{V} RT$ $= \frac{15}{60} = \frac{W_{Glucose}}{180}$ $= W_{Glucose} = \frac{15 \times 18}{60}$ = 45 g **OR** (a) Negative Deviation (b) Osmotic pressure (c) $\triangle Tb = 100.20^0C - 100\ ^0C = 0.20\ ^0C$ $\triangle Tb = K_b \,.\, m$ $m = \triangle Tb / K_b$ $m = 0.20\ K / 0.512\ Kkg\ mol^{-1} = 0.39\ mol\ kg\text{-}1$ $\triangle T_f = K_f.m$ $\triangle T_f = 1.86\ K\ kg\ mol^{-1} \times 0.39\ mol\ kg^{-1}$ $= 0.725\ K$ $T_f = T^0_f - \triangle T_f$ $= 273.15K - 0.725\ K$ $= 272.425\ K$	1 1 1 1+1 1 1 ½ ½ ½ ½ ½ ½

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S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-7

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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.
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f) SECTION E consists of 3 long answer questions carrying 5 marks each.
g) All questions are compulsory.
h) Use of log tables and calculator is not allowed.

SECTION A

Question number 1-12 MCQ type questions carrying, one mark each.

1. In the reaction given below, X is:

Neopentyl alcohol (H_2SO_4) → X

a)2-methylpent-2-ene b)2-methylpentane
c)2-methylbut-2-ene d)neopentane

2.Two possible stereo- structure of CH_3–CH(OH)COOH which are optically active are called:

a)Mesomers b)enatiomers
c)diasteriomers d)atropisomers

3.The C–O bond length in phenol is less than that in methanol due to:

a)Partial double bond character of oxygen with aromatic ring.
b)SP^2 hybridise carbon to which oxygen attached.
c)SP^3 hybridised carbon
d)both (a) and (b)

4.The standard electrode potential of an electrode is greater than zero then we can infer that it's:

a)Reduce farm is more stable compared to hydrogen gas.
b)Oxidised form is more stable compared to hydrogen gas.
c)Reduced and oxidised forms are equally stable.
d)Reduced form is less stable than the hydrogen gas.

5. Which one of the following is most reactive in nucleophilic addition reactions?

a)HCHO b)CH_3CHO
c)CH_3COCH_3 d)$CH_3COC_2H_5$

6. The reagent which does not react with both Acetone and benzaldehyde is:

a)Sodium hydrogen sulphide b)Phenyl hydrazine
c)Fehling's solution d)Grignard reagent

7. Nucleosides are composed of:

a) a pentose sugar and phosphoric acid.
b) a nitrogenous base and phosphoric acid.

c)a nitrogenous base and a pantose sugar.
d)a nitrogenous base, a pentose sugar and phosphoric acid.
8. CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives:
a)CH_3COONa b)CH_3NH_2
c)CH_3CH_2Br d)$CH_3CH_2NH_2$
9.The unit of the rate of reaction is the same as that of the rate constant for a:
a)first order reaction b)zero order reaction
c)second order reaction d)half-order reaction
10. The role of a catalyst is to change
a) Gibbs energy of reaction b)enthalpy of reaction
c)activation energy of reaction d)equilibrium constant
11. The most common and stable oxidation state of langthanoid is:
a)+2 b)+3
c)+4 d)+6
12. Actinoids exhibit greater number of oxidation States than lanthanoids. The main reason being:
a)more energy difference between 5f and 6d than between 4f and 5f-orbitals.
b)4f orbitals are more diffused than the 5f-orbitals.
c)lesser energy difference between 5f and 6d than between 4f and 5d-orbital.
(d) more reactive nature of the actinoids than the lanthanoids.

For question number 12 to 16, two statements are given one labeled as Assertion (A)and other level as Reason (R). Select the correct answer to these questions from the course (a), (b),(c) and (d) as given below.

(a) both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R)is true.

13.Assertion (A): Aldehydes and ketones both react with Tollens' reagent to form silver mirror.
Reason (R): both aldehydes and ketones contain a carbonyl group.
14.Assertion (A): aromatic primary news cannot be prepared by Gabriel -phthalimide synthesis.
Reason (R): Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.
15.Assertion (A): Vitamin C is called ascorbic acid.
Reason (R): It contains a –COOH group.
16.Assertion (A): Rusting of iron is quicker in saline water than in ordinary water.
Reason (R): Salt water helps inflow of current in the miniature cell develop on the iron surface.

SECTION B

17. Vapour pressure of water at 293 kelvin is 17.535 mm Hg. Calculate the vapour pressure of water at 293 K when 25 g of glucose is dissolved in 450 g of water.molar mass of glucose is 180g/mol
18.(a) Arrange the compounds in increasing order of reactivity towards SN2 displacement:
2-Bromo-2-methylbutane,1-Bromopentane,2-Bromopentane.
(b) write the chemical equation for friedel-craft alkylation.
19. Complete the following reactions:

(a)$(C_6H_5CH_2)_2Cd + CH_3COCl \rightarrow$

(b)$(CH_3)_2CH\text{-}COOH(i.Br_2/P_4\ ii.H_2O) \rightarrow$

OR

give reason in support of the answer:

(a) Presence of Alpha hydrogen in aldehyde and ketones is essential for aldol condensation.

(b)Ketones do not give Tollens' test but 3-Hydroxypentan -2-one shows positive Tollens' test.

20. How are vitamins classified? Name the vitamin responsible for the coagulation of blood.

21.(a)Write the difference between order and molecularity of reaction.(any two)

(b) Define pseudo first order reaction with the help of suitable example.

SECTION C

22. Write the nernst equation and calculate the emf of the following cell at 298 K.

$Zn/Zn^{2+}(0.001\ M) \backslash\backslash H^+(0.01)/ H_2(g)(1bar) / Pt(s)$

Given $E°_{Zn^{2+}/Zn} = -0.76V$, $E°_{H+/H2} = 0.00V$, [log10=1]

23. (a)On the basis of crystal field theory write the electronic configuration for d^5 ion with weak legend for which $\Delta_o < P$.

(b) Explain $[Fe(CN)_6]^{3-}$ is an inner orbital complex where as $[FeF_6]^{3-}$ is an outer orbital

24.(a) why is t-butyl bromide more reactive towards SN1 reaction as compared to n- butyl bromide?

(b) define Enantiomers.

(c) How will you distinguish between chloroform and carbon tetrachloride?

25. The rate constant for a first order reaction is 60 s^{-1} how much time will it take to reduce the initial concentration of the reactant to 1/10 of its initial value.

26.(a) What happen when benzaldehyde is heated with NaOH? write the chemical reaction involved.

(b)$CH_3CH_2COOH(redP_4/Br_2) \rightarrow$'X' ?

(c)Convert benzoic acid to Benzaldehyde.

27. What is the difference between a glycosidic linkage and peptide linkage?

(b) Define denaturation of protein with an example during the denaturation which structure of protein loses its biological activity?

28. Account for the following:(any two)

(a) Phenol is a stronger acid than alcohol.

(b)The boiling point of alcohol decreases with increase in branching of the alkyl chain.

(c) How will you bring the following conversion: phenol to picric acid?

SECTION D

29. A lead storage battery isthe most important type of secondary cell having a lead anode and A gride of lead packed with PbO_2 as cathode .38% solution of sulphuric acid is used as electrolyte (density =1.294 g mL^{-1}). The battery holds 3.5 L of the acid. During the discharge of the battery. The density of H_2SO_4 falls to 1.20 gmL^{-1}(20%H_2SO_4 by mass).

i) Write the reaction take king place at the cathode when the battery is in use.

ii) How much electricity in terms of Faradays required to carry out the reduction of one mole of PbO_2 .

iii) What is the molarity of sulphuric acid before discharge?

OR

Write the reaction involved during the charging of lead storage battery.

30. According to valence bond theory the central metal atom or ion in the coordinate complex make available a number of empty orbitals which form coordinate bonds with electron donor species known as lygans. These vacant orbitals also get hybridised to form equivalent or hybrid orbitals in case the metal atom or ion has no unpaired electron after binding with the legend the complex is diamagnetic and in case some unpaired electron are present the complex is paramagnetic in nature.

i) which type of ligands lead to the outer orbital complexes?

ii) what is the state of hybridization of metal atom or ion in the outer orbital and inner orbital complexes?

iii) using balance bond theory explain type of hybridization in our outer orbital compacts magnetic behaviour spin only magnetic moment of $[Co(NH_3)_6]^{3+}$

OR

Using balance bond theory explain type of hybridization in our outer orbital compacts magnetic behaviour spin only magnetic moment of $[Cr(H_2O)_6]^{3+}$

SECTION E

31. (i) Why is the value of Van't o Hoff factor for ethanoic acid in benzene close to 0.5?

(ii) Determine the osmotic pressure of a solution prepared by dissolving 2.32×10^{-2} g of K_2SO_4 in 2 L of solution at 25°C,assuming that K_2SO_4 is completely dissociated.

($R = 0.082$ L atm $K^{-1}mol^{-1}$,Molar massK_2SO_4 =174g/mol)

(iii) When 25.6 g of Sulphur was dissolve in 1000 g of benzene. The freezing point lowered by 0.512 K calculate the formula of (S_x).(K_f=5.12K kg /mol,At.mass of S=32g/mol)

OR

(i)Define the following terms:

(a) Azeotrope

(b)Osmotic pressure

(c)Colligative properties

(ii) determine the cosmetic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 L of water at 25°C assuming it to be completely dissociated.

(At.mass of K=39u,S=32u,O=16u)

32. Answer any five out of seven questions.

i) Give reason Eu^{2+} is a strong reducing agent.

ii) Zn^{2+} salts are colourless why?

iii) Write the reaction of the following -$Na_2Cr_2O_7$ from Na_2CrO_4.

iv) complete the following reaction:

$MnO_4^-(aq) + C_2O_4^{2-}(aq) + H^+(aq) \rightarrow$.

v)Complete the following reaction:

$Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \rightarrow$

vi) What are interstitial compounds?

vii)Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

33.(i) give reason:

(a)aniline on nitration gives good amount of m-nitroaniline through -NH2 group is Ortho/para directing in electrophilic substitution reactions.

(b)$(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.

(c) Ammonolysis of alkyl halide is not a good method to prepare pure primary amines.

(ii) Write the reaction involve in the following:

(a)Carbylamine reaction. (b)Gabriel phthalamide synthesis.

OR

(i)Write the structure of A,Band C in the following reactions:

(a)$C_6H_5N_2^+Cl^-(CuCN) \rightarrow A(H_2O/H^+) \rightarrow B(NH_3,\Delta) \rightarrow C$

(b)$C_6H_5NO_2(Fe/HCl) \rightarrow A(NaNO_2+HCl) \rightarrow B\ C_2H_5OH \rightarrow C$

(ii) why aniline does not undergo Friedel-Craft reaction.

(iii) Arrange the following in increasing order of their boiling point.

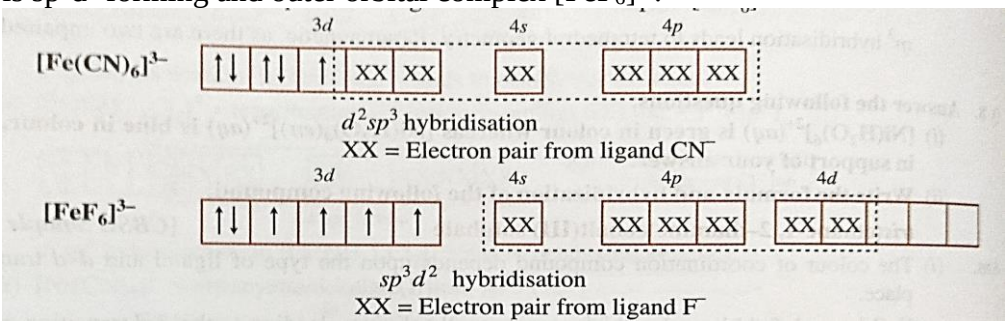
$C_2H_5OH, C_2H_5NH_2, (C_2H_5)NH$.

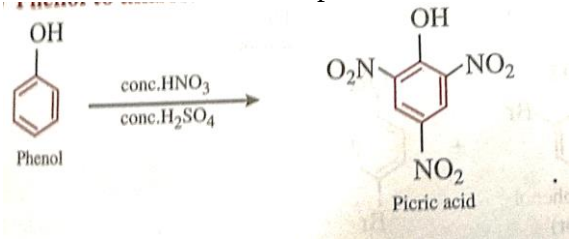
Marking scheme

Q.no.	SECTION A (Answer)	Marks
1	c	1
2	b	1
3	d	1
4	a	1
5	a	1
6	a	1
7	c	1
8	b	1
9	b	1
10	c	1
11	b	1
12	c	1
13	d	1
14	a	1
15	c	1
16	a	1
17	**SECTION B** 17.Ans.p°_A=17.535 mm Hg, W_B=25 g, W_A= 450 g,M_B =180g/mol, M_A=18g/mol $p^\circ_A - p_s / p^\circ_A = W_B \times M_A / M_B \times W_B$ 17.535-p_s/17.535 =25×18/180×450 1- p_s/17.535 =1/180 179/180= p_s /17.535,p_s=17.44 mg Hg	 1 1
18	18.Ans.(a)1-Bromopentane,2-Bromopentane,2-Bromo-2-methylbutane. (b) benzene and other aromatic compounds react with alkyl halide in the presence of anhydrous $AlCl_3$ to form alkyl benzene. $C_6H_6 + CH_3Cl$ (Anhy.$AlCl_3$) $\rightarrow C_6H_5CH_3 + HCl$	1 1
19	19.Ans.(a)$2C_6H_5CH_2COCH_3+CdCl_2$ **(**b) $(CH_3)_2C$,(Br)-COOH **OR** (a) The alpha hydrogen atoms are acidic in nature due to the presence of electron withdrawing carbonyl group. These can be easily removed by a base and the carbanion formed is resonance stabilised.	1 1 1

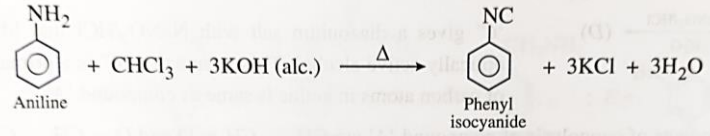
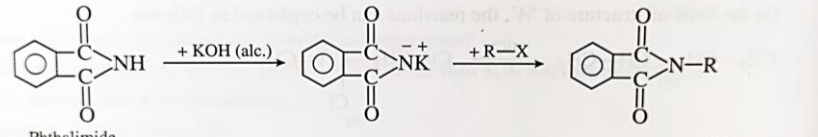
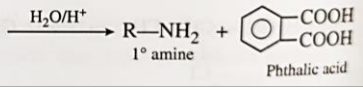
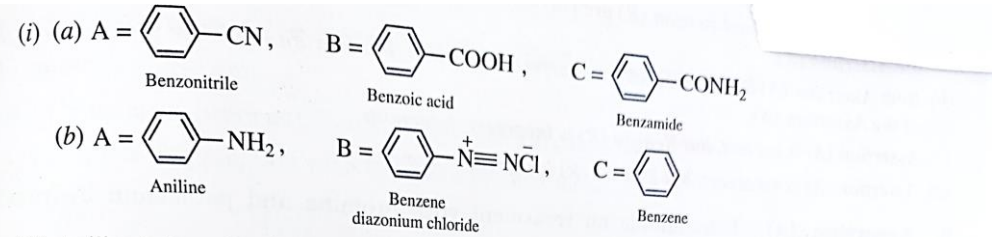
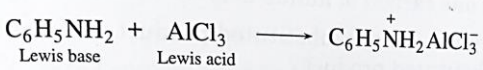
	(b) Tollens' reagent is a weak oxidizing agent not capable of breaking the C–C bond in ketones. Thus ketones cannot be oxidised using Tollens' reagent itself get reduce to Ag	1
20	20.Ans. Vitamins are classified into two groups depending upon their solubility in water or fat. i) Water soluble vitamins: these include vitamin B-complex (B1,B2,B5 i.e.nicotinic acid,B6,B12,pantothenic acid biotin,i.e.,vitamin H and Folic acid and vitamin C. ii) Fat soluble vitamins: These include vitamin A, D,E and K these are stored in liver and adipose tissues (fat storing tissues). Vitamin K is responsible for coagulation of blood.	1 1
21	21.Ans.(a) (Any two) (b) reaction which is not truly of first order but under certain conditions becomes a reaction of first order is called pseudo first order reaction. e.g., acid hydrolysis of ethyl acetate. $CH_3COOC_2H_5 + H_2O\ (H^+) \rightarrow CH_3COOH + C_2H_5OH$ Rate is directly proportional to $[CH_3COOC_2H_5]$ as H_2O is in excess.	1 1
	SECTION C	
22	Ans.Given cell $Zn/Zn^{2+}(0.001\ M) \backslash\backslash H^+(0.01)/ H_2(g)(1bar) / Pt(s)$ At anode: $Zn \rightarrow Zn^{2+} + 2e^-$ At cathode $2H^+ + 2e^- \rightarrow H_2$ Net cell equation $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$ Nernst equation $E_{cell} = E°_{cell} - 0.0951/2 \quad \log[Zn^{2+}]/[H^+]^2$ $=(0.00+0.76)-0.059/2 \log 0.001/.01\times0.01$ $=.76-0.591/2 \log 10=.76-.592/2$ $=(1.52-0.059)/2$ $=1.461/2=0.7305V$	1 1 1
23	Ans.(a)If $\Delta_o < P$, electronic configuration becomes t_{2g}^3, eg^2 . (b) in the presence of CN^-)a strong ligand) the $3d^5$ electrons pair up, the hybridization is d^2sp^3 forming an inner orbital complex $[Fe(CN)_6]^{3-}$ in the presence of F^- (a weak ligand) $3d^5$ electrons do not pair up, the hybridization	1 1+1

S.No.	Order	Molecularity
(*i*)	It is the sum of the powers of the concentration of the reactants in the rate law expression.	It is the number of reacting species taking part in an elementary reaction, which must collide simultaneously so as to result into a chemical reaction.
(*ii*)	It is determined experimentally.	It is a theoretical concept.
(*iii*)	It can be zero or a fraction.	It cannot be zero or a fraction.
(*iv*)	Order is applicable to elementary as well as complex reactions.	Molecularity is applicable only for elementary reactions. For complex reactions it has no meaning.

	is sp^3d^2 forming and outer orbital complex $[FeF_6]^{3-}$.  	
24	24.Ans.(a) due to higher stability of tertiary carbocation then primary carbocation. (b) The stereoisomers which are non-superimposable mirror images are called enantiomers. Enantiomers rotate the plane of Polarised light to the same extent but in opposite direction. (c) on heating chloroform and carbon tetrachloride with aniline and ethanolic potassium hydroxide separately chloroform forms pungent smelling isocyanide but carbon tetrachloride does not form this compound. $C_6H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_6H_5NC + 3KCl + 3H_2O$.	1 1 1
25	$t = \frac{2.303}{k}\log\frac{[R]_0}{[R]}$ as $[R] = \frac{[R]_0}{10}$ $\therefore \quad t = \frac{2.303}{k}\log\frac{[R]_0}{\frac{[R]_0}{10}} = \frac{2.303}{60}\times\log 10 = \frac{2.303}{60}\times 1 = \mathbf{3.838\times10^{-2}\,s}$	1 1+1
26	(a)$C_6H_5CHO + NaOH(conc.) \rightarrow C_6H_5CH_2OH + C_6H_5COO^-Na^+$ (b)X=$CH_3CH(Br)COOH$ (c)$C_6H_5COOH(SOCl_2) \rightarrow C_6H_5COCl$ (H_2/Pd-$BaSO_4$boiling xylene)$\rightarrow C_6H_5CHO$.	1 1 1
27	Ans.(a) glycosidic linkage joins two monosaccharides.The monomer units are joined by an oxide linkage called glycosidic linkage. A peptide linkage joins two amino acids. Peptide linkage is an amide formed between the -COOH group and -NH_2 group of amino acids. (b) The hydrogen bonds in the native protein are disturbed or broken when the protein molecules are subjected to physical stress (like temperature change or chemical change) like change in pH owing to this protein lose their biological activity which is known as denaturation of protein. Example -the egg protein undergoes coagulation when subjected to high temperature (boiling point). During the denaturation only the secondary and tertiary structures are destroyed but primary structures remain intact.	1 1+1
28	Ans (a) Phenol is stronger acid than alcohol because the phenoxide and left- after the release of a proton is stabilized by resonance but alkoxide ion is not, moreover the +I effect of alkyl group destabilize the alkoxide ion by intensifying negative charge on Oxygen atom. (b) In alcohols the increase of branching in carbon chain surface area decreases which results in decrease in vander Waals forces and hence decrease in boiling point.	1 1

	(c) When phenol is treated with concentrated HNO_3 and concentrated H_2SO_4 it will be converted into picric acid.  	1
	SECTION D	
29	Ans.i) reaction taking place at cathode when battery is in use $PbO_2(s)+SO_4^{2-}(aq)+4H^+(aq)+2e^-$ $\rightarrow PbSO_4(s) + 2H_2O(l)$ ii)2 Faradays (2F) of electricity is required. iii) H_2SO_4 before discharge can be calculated as follows: Mass of H_2SO_4 =38.0g Volume of the solution=100mL Mass of solution=volume/density =100 mL /1.294g mL^{-1}=77.28mL = 0.07728l Molarity of soln.=mass H_2SO_4/molar mass×1/vol.of soln (L) =(38.0g)/(98.0g/mol)×(0.7728L) =5.02 mol/L=5.02M **OR** $PbSO_4 + 2e^- \rightarrow Pb + SO_4^{2-}$(redu.) $PbSO_4+2H_2O \rightarrow PbO_2+SO^{2-}{}_4+4H^++2e^-$(oxida.) Overall reaction: $2PbSO_4+2H_2O \rightarrow Pb + PbO_2 +4H^+ + 2SO_4^{2-}$	1 1 1+1 1 1
30	30.Ans.i) strong feel ligands lead to the formation of outer orbital complexes. ii) it is sp^3d^2 in case of outer orbital complex and d^2sp^3 in case of inner orbital complex. iii) the element co is in +3 oxidation state.As a strong field ligand, electron pairing is possible in this case. the hybridization is of d^2sp^3 type It is an inner orbital complex. Diamagnetic in nature. Spin only magnetic moment is equal to zero. **OR** The element Cr is in +3 oxidation state as H_2O is a weak field ligand, electron pairing is not possible in this case. The hybridization is of d_2sp^3 type. It is an inner orbital complex. Paramagnetic in nature. Its spin only magnetic moment Magnetic moment=$\sqrt{n(n+2)}$ =$\sqrt{3(3+2)}$=$\sqrt{15}$=3.87BM.	1 1 1 1 1 1
31	(*i*) $2CH_3COOH \rightleftharpoons^{\text{Benzene}} (CH_3—COOH)_2$ Molecules of ethanoic acid dimerise in benzene due to hydrogen bonding. The number of particles reduced to nearly half of initial value due to dimerisation. Therefore value of Van't Hoff factor for ethanoic acid in benzene is close to 0.5.	1

	(ii) $K_2SO_4 \longrightarrow 2K^+ + SO_4^{2-}$, $i = \frac{3}{1} = 3$ Here $W_B = 2.32 \times 10^{-2}$ g, $i = 3$, R = 0.0821 L atom K^{-1} mol^{-1}, T = 298 K $M_B = 174$ g mol^{-1}, $V = 2$L. Substituting the values in the expression, $\pi = \frac{i \times W_B \times R \times T}{M_B \times V}$ We get, $\pi = \frac{3 \times 2.32 \times 10^{-2}\ g \times 0.0821\ L\ atom\ K^{-1}\ mol^{-1} \times 298K}{174\ g\ mol^{-1} \times 2L}$ $\pi = 4.89 \times 10^{-3}$ atm. (iii) $W_B = 25.6$ g, $W_A = 1000$ g, $\Delta T_f = 0.512$ K, $K_f = 5.12$ K kg mol^{-1} Substitution these values in the expression, we get $M_B = \frac{K_f \times W_B \times 1000}{\Delta T_f \times W_A}$, we get $M_B = \frac{5.12\ K\ kg\ mol^{-1} \times 25.6\ g \times 1000\ g\ kg^{-1}}{0.512\ K \times 1000\ g}$ $= 256$ g mol^{-1} Molecular mass of $S_x = 32x$ Now, $32x = 256$ or $x = \frac{256}{32} = 8$ Therefore, formula of sulphur = S_8	1+1 1+1
	OR (i)(a) The binary mixture of liquids having the same composition in liquid and vapour phase and boil at a constant temperature are called azeotropes. (b) The excess of pressure which must be applied to the solution side to prevent the passage of solvent in 28 through a semipermeable membrane is called osmotic tic pressure (c) The properties of solutions which depend only on the number of solute particles in the solution but independent of their nature are called colligative properties. (ii)K_2SO_4 dissolved=25 mg =0.025g, volume of solution=2L,T=25°C= 298K Molar mass of K_2SO_4 =2×39+32+4×16=174 g/mol Since K_2SO_4 dissociates completely as $K_2SO_4 \longrightarrow 2K^+ + SO_4^{2-}$ $i = \frac{\text{Number of moles of particles after dissociation}}{\text{Number of moles of particles before dissociation}} = \frac{3}{1} = 3$ Applying van't Hoff equation, $\pi = \frac{i \times W_B \times R \times T}{M_B \times V}$ $= \frac{3 \times 0.025\ g \times 0.0821\ L\ atm\ K^{-1}\ mol^{-1} \times 298\ K}{174\ g\ mol^{-1} \times 2\ L}$ $= \mathbf{5.27 \times 10^{-3}\ atm}$	1 1 1 2
32	i) This is because $\mathbf{Eu^{2+}}$ tends to change to $\mathbf{Eu^{3+}}$ as +3 is the common oxidation state of lanthanoids. ii)$Zn^{2+}(3d^{10})$ completely filled the orbitals as a result the d-d transition cannot occur due to that zinc salts are colourless iii)$2Na_2Cr_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$ iv)$2MnO_4^-(aq) + 5C_2O_4^{2-}(aq) + 16H^+(aq) \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$ v)$Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 3Sn^{4+} + 7H_2O$ vi) Interstitial compounds are those in which small atoms occupied interstitial sites in the crystal lattice. Interstitial compounds are well known for transition	1 1 1 1 1 1

	metals because small- sized atoms of H,B,C,N,etc. can easily occupy positions in the voids present in the crystal lattice of transition metals. vii)Mn^{3+} (d^4) is less stable than Mn^{2+} (d^4) half field while Fe^{3+}(d^5)half filled is more stable than Fe^{2+}(d^4).That is why $Mn^{2+}$is more resistant than Fe^{2+} towards oxidation.	1
33	(i)(a)In a strong acid aniline is protonated to form anilinium ion which is meta directing. That is why besides the ortho and para derivatives good amount of mata-nitro aniline is also obtained. (b) greater than stability of the substitute ammonium cation of stronger is the base.Due to the combination of the factor +I effect of methyl group ,solvation effect and steric hindrance of methyl group the substituted ammonium cation of(**$(CH_3)_2NH$** is more stable than (**$(CH_3)_2N$** in aqueous solutions,therefore (**$(CH_3)_2NH$** is more basic than (**$(CH_3)_2N$** in aqueous solutions. (c) Ammonolysis of alkyl halides games a mixture of primary, secondary and tertiary amines along with some quaternary ammonium salt s.If excess of alcoholic ammonia is used primary amine is the major product if excess of halides is used quaternary ammonium salt is the major product.As a mixture the mixture obtained are very impcomplex and difficult to separate therefore this is not good method to prepare for primary amines. **ii)(a)(b)** **Carbylamine test:** $R—NH_2 + CHCl_3 + 3KOH\ (alc.) \xrightarrow{\Delta} R—NC + 3KCl + 3H_2O$ 1° amine → Alkyl isocyanide  Aniline → Phenyl isocyanide **) Gabriel phthalimide synthesis:**  Phthalimide  1° amine; Phthalic acid OR  Benzonitrile; Benzoic acid; Benzamide Aniline; Benzene diazonium chloride; Benzene (*ii*) Aniline being a Lewis base, reacts with Lewis acid $AlCl_3$ to form a salt.  Lewis base; Lewis acid As a result, N of aniline acquires positive charge and hence it acts as a strong deactivating group for electrophilic substitution reaction. Consequently, aniline does not undergo Friedel–Crafts reaction. (*iii*) $C_2H_5NH_2 < C_2H_5OH < (C_2H_5)_3N$	1 1 1

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-8

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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.

1. Galvanization is coating of which of the following metal?

(a) Zinc (b) Nichrome (c) Copper (d) chromium

2. Identify A and B:

$RCOOH + PCl_3 \rightarrow A + B$

(a) A = $RCOCH_3$, B = $POCl_3$ (b) A = Benzophenone B = formaldehyde
(b) (c) A= RCOCl B = H_3PO_3 (d) A = Benzophenone , B = Acetophenone

3. A group of vitamins that the body need for clotting of blood and help wounds to heal

(a) Vitamin E (b) Vitamin K (c) Vitamin D (d) Vitamin A, D, E and K

4. Propanone can be prepared by

(a) oxidation of propan-1-ol on hot Copper gauze
(b) oxidation of propan-2-ol on hot Copper gauze
(c) oxidation of butan-1-ol on hot Copper gauze
(d) oxidation of butan-2-ol on hot Copper gauze

5. Which of the following statement is **not correct** regarding SN1 and SN2 Reactions

(a) SN1 Rections always result in recemisation.
(b) SN2 Rections result in recemisation most of the times.
(c) SN1 Rections may result in inversion of configuration.
(d) SN1 Rections may result in retention of configuration.

6. Which of the following is not correctly matched

(i)Sc+3 Generally form colorless salts
(ii)Ti +3 shows paramagnetism
(iii)Zn+2 Generally form colored salts
(iv)Cu+2 salts are generally blue

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

7. Mark the incorrect statement regarding order of a reaction?
(a) Order of reaction can be zero or a fraction.
(b) Order of a reaction is equal to the sum of powers of concentration terms in a rate law.
(c) Order of a reaction is an experimental quantity
(d) Reactions with order of reaction three are very slow.

8. Write the IUPAC name of the product of the following reaction

$C_6H_5N_2Cl + H_2O \rightarrow$

(a) Chlorobenzene (b) Bromobenzene (c) P-chlorophenol (d) Phenol

9. Propan-1-ol and propan-2-ol can be distinguished by

(a) 2,4-DNP test (b) Bromine water test (c) Iodoform test (d) Lucas test

10. Identify the order of reaction from the following rate constants

(i) $K=2.3 \times 10^{-5}\ Lmol^{-1}S^{-1}$ (ii) $k= 3\times10\text{-}4S^{-1}$

(a) (i)=second order, (ii)=first order (b) (i)=First order, (ii)=first order

(c) (i)=third order, (ii)=first order (d)(i)=first order, (ii)=second order

11. Phenols are

(a) ortho para directing for nucleophilic substitution.
(b) ortho para directing for electrophilic substitution.
(c) meta directing for electrophilic substitution.
(d) electrophile can attack at any position in phenols as all positions are equivalent.

12. Which of the following oxidation state is most common in lanthanoids

(a) +2 (b) +3 (c) +4 (d) +7

13. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Addition of water to but-1-ene in acidic medium yields butan-2-ol
Reason (R): Addition of water in acidic medium proceeds through the formation of 2^0carbocation.
Select the most appropriate answer from the options given below:
(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

14. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Formaldehyde is a planar molecule.
Reason (R): It contains SP^2 hybridised carbon.
Select the most appropriate answer from the options given below:
(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

15. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Amino acids are usually colourless,crystalline solids and behave like salts.
Reason (R): Amino acids form zwitter ions.
Select the most appropriate answer from the options given below:
(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

16. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Copper sulphate can not be stored in a zinc vessel.
Reason (R): Zinc is less reactive than copper.
Select the most appropriate answer from the options given below:
(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

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. Calculate the half life of a first order reaction from their rate constants
(i) 400 s^{-1} (ii) 5 min^{-1}

18. Determine the amount of $CaCl_2$(i=2.47) dissolved in 2.5 lit of water such that its osmotic pressure is 0.75 atm at 27 ^{0}C.

OR

Calculate the molality of 2.5 g ethanoic acid (CH_3COOH) in 75 g of benzene.

19. Complete the following reations
a. $CH_3CH_2CH_2Cl$ + NaI $\xrightarrow[heat]{acetone}$
b. $(CH_3)_3$ Br + KOH $\xrightarrow[Heat]{Ethanol}$

20. how will you bring about the following conversions in not more than 2 steps
a. Benzoic acid to Benzaldehyde
b. Propanone to Propene

21.What happens when D-glucose is treated with
a. HI b. Bromine water

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.

22. Write IUPAC names of following co-ordination compounds :
(a) $[CO(NH_3)_6]Cl_3$
(b) Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers:
(i)$K[Cr(H_2O)_2(C_2O_4)_2]$
(ii)$[CO(en)_3]Cl_3$

23. How much of charge is required for the following reductions
a. 1 mol of MnO_4^- to Mn^{+2}
b 2 mols of Cu^{+2} to Cu
c. 1 mol of Al^{+3} to Al

24. Give the structures and IUPAC names of the products expected from
a. Catalytic reduction of butanal
b. hydration of propene in presence of dil sulphuric acid
c. reaction of propanone with methylmagnesiumbromide followed by hydrolysis.

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). (Q on dehydration gives but-l-ene. Write equations for the reactions involved.

26. Define the following as related to proteins:
    (i) Peptide linkage
    (ii) Primary structure
    (iii) Denaturation

27.(i) Identify the biomolecule and place where is it found from its role as described below

a. responsible for transfer of hereditary characters from one generation to another.

b. this is responsible for the digestion of protein in humans.

(ii) What is the difference between nucleotide and nucleoside.

28. The reaction between A and B is first order with respect to A and zero order with respect to B. Fill in the blanks in the following table:

Exper-iment	[A] mol L^{-1}	[B] mol L^{-1}	Initial rate mol L^{-1} min^{-1}
I	0.1	0.1	2.0×10^{-2}
II	-	0.2	4.0×10^{-2}
III	0.4	0.4	-
IV	-	0.2	2.0×10^{-2}

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. Werner in 1898, propounded his theory of coordination compounds. The modern theory of coordination chemistry is based largely on the work of Alfred Werner (1866–1919; Nobel Prize in Chemistry in 1913). In a series of careful experiments carried out in the late 1880s and early 1890s, he examined the properties of several series of metal halide complexes with ammonia. The main postulates are: In coordination compounds metals show two types of linkages (valences)-primary and secondary. The primary valences are normally ionisable and are satisfied by negative ions. The secondary valences are non ionisable. Werner's theory is responsible for the formation of structures of various cobalt amines. Cobalt has a primary valency (oxidation state) of three and exhibits secondary valency (coordination number) of 6. We represent the secondary valencies by thick lines and the primary valency by broken lines.

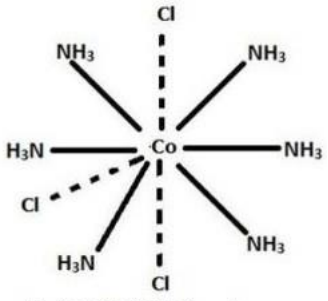


Fig.)$CoCl_3.6NH_3$ Complex
No of Cl- precipated =3
Total No of ions =4

(i)Find the primary and secondary valencies of central metal ion/atom in $K_4[Fe(CN)_6]$ and $[Ni(CO)_4]$.

(ii) What are ambident ligands? Give a suitable example of it.

OR

Draw the geometrical isomers of $[CoCl_2(en)_2]$. Also mark them correctly as cis and trans.

(iii) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral why?

30. A famous book of Paulo Coehlo The Alchemist was best seller of his time. Alchemistry in olden days was defined as study metals and their properties. All the efforts were concentrated largely to convert cheaper metals like iron etc into precious metals like gold. These efforts however could not convert cheaper metals into gold but new theories in field of chemistry led us to todays technique of electroplating. Now a days we can plate precious metals like gold and platinum on cheaper metals and can enjoy artificial jewelery which shines like real one. Faradya's laws of electrolysis helped us to make use of electrolysis for purification of metals and plating of a desired metal on to the other. Farady's laws are actually not new to mankind as similar techniques were known to ancient Indians also and were in use as reported in many of our literature like Visheshika Sutras as written by Rishi Kannad.

(i) Predict the product of electrolysis when an aqueous solution of $AgNO_3$ is electrolysed with silver electrodes.

OR

Define the kohlraush law of independent migration of ions

(ii) How will you determine the limiting molar conductivity of water?

(iii) If a current of 2.0 ampere flows through a metallic wire for 3 hours, then how many electrons would flow through the wire?

SECTION E

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

31.a**.** What is lanthanoid contraction? What are the consequences of lanthanoid contraction?

b. What are interstitial compounds? Why are such compounds well known for transition metals?

OR

a. Describe the oxidising action of potassium dichromate and write the ionic equations for its reaction with:
   (i)iodide
   (ii)iron (II) solution and
   (iii)H_2S

b. How does the acidified permanganate solution react with (i) iron (II) ions (ii) $S0_2$ and (iii) oxalic acid? Write the ionic, equations for the reactions.

32. (i) Define Molarity, molality and mole fraction.

(ii) Calculate the mass of ascorbic acid (vitamin C, $C_6H_8O_6$) to be dissolved in 75 g of acetic acid to lower its melting point by 1·5°C. (K_f for CH_3COOH) = 3·9 K kg mol^{-1})

OR

(i) What is meant by colligative properties? How the concept of reverse osmosis find use in solving the problem of drinking water?

(ii) Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185,000 in 450 mL of water at 37°C.

33. (i) Give one chemical test to distinguish between

a. methylamine and dimethylamine.

b. anilin and benzylamine

c. secondary and tertiary amine.

(ii) Explain why

a. Aniline does not undergo Friedal craft reaction

b. Diazo salts of aromatic amines are more stable as compared to those of aliphatic amines.

OR

(i) 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 compounds A, B and C.

(ii)Give Gabrial Pthalamide reaction for the preparation of primary amines.

MARKING SCHEME

SECTION A

1. a	2. C
3. b	4 b
5 b	6. b
7. d	8. d
9. c	10 a
11.b	12.b
13. a	14 a
15. a	16. C

SECTION B

17 (i) 0.001732 sec (ii) 0.138 min deduct ½ mark if either value or unit is wrong.

18. $\pi = iCRT$

$=i\frac{n}{v}RT$

n = π xV/ iRT 1/2

0.75atm x2.5 L/ 2.47x0.0832 Latm K^{-1} mol^{-1} x300K 1/2

=0.038 mol 1/2

Molar mass of CaCl2 = 111 g/mol

Therefore weight of CaCl2 required = 0.038x111=3.42 g ½

OR

Molality $=\frac{w2}{m2}\times\frac{1000}{w1}$ 1/2

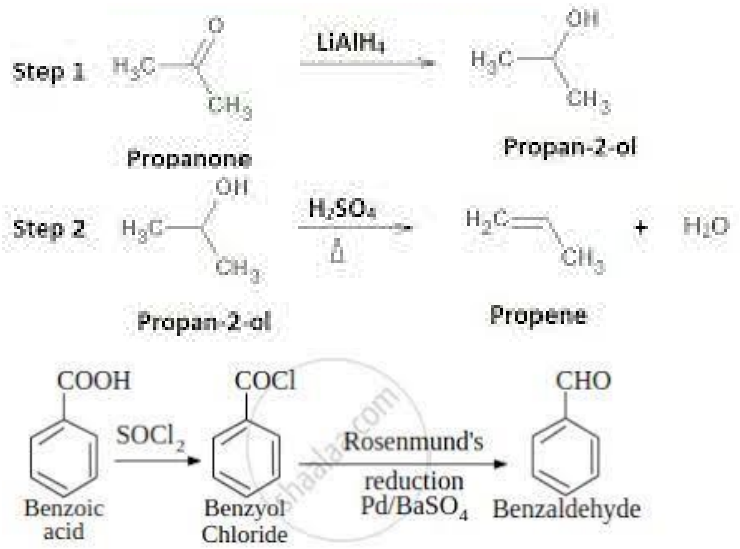
m = $\frac{2.5g}{60g/mol}\times\frac{1000g/kg}{75g}$ 1

= 0.556mol/Kg ½

19. a $CH_3CH_2CH_2I$

b. $(CH_3)_2C=CH_2$

20.



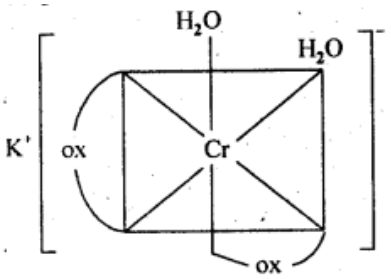
21. a. n-hexane C_6H_{14}

b. Gluconic acid $HOCH_2(CHOH)_4COOH$

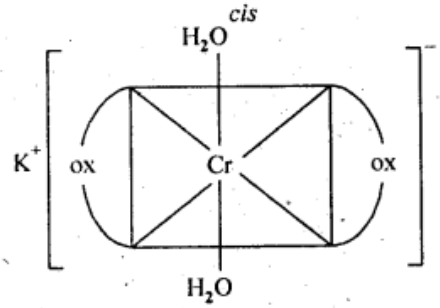
SECTION C

22. a. hexaamminecobalt (III) chloride 1

b. Geometrical isomerism Cis-Trans ½, ½

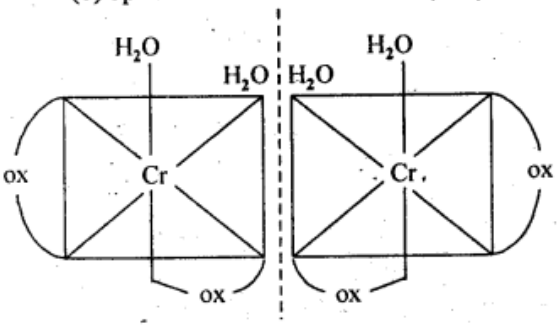


cis



trans

(b) optical isomerism of cis-form, i.e.,



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23.

a. 482500c

b.386000c

c.289500c

24. a. $CH_3CH_2CH_2CH_2OH$ Butan-1-ol ½, ½

b. $CH_3CH(OH)CH_3$ Propan-2-ol ½, ½

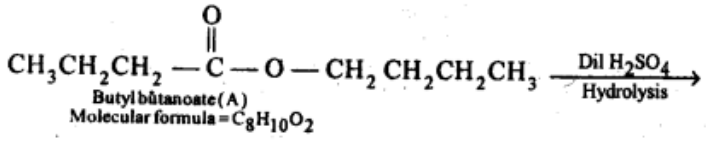
c.$(CH)_3C(OH)$ 2-Methylpropan-2-ol ½, ½

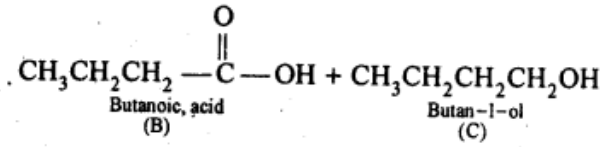
25. Since an ester A with molecular formula $C_8H_{16}O_2$ upon hydrolysis gives carboxylic acid B and the alcohol C and oxidation of C with chromic acid produces the acid B, therefore, both the carboxylic acid B and alcohol C must contain the same number of carbon atoms.

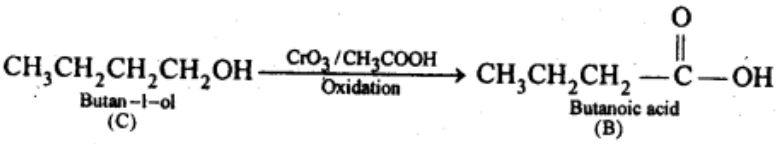
Further, since ester A contains eight carbon atoms, therefore, both the carboxylic acid B and the alcohol C must contain four carbon atoms each.

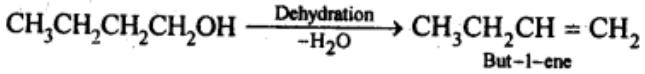
Since the alcohol C on dehydration gives but-l-ene, therefore, C must be a straight chain alcohol, i.e., butan-l-ol.

If C is butan-l-ol, then the acid B must be butanoic acid and the ester A must be butyl butanoate.The chemical equations are as follows:

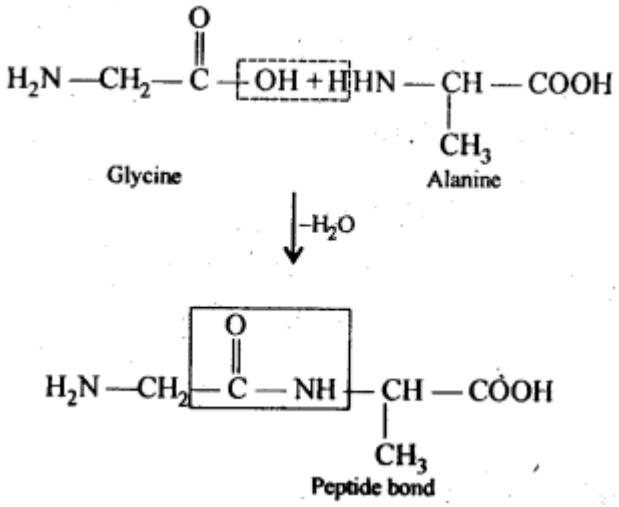








26. **i) Peptide bond:** Proteins are condensation polymers of α-amino acids in which the same or different α-amino acids are joined by peptide bonds. Chemically, a peptide bond is an amide linkage formed between – COOH group of one α-amino acid and -NH-, group of the other α-amino acid by loss of a molecule of water. For example,



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b. **Primary structure:** Proteins may contain one or more polypeptide chains. Each . polypeptide chain has a large number of α-amino acids which are linked to one another in a specific manner. The specific sequence in which the various amino acids present in a protein linked to one another is called its primary structure. Any change in the sequence of α-amino acids creates a different protein. 1

c. **Denaturation:** When a protein in its native form is subjected to a physical change such as change in temperature or a chemical change like change in pH, etc., hydrogen bonds gets broken. As a result, soluble forms of proteins such as globular proteins undergo coagulation or precipitation to give fibrous proteins which are insoluble in water. This coagulation also results in loss of biological activity of the proteins and this loss in biological activity, is called denaturation. During denaturation, 2° and 3° structures of proteins are destroyed but 1° structure remains intact.

27. (i)a. DNA in nucleus of the cells 1

b. Enzyme pepsin in stomach and trypsin in small intestine 1

(ii) A nucleoside contains only two basic components of nucleic acids i.e., a pentose sugar and a nitrogenous base. It is formed when 1- position of pyrimidine (cytosine, thiamine or uracil) or 9-

position of purine (guanine or adenine) base is attached to C -1 of sugar (ribose or deoxyribose) by a β-linkage. Nucleic acids are also called polynucleotides since the repeating structural unit of nucleic acids is a nucleotide.

A nucleotide contains all the three basic . components of nucleic acids, i.e., a phosphoric acid group, a pentose sugar and a nitrogenous base. These are obtained by esterification of C_5, – OH group of the pentose sugar by phosphoric acid. 1

28.

Rate law expression :

$$\text{Rate} = k[A]^1[B]^0 = k[A]$$

$$R_1 = 2{\cdot}0 \times 10^{-2}\ \text{mol L}^{-1}\ \text{min}^{-1}$$

$$= k[0{\cdot}1]\ \text{mol L}^{-1}$$

$$\therefore \quad k = 0{\cdot}2\ \text{min}^{-1}$$

$$R_2 = 4{\cdot}0 \times 10^{-2}\ \text{mol L}^{-1}\ \text{min}^{-1}$$

$$= (0{\cdot}2\ \text{min}^{-1})[A]$$

$$\therefore \quad [A] = 0{\cdot}2\ \text{mol L}^{-1}$$

$$R_3 = \text{Rate} = k[A]$$

$$= (0{\cdot}2\ \text{min}^{-1})(0{\cdot}4\ \text{mol L}^{-1})$$

$$= 0{\cdot}08\ \text{mol L}^{-1}\ \text{min}^{-1}$$

.

SECTION D

29. (i)Fe primary valency=4 secondary valency =6

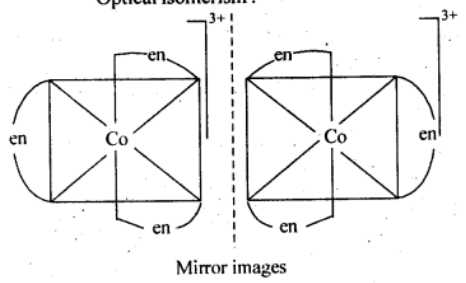
Ni primary valency=0 secondary valency=4

(ii) Ambident ligands: those ligands which have two binding sites but can use only one at a time eg CN^-

OR

(ii) $[Co(en)_3]Cl_3$

Optical isomerism :

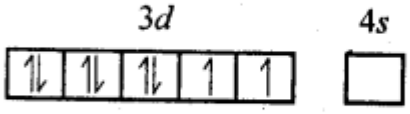


(iii)

In $[NiCl_4]^{2-}$, Ni is in +2 oxidation state

Ni (28) : $3d^8 4s^2$

Ni^{2+} : $3d^8\ 4s^0$

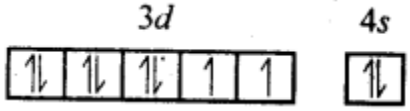


Cl^- is weak field ligand. It does not pair up e^{-1}s.

Hence, it is paramagnetic

In $[Ni(CO)_4]$, Ni is in 0 O.S.

Ni (28) : $3d^8 4s^2$



CO is strong field ligand, as it pairs the $4s$ e^{-1}s with $3d$ e^{-1}s to give $3d^{10}$ $4s^0$. So, no unpaired e^- and hence, the complex is diamagnetic.

30.(i) at cathode Ag will be deposited and at Cathode anode Ag^{+2} will pass into the solution.

OR

an electrolyte's limiting molar conductivity is equal to the sum of the individual limiting molar conductivities of the cations and anions that make up the electrolyte.

(ii)

By using Kohlrausch's law, Λ°_m for H_2O can be calculated, we can write,

$\Lambda^\circ_m = \Lambda^\circ_m(HCl) + \Lambda^\circ_m(NaOH) - \Lambda^\circ_m(NaCl)$

Being strong electrolytes, Λ°_m values of HCl, NaOH and NaCl are known. By substituting their values, we can obtain Λ°_m for H_2O.

(ii)

(iii) Q=IT

2x3x60x60 c =>21600c

Q= $nx1.6x10^{-19}$

Therefore 21600= $nx1.6x10^{-19}$ hence n=$1.3x10^{23}$ electrons.

SECTION E

31. a. Lanthanoid Contraction : a gradual dec in atomic and ionic radius from lanthanum to lutetium is called as lanthanoid contraction. 1

Consequences of lanthanoid Contraction

(a)Separation Lanthanoids: All the lanthanoids have quite similar properties and due to this reason they are difficult to separate.

(b)Variation in basic strength of hydroxides: Due to lanthanoid contraction, size of M^{3+} ions decreases and thus there is a corresponding increase in the covalent character in M—OH bond. Thus basic character of oxides and hydroxides decreases from $La(OH)_3$ to $Lu(OH)_3$.

(c)Similarity in the atomic sizes of the elements of second and third transition series present in the same group. The difference in the value of atomic radii of Y and La is quite, large as compared to the difference in the value of Zr and Hf. This is because of the lanthanoid contraction.

(d)Variation in standard reduciton potential: Due to lanthanoid contraction there is a small but steady increase in the standard reduction potential (E°) for the reduction process.

M^{3+} (aq) + $3e^-$ ——> 4 M(aq)

OR any two correct consequences 2

b. Transition metals form large number of interstitial compounds; this is due to the presence of voids in their crystal lattices. They are able to entrap small atoms of elements like H, G, N, B, etc., in their crystal lattice and even can make weak bonds with them.

Due to formation of interstitial compounds, their malleability and ductility decreases and tensile . strength increases. Steel and cast iron are hard in comparison to wrought iron due to the presence of trapped carbon atoms in interstitial spaces.

OR

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$

(i) **Iodide**: Iodide ion (I^-) is oxidised to I_2 by the acidfied solution of $K_2Cr_2O_7$.
Reaction:

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$
$$6I^- \longrightarrow 3I_2 + 6e^-$$

$$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 3I_2 + 2Cr^{3+} + 7H_2O$$

(ii) **Iron (II) solution:** Ferrous salts (Fe^{2+}) are oxidised to ferric (Fe^{3+}) salts when they are treated with acidified $K_2Cr_2O_7$.
Reaction:

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$
$$6Fe^{2+} \longrightarrow 6Fe^{3+} + 6e^-$$

$$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow$$
$$2Cr^{3+} + 6Fe^{3+} + 7H_2O$$

(iii) **H_2S :** H_2S is oxidised to sulphur.

$$Cr_2O_7^{2-} + 3H_2S + 8H^+ \longrightarrow 2Cr^{3+} + 7H_2O + 3S$$

32. (i) Molality: may be defined as number of moles of solute per kilogram of solvent.
Molarity: may be defined as number of moles of solute per liter of solution.
Mole fraction: Mole fraction is the number of moles of a specific component in the solution divided by the total number of moles in the given solution.

(ii)

$$W_B = \frac{M_B \times \Delta T_f \times W_A}{K_f}$$

Mass of acetic acid (W_A) = 75 g = 0·075 kg.
Depression in freeing point (ΔT_f) = 1·5°C = 1·5 K
Molar mass of ascorbic acid (M_B) = $6 \times 12 + 8 \times 1 + 6 \times 16 = 176$ g mol^{-1}
Molal depression constant (K_f) = 3·9 K kg mol^{-1}

$$W_B = \frac{(176\,\text{g mol}^{-1}) \times (1{\cdot}5\,\text{K}) \times (0{\cdot}075\,\text{kg})}{(3{\cdot}9\,\text{K kg mol}^{-1})} = \mathbf{5{\cdot}08\ g}$$

OR

(i) Colligative properties:properties of solutions that depend *only* upon the total concentration of solute species, regardless of their identities.

OR defined in any other correct way.

Reverse osmosis can be used for desalination or purification of contaminated water for obtaining pure drinking water.

(ii)

Given: $V = 450\,\text{mL} = 0.45\,\text{L}$
$T = 37°\text{C} = 310\,\text{K}$
$R = 8.314\,\text{kPa L K}^{-1}\,\text{mol}^{-1}$
To find: $\pi = ?$
Solution: Applying the formula,

$$\pi = CRT = \frac{n}{V}RT$$

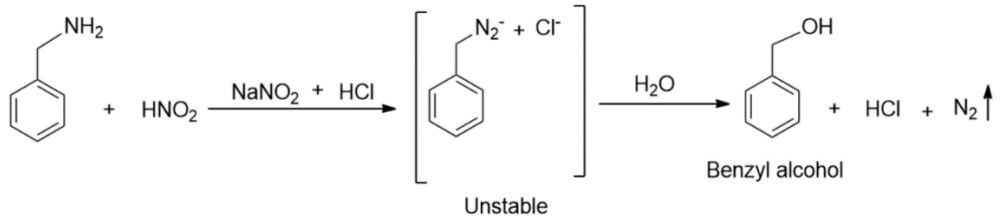
$$n = \frac{1.0\text{g}}{185{,}000\text{g mol}^{-1}}$$

$$\therefore P = \frac{1}{185{,}000} \times \frac{1}{0.45} \times 8.314 \times 10^3 \text{ Pa LK}^{-1} \text{ mol}^{-1} \times 310\text{K} = 30.96 \text{ Pa}$$

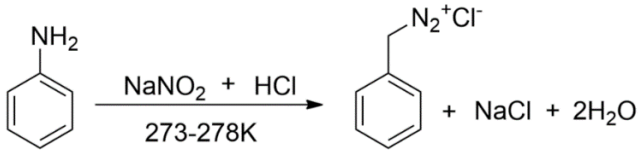
33. (i)

a. Methyl amine and dimethylamine can be distinguished by carbylamine test. Methyl amine when treated with chloroform and aqueous KOH give foul smell (CH_3NC)whereas dimethyl amine dot respond to this test.

$CH_3NH_2 + CHCl_3 + 3KOH \rightarrow CH_3NC + 3KCl + 3H_2O$



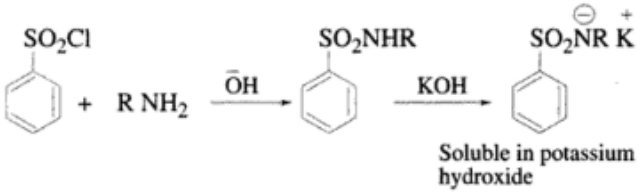
b.

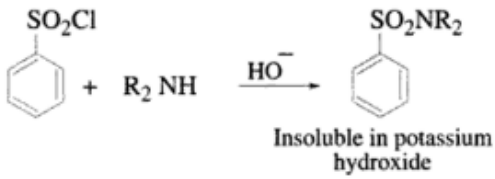


c. Hinsberg Test: The reagent used in this test is benzene sulfonyl chloride. Amines reacts with benzene sulfonyl chloride in the alkaline medium.

Primary amines reacts with benzene sulfonyl chloride to produce substituted sulfonamide which contains an acidic hydrogen and dissolve in basic medium.

A *secondary amine* forms a substituted sulfonamide which is insoluble in alkali because it does not have acidic hydrogen.





(ii) (a) Aniline is a Lewis base and therefore forms salt with Lewis acid like $AlCl_3$ used as acatalyst in Friedal Craft reaction.

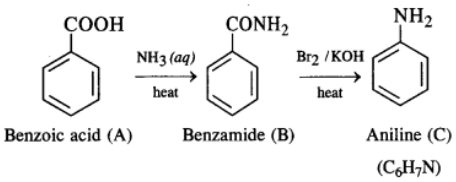
a. Aromatic diazonium chlorides are resonately stabilized and aliphatic diazonium salts are not resonantly stabilized.

OR

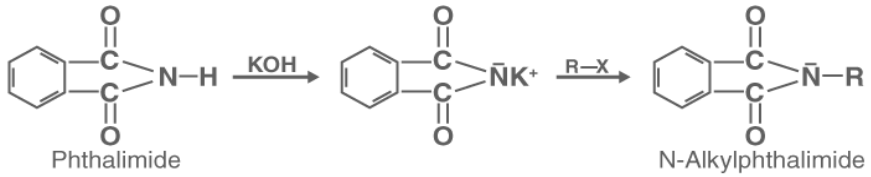
(i) From the available information, we find that 'B' upon heating with Br_2 and KOH forms a compound 'C'. The compound 'B' is

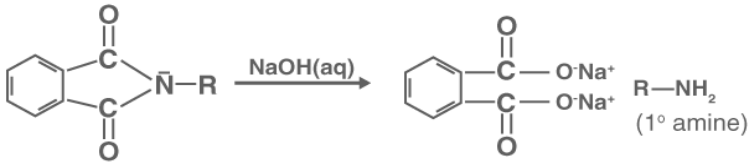
expected to be an acid amide. Since 'B' has been formed upon heating compound 'A' with

aqueous ammonia, the compound 'A' is an aromatic acid.
It is benzoic acid. The reactions involved are given as follows:



(ii) Gabriel Pthalamide reaction.





b.

Electrolytically:

$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

In acidic medium of dilute sulphuric acid, $KMnO_4$ acts as strong oxidising agent and it reacts as:

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$

(i) **Iron (II) solution :** Ferrous (Fe^{2+}) ion solution to ferric (Fe^{3+}) ion solution

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$
$$5Fe^{2+} \rightarrow 5Fe^{3+} + 5e^-$$

$$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

(ii) **Sulphur dioxide (SO_2)**

$$[MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O] \times 2$$
$$10H_2O + 5SO_2 \rightarrow 5SO_4^{2-} + 2Mn^{2+} + 10e^-$$

$$2MnO_4^- + 5SO_2 + 2H_2O \rightarrow 5SO_4^{2-} + 2Mn^{2+} + 4H^+$$

(iii) Oxalic acid

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O] \times 2$$
$$5 \left| \begin{matrix} COO^- \\ | \\ COO^- \end{matrix} \right. \rightarrow 10CO_2 + 10e^-$$

$$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \rightarrow$$
$$2Mn^{2+} + 10CO_2 + 8H_2O$$

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-9

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

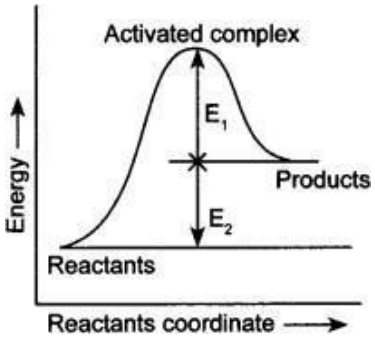
MM: 70 **Time:3 Hours**

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 very 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 calculator is not allowed.

SECTION A

1.	The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is (a) 1F (b) 3F (c) 5F (d) 6F	1
2.	In a chemical reaction, A → 2B, the rate of disappearance of A is 6.0×10^3mole per litre per second. What will be rate of appearance of B? (a) 12.0×10^3 mole per litre per second (b) 6.0×10^3 mole per litre per second (c) 3.0×10^3 mole per litre per second (d) 6.0×10^6 mole per litre per second	1
3.	Whichofthefollowinghas magneticmomentvalueof5.9? (a) Fe^{2+} (b) Fe^{3+} (c) Ni^{2+} (d) Cu^{2+}	1
4.	Consider Fig. and mark the correct option  	1

	(a) Activation energy of forward reaction is E_1+ E_2 and product is less stable than reactant. (b) Activation energy of forward reaction is E1+E2 and product is more stable than reactant. (c) Activation energy of both forward and backward reaction is E1+E2 and reactant is more stable than product. (d) Activation energy of backward reaction is E1 and product is more stable than reactant.	1
5	The complex ions $[Co(NH_3)_5(NO_2)]^{2+}$ and $[Co(NH_3)_5(ONO)]^{2+}$ arecalled (a) Ionization isomers (b)Linkage isomers (c)Co-ordination isomers (d) Geometrical isomers	1
6	Whichofthefollowingarearrangedinthedecreasingorderofdipolemoment? (a)CH_3Cl, CH_3Br, CH_3F (b)CH_3Cl, CH_3F, CH_3Br (c)CH_3Br, CH_3Cl, CH_3F (d)CH_3Br, CH_3F, CH_3Cl	1
7	Phenol reacts with bromine in CS_2 at low temperature to give a) m-bromophenol b) p-bromophenol c) o-andp-bromophenol d) 2,4,6-tribromophenol	1
8.	The alcohol which does not react with Lucas reagent. a) Iso-butylalcohol b) tert-butyl alcohol c) sec-butylalcohol d) n-butanol	1
9	The addition of HCN to carbonyl compounds is an example of (a)nucleophilic addition (b)electrophilic addition (c)free radical addition (d)electromeric addition	1
10.	Formaldehyde react with Grignard's reagent to give addition products which on hydrolysis give (a)tertiary alcohols (b)secondary alcohols (c)primary alcohols (d)carboxylic acids	1
11.	Which of the following: when heated with a mixture of ethanamineand alcoholic potash gives ethyl isocyanide? (a)2-chloropropane (b)2,2-dichloropropane (c)trichloromethane (d)tetrachloromethane	1
12.	Amine that can not be prepared by Gabriel-Phthalimide synthesis is (a)aniline (b)benzylamine (c)methylamine (d)iso-butylamine	1
13.	Given below are two statements labelled as Assertion (A) and Reason (R) Assertion (A): Zn is not considered as transition metal. Reason(R): Zn do not have their last electron in d orbital. Select the most appropriate answer from the options given below: 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) Ais true but R is false. d) A is false but R is true.	1

14	Given below are two statements labelled as Assertion (A) and Reason (R) Assertion (A): With HI, anisole gives iodo benzene and methyl alcohol. Reason: Iodide ion combines with smaller group to avoid steric hindrance Select the most appropriate answer from the options given below: 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) Ais true but R is false. d) A is false but R is true.	1
15	Given below are two statements labelled as Assertion (A) and Reason (R) Assertion: Hoffmann's bromamide reaction gives primary amines. Reason: Primary amines are more basic than secondary amines Select the most appropriate answer from the options given below: 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) Ais true but R is false. d) A is false but R is true.	1
16	Given below are two statements labelled as Assertion (A) and Reason (R). Assertion(A): Glucose produces n-hexane when reduced in presence of HI. Reason: Glucose has an aldehyde group Select the most appropriate answer from the options given below: 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) Ais true but R is false. d) A is false but R is true.	1
	SECTION:B This section contains 5 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.	
17	Define conductivity and molar conductivity for the solution of an electrolyte	2
18	a) Define rate of reaction b) Express the rate of the following reaction in terms of the formation of ammonia: $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$	2
19.	a) Arrange the following in increasing order of boiling point: (i) $CH_3CH_2CH_2CH_2Br$ (ii)$(CH_3)_3.Br$ (iii)$(CH_3)_2C.Br$ b) Convert Propene to1-iodopropane **OR** Giver easons: a) R- X reacts with KCN to give cyanides as major product and isocyanides as major product with AgCN. b) Chloroform is preserved in dark coloured bottles.	2
20.	a) Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions: Ethanal, Propanal, Propanone, and Butanone. b) Give a chemical test to distinguish between Ethanal and Propanal.	2
21.	a) Write a difference between a nucleoside and a nucleotide b) Vitamin C must be taken regularly in diet. Why?	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) Write IUPAC name for the compound: $[CoCl_2(en)_2]Cl$ b) Out of the following two coordination entities which is chiral (optically active) and Why? (1) cis-$[CrCl_2(ox)_2]^{3-}$ (2) trans-$[CrCl_2(ox)_2]^{3-}$	3
23	Show that in a first order reaction, time required for completion of 99.9% is10 times of half-life ($t_{1/2}$) of the reaction. **OR** A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactantis (i) Doubled, (ii)reduced to half.	3
24.	a) State Henry's law. b) The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5 g when added to 39.0 g of benzene (molar mass 78 g mol^{-1}). Vapour pressure of the solution, then, is 0.845 bar. What is the molar mass of the solid substance?	3

25.	a) The Complex $[Ti(H_2O)_6]^{3+}$ is a coloured compound. Justify. b) Explain: $[Co(NH_3)_6]^{3+}$is an inner orbital complex whereas $[CoF_6]^{3-}$is an outer orbital complex. c) Write the coordination number and oxidation number for Fe in the coordination entity $[Fe(CN)_6]^{4-}$ **OR** a) Explain on the basis of valence bond theory that $[Ni(CN)_4]^{2-}$ ion with square planar structure is diamagnetic and $[NiCl_4]^{2-}$ ion with tetrahedral geometry is paramagnetic. b) $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1: 1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1:4 molar ratio does not give the test of Cu^{2+} ion. Explain why?	3
26	a) Which one of the following compounds will undergo faste rhydrolysis reaction by SN1 mechanism? Justify your answer. $C_6H_5CH_2Cl$ or $CH_3CH_2CH_2Cl$ b) What happens when chlorobenzene reacts with Sodium hydroxide at 623 K and 300 atm pressure?	3
.27	What happens when (Attempt any three) i) Propanone is treated with methyl magnesium bromide and the product ishydrolysed. ii) Two moles of Benzaldehyde are heated with concentrated NaOH. iii) Tert-butyl alcohol is heated with copper at 573K.	3
28.	a) Arrange the following in decreasing order of their basic strength: $C_6H_5NH_2$, $C_2H_5NH_2$,$(C_2H_5)_2NH$,NH_3 b) Why Aniline does not undergo Friedel-Crafts reaction? c) What happen when $C_6H_5(NH)CH_3$ reacts with $CHCl_3$ and KOH?	3

	SECTION :D The following questions are case-based questions. Each question has aninternal choice and carries 4(1+1+2) marks each. Read the passage carefully and answer the questions that follow:	
29	When a solution does not obey Raoult's law over the entire range of concentration, then it is called non-ideal solution. The vapour pressure of such a solution is either higher or lower than that predicted by Raoult's law. If it is higher, the solution exhibits positive deviation and if it is lower, it exhibits negative deviation from Raoult's law. The osmotic pressure of a solution is the excess pressure that must be applied to a solution to prevent osmosis, i.e., to stop the passage of solvent molecules through a Semipermeable membrane into the solution. Osmotic pressure is colligative property as it depends on the number of solute molecules and not on their identity. For dilute solutions, it has been found experimentally that osmotic pressure is proportional to the molarity, C of the Solution at a given temperature T. Thus: $\Pi = C\ R\ T$. Here Π is the osmotic pressure and R is the gas constant. $\Pi=(n_2/V)RT$ a) Define ideal solution. b) What kind of deviation is found in solution of alcohol in water? c) 200 $cm^3$of anaqueoussolutionofaproteincontains1.26goftheprotein.Theosmoticpressureofsuchasolutionat300 K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein. OR Why Osmotic Pressure is used to measure the molar mass of biomolecules?	4
30	The carbohydrates may also be classified as either reducing or nonreducing sugars. All those carbohydrates which reduce Fehling's solution and Tollens' reagent are referred to as reducing sugars. All monosaccharides whether aldose or ketose are reducing sugars. Fructose also has the molecular formula $C_6H_{12}O_6$ and on the basis of its reactions itwas found to contain a ketonic functional group at carbon number 2 and six carbons in straight chain as in the case of glucose. It belongs to D- series and is a laevo rotatory compound. It is appropriately written as D-(–)-fructose. Poly saccharides contain a large number of mono saccharide units joined together by glycosidic linkages. These are the most commonly encountered carbohydrates in nature. They mainly act as the food storage or structural materials. Protein found in a biological system with a unique 3D structure and biological activity is called a native protein. When a protein in its native form, is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds are disturbed. a) Sucrose can not reduce the Tollen's reagent. Why? b) The optical activity of sucrose is changed from dextro toleavo after some time. Explain it. c) What is denaturation of protein and which structure of protein remainsintact during denaturation? **OR** What is the significance of D and L and + and – sign in sugars.	4
	SECTION:E The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.	

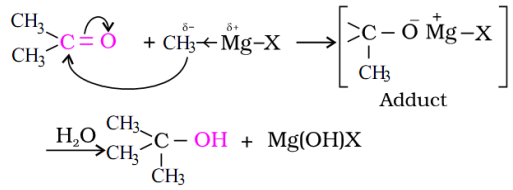
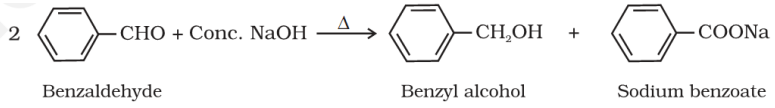
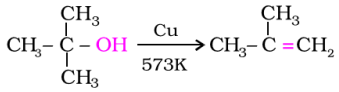
31	(a) A cell is prepared by dipping a zinc rod in 1M zinc sulphate solution and a silver electrode in 1M silver nitrate solution. The standard electrode potential given: E^0Zn^{2+}/Zn =- 0.76 V, E^0Ag^+ /Ag =+0.80 V What is the effect of increase in concentration of Zn^{2+} on the E_{cell}? (b) Write the products of electrolysis of aqueous solution of NaCl with platinum electrodes. (c) Represent the cell in which the following reaction takes place $Mg(s) + 2Ag^+(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$ Calculate its E_{cell} if E^o_{cell} = 3.17 V. Write the cell configuration **OR** a) What is the role of zinc chloride in dry cell? b) $\Lambda_m°$ for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm^2/mol respectively. Calculate Λ^o for HAc. c) Write the chemical reactions taking place at the electrodes during discharging of lead storage battery.	5
32	a) Assign reasons for the following: (i) Copper(I) ion is not known in aqueous solution. (ii) Actinoids exhibit greater range of oxidation states than lanthanoids (iii) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidizing agent. b) Complete the following chemical equations: (i) $5S^{2-} + 2MnO^-_4 + 16H^+ \longrightarrow$ (ii) $Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+} \rightarrow$	5

33.	a) Arrange the following compounds in increasing order of their boiling points: CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$ b) Would you expect Benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanal? Explain your answer. c) 4-Nitrobenzoic acid is more acidic than 4-methoxybenzoicacid. Give reason. d) Explain the following reaction (i) Aldol condensation (ii) Etard reaction **OR** a) Arrange the following compounds in increasing order of their acidity: benzoicacid, p-nitrobenzoicacid, p-methylbenzoicacid b) What happens when alkyl magnesium bromide reacts with dry ice. c) Write the reactions involved in the following: (i) Hell-Volhard Zelinsky reaction. (ii) Decarboxylation reaction. (iii) Wollf-Kishner reduction.	5

MARKING SCHEME

SECTION-A

Q. No.	Scheme of Answer	Marks
1.	3 F	1
2.	(c)3.0×10^3 mole per litre per second	1
3.	Fe^{3+}	1
4.	(a) Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.	1
5.	(b)Linkage isomers	1
6.	(c)CH_3Br,CH_3Cl,CH_3F	1
7.	o-and p-bromophenol	1
8.	d)n-butanol	1
9.	(a)nucleophilic addition	1
10.	(c)primary alcohols	1
11.	(c)trichloromethane	1
12.	(a)aniline	1
13.	(c) A is true but R is false.	1
14.	b) Both A and R are true but R is not the correct explanation of A.	1
15.	c) A is true but R is false.	1
16.	b) Both A and R are true but R is not the correct explanation of A.	1
	SECTION:B	
17.	Correct definitions	1+1
18.	a) Definition b) ½ × Δ[NH_3]/Δt	1 1
	$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$ Correct solution **OR** (i)4 times (ii)¼ times	½ 1 ½ 1 1
19.	a) (i)$CH_3CH_2CH_2CH_2Br$ >(ii)$CH_3CH_2CH(CH_3).Br$ >(iii)$(CH_3)_3C.Br$ b)$CH_3CH{=}CH_2 \xrightarrow{HBr/H_2O_2} CH_3CH_2CH_2Br \xrightarrow{AgI}$ CH3CH2CH2I **OR** a) Correct reason b) Correct reason	1 1 1 1
20.	a) Ethanal>Propanal>Propanone>Butanone. b) Tollens test	1 1
21.	Nucleotide contains a phosphate group Deficiency of Vitamin C caused scurvy diseased.	1 1
	SECTION :C	

22	a) Bis-(ethane-1,2-diamine)dichloridocobalt(III) chloride b) (1)cis-$[CrCl_2(ox)_2]^{3-}$ this compound has nonsuperimposable mirror image.	1 1 1
23	$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$ Correct solution **OR** (i)4 times (ii)¼ times	1 2 1 1
24.	b) Henry's law. c) $\frac{P^o - P}{P^o} = \frac{w_2 \times M_1}{M_2 \times w_1}$ $\frac{0.85 - 0.845}{0.85} = \frac{0.5 \times 78}{M_2 \times 39}$ Calculation =170 g mol^{-1}	1 ½ ½ ½ ½
25.	Ti^{3+}contains one unpaired electron b) $NH_3$is a strong ligand whereas Fis a weak ligand c) Coordinationnumber=6,oxidationnumber=+2 **OR** a) Ni^{2+} in $[Ni(CN)_4]^{2-}$ ion has all electron paired to form dsp2 hybridisation whereas Ni^{2+} in $[NiCl_4]^{2-}$ ion has unpaired electron in sp3 hybrid state. b) $FeSO_4$ solution with $(NH_4)_2SO_4$forms a double salt (Mohrs salt) while$CuSO_4$solutionwithammoniaform a complex.	1 1 ½ + ½ 1+1 1
26.	a) $C_6H_5CH_2Cl$ because stable benzyl carbocation $C_6H_5Cl + NaOH \rightarrow C_6H_5OH + NaCl$	1 1 1
27.	i.  ii.   iii.	1 1 1
28.	a) $(C_2H_5)_2NH > C_2H_5NH_2 > C_6H_5NH_2 > NH_3$ b) -NH_2 group react with AlCl3 predominantly. c) No reaction, because it is a secondary amine and does not undergo carbylamine reaction.	1 1 1
	SECTION :D	

29.	Definition of idealsolution. Negative deviation c) $M = \frac{w \times RT}{V \times \Pi}$ $M = \frac{1.26 \times 0.083 \times 300 \times 1000}{200 \times 2.57 \times 10^{-3}}$ Calculation = 61039 g mol^{-1} **OR** Because biomolecules are macromolecule. They have large molar mass and variable molar mass.	1 1 ½ 1//2 ½ ½ 2
30.	a) Because it does not contain an aldehyde group. b) Sucrose is a dextro compound but after hydrolysis it convert to equimolar mixture of glucose and fructose which is a leavo rotatory mixture. c) destruction of working nature of protein by any factor is called denaturation. Primary structure. **OR** D andLare configuration which can be explained by pen-paper by the configuration of OH group on second-last carbon. +and–are the sign for dextro and leavo respectively after experimental verification	1 1 1 1 2
	SECTION:E	
31.	(a) $E_{(cell)} = E^{\ominus}_{(cell)} - \frac{RT}{2F} \ln \frac{[Zn^{2+}]}{[Ag^{+}]^2}$ According to Nernst equation if concentration of Zn^{2+}increased, Ecell will be decreased. (b) $NaCl\ (aq) \xrightarrow{H_2O} Na^+\ (aq) + Cl^-\ (aq)$ Cathode: $H_2O(l) + e^- \rightarrow ½\ H_2(g) + OH^-\ (aq)$ Anode: $Cl^-\ (aq) \rightarrow ½\ Cl_2(g) + e^-$ (c) $E_{(cell)} = E^{\ominus}_{(cell)} - \frac{RT}{2F} \ln \frac{[Mg^{2+}]}{[Ag^{+}]^2}$ $= 3.17\ V - \frac{0.059V}{2} \log \frac{0.130}{(0.0001)^2}$ Calculation = 2.96 V $Mg(s) + 2Ag^+(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$ **OR** a) Zinc chloride increased conductivity of electrolyte and captures produced ammonia gas b) $\Lambda^{o}_{m(HAc)} = \Lambda^{o}_{m(HCl)} + \Lambda^{o}_{m(NaAc)} - \Lambda^{o}_{m(NaCl)}$ $= (425.9 + 91.0 - 126.4)$ Calculation = 390.5 S cm^2 mol^{-1}	1 1 ½ ½ ½ 1 1 ½ ½ ½ ½

	c) Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$ Cathode: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$	2
34.	a)(i) Cu^+ in an aqueous solution is unstable because it disproportionates to give Cu^{2+} and Cu. (ii) because of the very small energy gap between 5f, 6d and 7s ubshells. (iii) Cr^{3+} is more stable than Cr^{+2} ion Mn^{2+} is more stable than Mn^{3+} b) (i) $5S^{2-} + 2MnO^-_4 + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 5S$ (ii) $Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+} \rightarrow 2\ Cr^{3+} + 6\ Fe^{3+} + 7\ H_2O$	1 1 1 1 1
35.	a) $CH_3CH_2CH_3 > CH_3OCH_3 > CH_3CHO > CH_3CH_2OH$ b) Propanal is more reactive towards nucleophilic reaction because carbon atom in propanal is more electrophilic than benzaldehyde. Benzaldehyde undergoes resonance. c) Because nitro group is electron withdrawing which stabilizes carboxylate anion and ease the releasing of proton. d) (i) $2\ CH_3\text{–}CHO \underset{}{\overset{\text{dil. NaOH}}{\rightleftharpoons}} CH_3\text{–}CH(OH)\text{–}CH_2\text{–}CHO \xrightarrow[-H_2O]{\Delta} CH_3\text{–}CH{=}CH\text{–}CHO$ Ethanal — 3-Hydroxybutanal (Aldol) — But-2-enal (Aldol condensation product) (ii) Toluene $\xrightarrow[CS_2]{+\ CrO_2Cl_2}$ Chromium complex $\xrightarrow{H_3O^+}$ Benzaldehyde **OR** a) p-methylbenzoicacid> benzoicacid > p-nitrobenzoicacid b) Carboxylic acid is formed $R\text{-}Mg\text{-}X + O{=}C{=}O \xrightarrow{\text{Dry ether}} R\text{—}C(=O)(O^-MgX^+) \xrightarrow{H_3O^+} RCOOH$ c) (i) $R\text{-}CH_2\text{-}COOH \xrightarrow[(ii)\ H_2O]{(i)\ X_2/\text{Red phosphorus}} R\text{-}CH(X)\text{-}COOH$ (ii) $R\text{-}COONa \xrightarrow[\text{Heat}]{NaOH\ \&\ CaO} R\text{-}H + Na_2CO_3$ (iii) $>C{=}O \xrightarrow[-H_2O]{NH_2NH_2} >C{=}NNH_2 \xrightarrow[\text{heat}]{KOH/\text{ethylene glycol}} >CH_2 + N_2$	1 1 1 1 1 1 1 1 1 1 1

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-10

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator is not allowed.

SECTION A

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

1. Calculate the emf of the following cell at 298 K:
$Mg(s)|Mg^{2+}_{(0.1\ M)}// Cu^{2+}_{(0.001\ M)}/Cu_{(s)}$[Given: Ecell = 2.71 V]
(A) 1.426 V (B) 2.503 V
(C) 2.651 V (D) 1.8 V

2. Curdling of milk is an example of:
(A) breaking of peptide linkage (B) hydrolysis of lactose
(C) breaking of protein into amino acids (D) denaturation of protein

3. Which of the following is the reason for zinc not exhibiting variable oxidation state?
(A) inert pair effect (B) completely filled 3d subshell
(C) completely filled 4s subshell (D) common ion effect

4. The increase in the temperature of the aqueous solution will result in its:
(A)Molarity to increase (B) Molarity to decrease
(C) Mole fraction to increase (D) Mass % to increase

5. Propanamide on reaction with bromine in aqueous NaOH gives:
(A) Propanamine (B) Ethanamine (C) N-MethyIethanamine (D) Propanenitrile

6.Which set of ions exhibit specific colours? (Atomic number of Sc = 21, Ti = 22, V =23, Mn = 25, Fe = 26, Ni = 2S cu = 29 and zn =30)
(A) sc^{3+}, Ti^{4+}, Mn^{3+} (B) sc^{3+}, zn^{2+}, Ni^{2+}
(C) V^{3+}, V^{2+} ,Fe^{3+} (D) Ti^{3+} Ti^{4+}, Ni^{2+}

7.Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follows:
(A)SN_I mechanism
(B)SN_2 mechanism
(C) Saytzeff rule
(D) Any of the above two depending upon the temperature of reaction

8.The formula of the coordination compound tetraamineaquachloridocobalt(III)chloride is

(A)$[Co(NH_3)_4(H_2O)Cl]Cl_2$ (B) $[Co(NH_3)_4(H_2O)Cl]Cl_3$

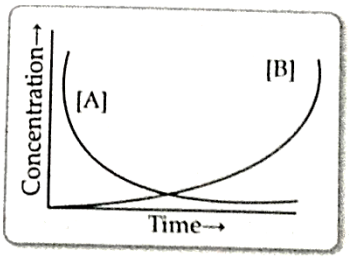
(C) $[Co(NH_3)_2(H_2O)Cl]Cl_2$ (D)$[Co(NH_3)_4(H_2O)Cl]Cl$

9. CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives:

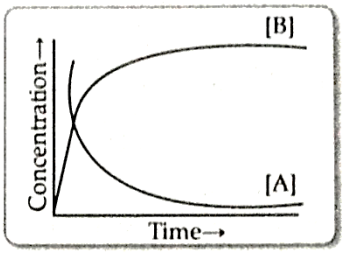
(A) $CH_3CH_2NH_2$ (B) CH_3CH_2Br

(C) CH_3NH_2 (D) CH_3COONa

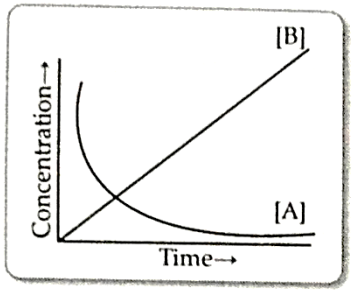
10. Consider the reaction A----→B. The concentration of both the reactants and the products varies exponentially with time. Which of the following figures correctly describes the change in concentration of reactants and products with time?



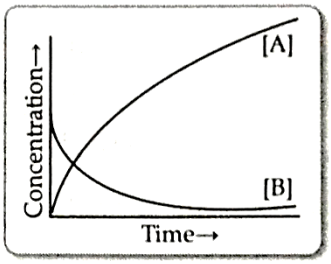
(B)



(C)



(D)



11. IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride is:

(A)N,N-Dimethylethanamine (B) N,N-Diethylmethanamine

(C) N-Methyl ethanamine (D) N-Ethyl- N-methylethanamine

12.Which of the following statement is correct?

(A)The rate of a reaction decreases with passage of time as the concentration of reactants decreases.

(B)The rate of a reaction is same at any time during the reaction.

(C)The rate of a reaction is independent of temperature change.

(D)The rate of a reaction decreases with increase in concentration of reactant(s)

Questions 13-16 are Assertion and Reason Questions:

(A)Both assertion (A) and reason (R) are correct statements, and reason (R) is the correct explanation of the assertion.

(B)Both assertion (A) and reason (R) are correct statements, but reason (R) is not the correct explanation of the assertion.

(C)Assertion (A) is correct, but reason (R) is the wrong statement.

(D)Assertion (A) is wrong, but reason (R) is the correct statement.

13. Assertion (A): When methyl alcohol is added to water, boiling point of water decreases.
Reason (R): When a volatile solute is added to a volatile solvent, elevation in boiling point is observed.

14. **Assertion :** Aniline does not undergo Friedel-Crafts reaction.

Reason : $–NH_2$ group of aniline reacts with $AlCl_3$ (Lewis acid) to give acid-base reaction.

15. **Assertion:** The order and molecularity of a reaction are always the same.
Reason: Order is determined experimentally whereas molecularity by a balanced elementary reaction..

16. Assertion (A): The rate of reaction increases with increase in temperature.
Reason (R): The reactant molecules collide less frequently.

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. Complete and balance the following chemical equations:
(a) $Fe^{2+} + MnO_4^- + H^+ \longrightarrow$
(b) $MnO_4^- + H_2O + I^- \longrightarrow$

18. With the help of resonating structures explain the effect of presence Of nitro group at ortho position in chlorobenzene.

OR

Carry out the following conversions in not more than 2 steps:
(a)Aniline to chlorobenzene
(b)2-Bromopropane to 1-Bromopropane

19.The C-14 content of an ancient piece of wood was found to have three tenths of that in living trees.How old is that piece of wood? (log 3=0.4771, log 7= 0.8540 , Half-life of C-14= 5730 years)

20. When ethanol is treated with H_2SO_4 at 423K, the following reaction takes place:
$CH_3\text{-}CH_2\text{-}OH + H_2SO_4 \longrightarrow CH_2{=}CH_2$
Give a mechanism for this reaction.

21.(a) Using crystal field theory, write the electronic configuration of Iron ion in the following complex ion. Also predict its magnetic behaviour:$[Fe(H_2O)_6]^{2+}$
(b) Write the IUPAC name of the coordination complex:$[CoCl_2(en)_2]NO_3$

SECTION C

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

22.Give reasons for the following:
(a)Transition elements and their compounds acts as catalysts.
(b)E^O value for (Mn^{2+}/Mn) is negative whereas for (Cu^{2+}/Cu) is positive.
(c)Actinoids show irregularities in their electronic configuration.

23. Arrange the following in increasing order of property specified:
(a) Aniline, ethanamine, 2-Ethylethanamine (solubility in water)
(b)Ethanoic acid, ethanamine, ethanol (boiling point)
(c)Methanamine, N, N-Dimethylmethanamine and N-Methylmethanamine (basic strength in aqueous phase)

24. Three amino acids are given below:
Alanine $CH_3\text{-}CH(COOH)(NH_2)$ Aspartic acid $HOOC\text{-}CH_2\text{-}CH(COOH)(NH_2)$ and Lysine $H_2N\text{-}(CH_2)_4\text{-}CH(COOH)(NH_2)$
(a) Make two tripeptides using these amino acids and mark the peptide linkage in both cases.
(b) Represent alanine in the zwitter ionic form.

25 Write name of the reaction, structure and IUPAC name of the product formed when (any 2):

(a) phenol reacts with $CHCl_3$ in the presence of NaOH followed by hydrolysis.

(b) $CH_3CH_2CH(CH_3)CH(CH_3)ONa$ reacts with C_2H_5Br

(c) CH_3CH_2CN reacts with stannous chloride in the presence of hydrochloric acid followed by hydrolysis

26. Represent the cell in which the following reaction takes place. The value of E^O for the cell is 1.260 V. What is the value of E_{cell}?

$2Al(s) + 3Cd^{2+}_{(0.1M)} \longrightarrow 3Cd(s) + 2A1^{3+}_{(0.01M)}$

27. Write chemical reactions to show that open structure of D-glucose contains the following :

(i) Straight chain

(ii) Five alcohol groups

(iii) Aldehyde as carbonyl group

28. The following haloalkanes are hydrolysed in presence of aq. KOH.

(a) 1 Chlorobutane (b) 2-Chloro-2-methylpropane

Which of the above is most likely to give racemic mixture? Justify your answer.

(c) Calculate the spin only magnetic moment of $[Cu(NH_3)_4]^{2+}$ion.

SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (I +1 +2) marks each.

Read the passage carefully and answer the questions that follow.

29.Several transition metal compounds show a transition from the low-spin (LS) to the high-spin (HS) electronic state with increasing temperature. The cooperative nature of the transition is usually parametrised by an interaction constant gamma, the origin of which is still under discussion. In the frame of the lattice expansion mode, the interaction gamma is attributed to the elastic interaction between the spin-changing ions as a result of the deformation of the crystal accompanying the transition.

(a)Why are low spin tetrahedral complexes not formed?

(b) What type of isomerism shown by the complex $[Co(NH_3)_5Cl]SO_4$

(c) Define the following terms with a suitable example of each:

(i) Polydentate ligand

(ii)Homoleptic complex

OR

Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.

30. Read the passage given below and answer the following questions:

An efficient, aerobic catalytic system for the transformation of alcohols into carbonyl compounds under mild conditions, copper-based catalyst has been discovered. This copper-based catalytic system utilizes oxygen or air as the ultimate, stoichiometric oxidant, producing water as the only by-product.

$$C(R_1)(R_2)\text{-H-OH} \xrightarrow[\text{5\% DBADH}_2\text{0}_2\text{ Toluene; 70 to 90 C}]{\text{5\% CuC1; 5\% Phen; 2 equiv. K}_2\text{C0}_3;} C(R_1)(R_2)=O$$

A wide range of primary, secondary, allylic, and benzylic alcohols can be smoothly oxidised to the corresponding aldehydes or ketones in good to excellent yields. Air can be conveniently used instead of oxygen without affecting the efficiency of the process. However, the use of air requires slightly longer reaction times.

This process is not only economically viable and applicable to large-scale reactions, but it is also environmentally friendly.

(a)What is the use of copper based catalyst mention in the above study?

(b)Write the reaction involved in Kolbe's reaction.

(c) (i) Out of but-3-en-2-ol and but-2-en-2-ol, which is a secondary allylic alcohol?

(ii)Explain why alcohols and ethers of comparable molecular mass have different boiling points?

OR

How do you convert:

(i) Phenol to benzene (ii) Formaldehyde to ethanol

SECTION E

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

31. Attempt any five of the following:

(i)Write the reaction for cross aldol condensation of acetone and ethanal.

(ii) Give a chemical test to distinguish between Benzoic acid and Phenol.

(iii)Give the structure of 4- Nitro Propiophenone.

(iv) Arrange the following in decreasing order of their acidic strength

CH_3CH_2OH, CH_3COOH, $ClCH_2COOH$, FCH_2COOH, $C_6H_5CH_2COOH$

(v) Carboxylic acids contain the carbonyl group but do not show the nucleophilic addition reaction like aldehydes or ketones. Why?

(vi) What is Tollen's reagent? Write one usefulness of this reagent

(vii) Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions : ethanal, propanal, propanone, butanone.

32. (a) What is Kohlrausch's law of independent migration of ions explain it's application with an example?

(b) Calculate the emf of the following cell at 298 K:

$Al_{(s)} / Al^{3+}_{(0.15M)} // cu^{2+}_{(0.025M)} / cu_{(s)}$

(Given $E^{O}_{(Al3+/Al)}$ = — 1 66V ,$E^{O}_{(Cu2+/Cu)}$ = 0.34V, log 0.15 = -0.8239, log 0.025 =—1.6020)

OR

The cell in which the following reaction occurs: $2Fe^{3+}(aq) + 2I^{-}(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$ has E°_{cell}=0.236 V at 298 K. Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

33. (a) 30 g of urea (M = 60 g mol^{-I}) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

(b) Write two differences between ideal solutions and non-ideal solutions.

OR

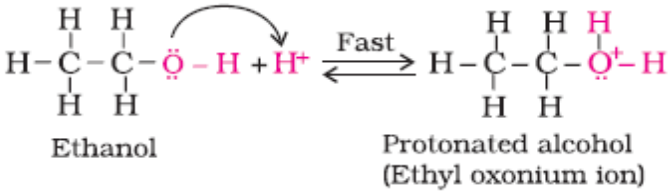
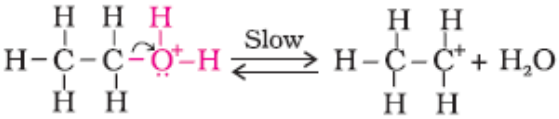
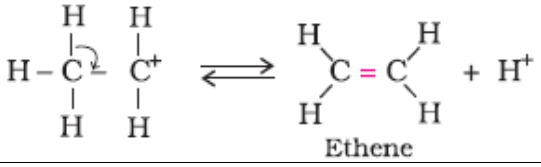
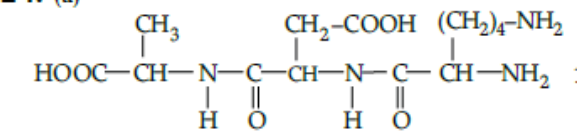
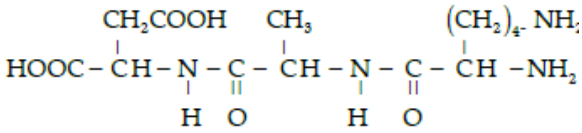
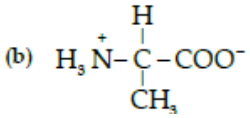
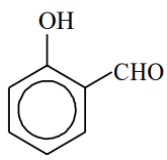
(a) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K.

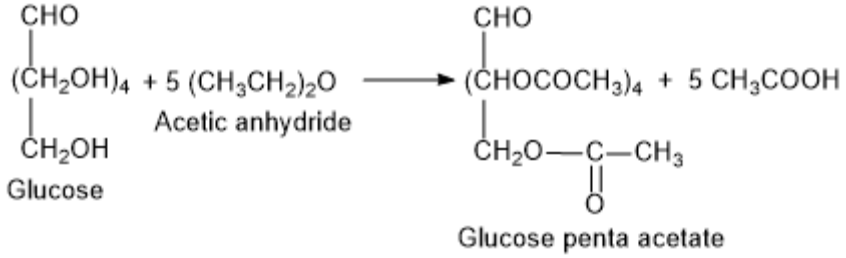
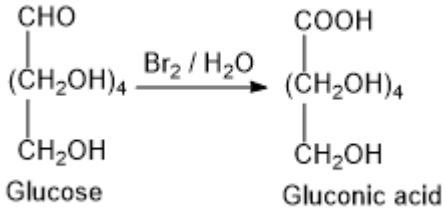
Given: (Molar mass of sucrose = 342 g mol^{-1})(Molar mass of glucose = 180 g mol^{-1})

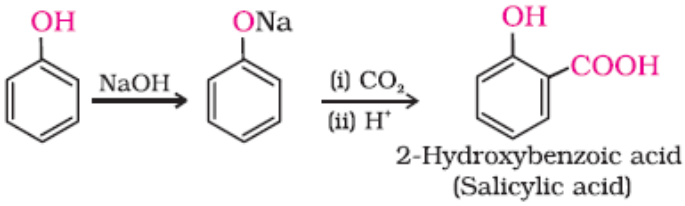
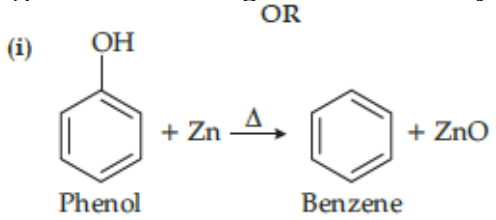
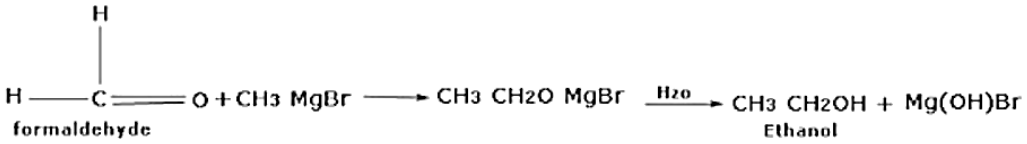
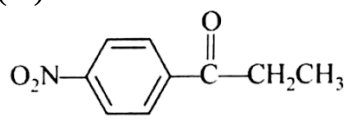
(b) Define the term: Molality (m)

MARKING SCHEME

1	C	1
2.	D	1
3	B	1
4	B	1
5	B	1
6	C	1
7	A	1
8	A	1
9	C	1
10	B	1
11	D	1
12	A	1
13	C	1
14	A	1
15	D	1
16	C	1
17	(A) $5\,Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$ (B) $2\,MnO_4^- + H_2O + I^- \longrightarrow \mathbf{2MnO_2 + IO_3^- + 2OH^-}$	1 1
18	Nitro group at orthoposition withdraws the electron density from the benzene ring and thus, facilitates the attack of the nucleophile on haloarenes (fig representation). OR	2
	(a) Aniline $\xrightarrow[273-278\ K]{NaNO_2 + HCl}$ $C_6H_5N_2^+Cl^-$ $\xrightarrow{Cu_2Cl_2}$ Chorobenezene 1 (b) $CH_3CH(Br)CH_3$ (2-Bromopropane) $\xrightarrow{alc.KOH}$ $CH_3CH=CH_2$ $\xrightarrow{HBr,\ organic\ peroxide}$ $CH_3CH_2CH_2Br$ (1-Bromopropane) 1	1 1
19	$k = 0.693/t_{1/2}$ $k = \frac{0.693}{5730}\ years^{-1}$ $t = \frac{2.303}{k}\log\frac{C_o}{C_t}$ $t = \frac{2.303}{0.693} \times 5730 \log\frac{10}{3}$ $t = 19042 \times (1 - 0.4771)$ $= 9957\ years$	½ ½ ½ ½

20	***Mechanism*** *Step 1:* Formation of protonated alcohol.  Ethanol — Protonated alcohol (Ethyl oxonium ion) *Step 2:* Formation of carbocation: It is the slowest step and hence, the rate determining step of the reaction.  *Step 3:* Formation of ethene by elimination of a proton.  Ethene	1 ½ ½
21	**(a)** $t_{2g}^4\ e_g^2$, Paramagnetic **(b)** Dichloridobis (ethane-1,2-diamine) cobalt (III) nitrate	½ + ½ **1**
22	**(a)** Due to variable oxidation state. **(b)** Mn^{2+} is stable due to exactly half filled $3d^5$ configuration/ Due to high $\Delta_a H^\circ$ and low $\Delta_{hyd} H^\circ$ for Cu^{2+}/Cu is positive **(c)** Due to comparable energies of 5*f*, 6*d* and 7*s* orbitals.	**1** **1** **1**
23	**(a)** Aniline, *N*-Ethylethanamine, ethanamine **(b)** Ethanamine, ethanol, ethanoic acid **(c)** N, N dimethylmethanamine, methanamine, N-Methylmethanamine	**1** **1** **1**
24	**24.** (a)   (b) 	**1** **1** **1**
25	(a) Reimer Tiemann ,  2-Hydroxybenzaldehyde (b) Williamson synthesis, $CH_3CH_2CH(CH_3)CH(CH_3)OC_2H_5$ 2- Ethoxy-3 -methylpentane (c) Stephen reaction, CH_3CH_2CHO, Propanal	½+1/2+1 /2 ½+1/2+1 /2 ½+1/2+1 /2

26	$Al(s) / Cd^{2+}(0.1M) // Al^{3+}(0.01M) / Cd(s)$ $2\,Al(s) + 3Cd^{2+}(0.1\,M) \rightarrow 3\,Cd(s) + 2Al^{3+}(0.01)M$ $E_{cell} = E^{\circ}_{cell} \frac{-0.059}{n} \log \frac{[Al^{3+}]^2}{[Cd^{2+}]^3}$ $E_{cell} = 1.26 - \frac{0.059}{6} \log \frac{(0.01)^2}{(0.1)^3}$ $= 1.26 - \frac{0.059}{6}(-1)$ $= 1.26 + 0.009$ $= 1.269\,V$	½ ½ ½ ½ **1**
27	(i) Glucose when heated with HI it gives n-hexane which suggests that all the carbons are forming straight chain structure in glucose. (ii) When glucose is made to react with acetic anhydride it gives glucose pentaacetate which confirms the presence of five OH group in glucose.  (iii) When glucose is treated with mild oxidizing agent it will form six carbon carboxylic acid hence the carbonyle group is present as an aldehyde.  	**1** **1** **1**
28	**(a)** Racemic mixture will be given by 2-chloro- 2-methyl butane as it is an optically active compound. **(b)** When 2-chloro-2-methyl butane undergoes S_N1 reaction, both front and rear attack are possible, resulting in a racemic mixture. (c) $\mu=\sqrt{n(n+2)}$ $=\sqrt{1(1+2)}=1.73BM$	**1** **1** **1**
29	**a)** Orbital splitting energies are not sufficiently large for force pairing. b)Ionisation isomerism c)**(i)** A ligand having several donor atoms. Example- EDTA **(ii)** A complex in which a metal is bound to only one kind of donor groups / ligands. Example- $[Co(NH_3)_6]^{3+}$ **OR** It is the magnitude of difference in energy between the two sets of *d* orbital, i.e., $t_{2g}$and e_g $t_{2g}^3\ e_g^1$	**1** **1** **2**

30	**(a)** The copper based catalyst mention in the above study can be used to convert propan-2-ol to propanone. **(b)**  2-Hydroxybenzoic acid (Salicylic acid) **(c)** i) But-3-en-2-ol is a secondary allylic alcohol. ii)presence of strong intermolecular hydrogen bonding.   	**1** **1** **2**
31	(i) Correct answer (ii) Ferric chloride test: Phenol reacts with neutral FeCl3 to form an iron-phenol complex giving violet colouration. But benzoic acid reacts with neutral FeCl3 to give a buff coloured ppt. (iii)  **(iv)** the acidity order is : FCH2COOH>ClCH2COOH>C6H5CH2COOH>CH3COOH>CH3CH2OH (v) Correct reason (vi) correct answer and one use (vii) Butanone < Propanone < Propanal < Ethanal.	**1** **1** **1** **1** **1** ½+ ½ 1
32	a)Definition and one application. **(ii)** E^o cell = E^o cathode -E^o anode = 0.34-(-1.66) = 2.00 V $Ecell = E^o cell - \frac{0.059}{n} \log \frac{[Al^{3+}]^2}{[Cu^{2+}]^3}$ Here n = 6 $Ecell = 2 - \frac{0.059}{6} \log \frac{[0.15]^2}{[0.025]^3}$ $= 2 - \frac{0.059}{6} (2\log 0.15 - 3 \log 0.025)$ $= 2 - \frac{0.059}{6}$ (-1.6478 +4.8062) = 2- 0.0311 = 1.9689V **OR**	**1+1** **1/2** **1/2** **1/2** **1/2** **1**

	$2\,Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2\,Fe^{2+}(aq) + I_2(s)$ For the given cell, $n = 2$ $\Delta_r G^\circ = -nF\,E^\circ_{cell}$ $= -2 \times 96500 \times 0.236$ $= -45.55\ kJ\ mol^{-1}$ Also, $\Delta_r G^\circ = -2.303\,RT \log K_C$ $\Rightarrow \log K_C = \frac{-\Delta_r G^\circ}{2.303RT}$ $= \frac{-45.55}{2.303 \times 8.314 \times 10^{-3} \times 298}$ $= 7.983$ $\Rightarrow K_C = \text{antilog}(7.983)$ $= 9.616 \times 10^7$	½ ½ ½ ½ ½ 1/2 1 1
33	$(P_A^0 - P_A)/P_A^0$ $= (w_B \times M_A)/(M_B \times w_A)$ $\frac{23.8 - P_A}{23.8}$ $= (30 \times 18)/60 \times 846$ $23.8 - P_A = 23.8 \times [(30 \times 18)/60 \times 846]$ $23.8 - P_A = 0.2532$ $P_A = 23.55$ mm Hg	1 1 1
	(b) **Ideal solution**: (a) It obeys Raoult's law over the entire range of concentration. (b) $\Delta_{mix} H = 0$ (c) $\Delta_{mix} V = 0$ **Non-ideal solution**: (a) It does not obeys Raoult's law over the entire range of concentration. (b) $\Delta_{mix} H$ is not equal to 0. (c) $\Delta_{mix} V$ is not equal to 0.	1+1
	OR (a) $\Delta T_f = K_f m$ Here, $m = w_2 \times 1000/M_2 \times W_1$ $273.15 - 269.15 = K_f \times 10 \times 1000/342 \times 90$ $K_f = 12.3$ K kg/mol $\Delta T_f = K_f m$ $= 12.3 \times 10 \times 1000/180 \times 90$ $= 7.6$ K $T_f = 273.15 - 7.6 = 265.55$ K (or any other correct method) (b) Number of moles of solute dissolved in pe kilogram of the solvent.	1 1 1 1 1

BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-11

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

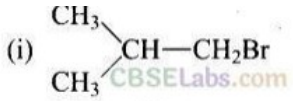
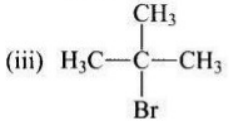
MM: 70 **Time:3 Hours**

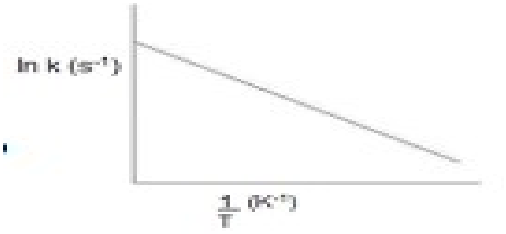
General Instructions:

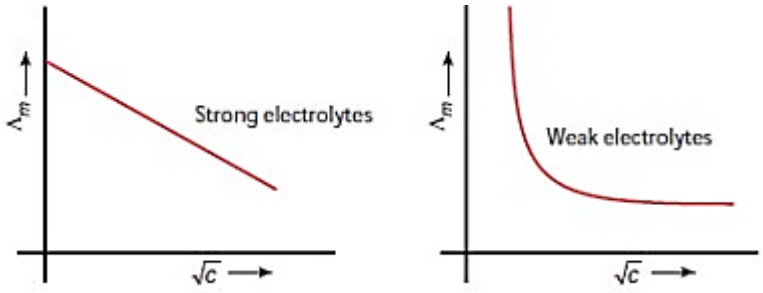
Read the following instructions carefully.

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 very 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 calculator 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.
1.	If 96500 coulomb electricity is passed through $CuSO_4$ solution, it will liberate a) 63.5 g of Cu b) 31.75 g of Cu c) 127 g of Cu d) 100 g of Cu
2.	For a reaction X → Y the rate of reaction becomes twenty-seven times when the concentration of X is increased three times. What is the order of the reaction? (a) 2 (b) 1 (c) 3 (d) 0
3	The ΔH value of the reaction $H_2+Cl_2 \rightleftharpoons 2HCl$ is −44.12 kcal. If E1 is the activation energy of the reactants and E2 is the activation energy of the products, then for the above reaction (a) E1>E2 (b) E1<E2 (c) E1=E2 (d) ΔH is not related to E1 and E2
4	The equivalent mass of $K_2Cr_2O_7$, when it acts as oxidizing agent in acidic medium, is equal to (a) M (b) M/2 (c) M/6 (d) M/5
5	Highest oxidation state of manganese in fluoride is +4 (MnF_4) but highest oxidation state in Oxides is +7 (Mn_2O_7) because (a) fluorine is more electronegative than oxygen. (b) fluorine does not possess d-orbitals. (c) fluorine stabilizes lower oxidation state. (d) in covalent compounds fluorine can form single bond only while oxygen forms double bond

6	Arrange the following compounds in increasing order of their boiling points  (i) (ii) $CH_3CH_2CH_2CH_2Br$  (iii) (a) (ii) < (i) < (iii) (b) (i) < (ii) < (iii) (c) (iii) < (i) < (ii) (d) (iii) < (ii) < (i)
7	An Organic Compound with a Pleasant Odour and 78 Degrees Boiling Point is boiled with Concentrated H_2SO_4. It gives a Colourless gas that Decolorizes Bromine Water and Alkaline Potassium Permanganate. What is this Organic Compound? . (a) $C_2H_5COOCH_3$ (b) C_2H_5OH (c) C_2H_5Cl (d) C_2H_6
8	Due to _____ An ether is More Volatile than an Alcohol having the same Molecular Formula. (a)The dipolar character of ether (b) Alcohols having resonance structures (c) Intermolecular hydrogen bonding in ethers (d) Intermolecular hydrogen bonding in alcohols
9	Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution? (a) Butan-1-ol (b)Butan-2-ol (c) Both of these (d)None of these
10	In Clemmensen Reduction carbonyl compound is treated with _____. (a) Zinc amalgam + HCl (b)Sodium amalgam + HCl (c) Zinc amalgam + nitric acid (d)Sodium amalgam + HNO_3
11	Arrange the following compounds in increasing order of basicity: CH_3NH_2, $(CH_3)_2$ NH, NH_3, $C_6H_5NH_2$ in aqueous medium a. $C_6H_5NH_2 < NH_3 < (CH_3)_2NH < CH_3NH_2$ b. $CH_3NH_2 < (CH_3)_2NH < NH_3 < C_6H_5NH_2$ c. $C_6H_5NH_2 < NH_3 < CH_3NH_2 < (CH_3)_2NH$ d. $(CH_3)_2NH < NH_3 < C_6H_5NH_2 < CH_3NH_2$
12	The helical structure of protein is stabilized by: (a) Peptide band (b) Dipeptide band (c) Hydrogen bands (d) vander Waal's forces
13	Given below are two statements labelled as Assertion (A) and Reason (R) Assertion (A): Enzymes are very specific for a particular reaction and for a particular substrate. Reason (R): Enzymes are biocatalysts. Select the most appropriate answer from the options given below: (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.

14	Assertion : Aldehydes and ketones, both react with Tollen's reagent to form silver mirror Reason : Both, aldehydes and ketones contain a carbonyl group. Select the most appropriate answer from the options given below: (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.
15	Assertion: With HI at 373 K, tert-butyl methyl ether gives tert-butyl iodide and methanol. Reason: The reaction occurs by SN2 mechanism. Select the most appropriate answer from the options given below: (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.
16	Assertion: Electrical conductivity of copper increases with increase in temperature. Reason: The electrical conductivity of metals is due to the motion of electrons. Select the most appropriate answer from the options given below: (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.
	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	Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing (i) 1.2% sodium chloride solution? (ii) 0.4% sodium chloride solution?
18	(a) Arrange the isomeric dichlorobenzene in the increasing order of their boiling point and melting points. (b) Explain why the electrophilic substitution reactions in haloarenes occur slowly and require more drastic conditions as compared to those in benzene.
19	Arrhenius equation can be represented graphically as follows: (i) What will be the intercept and slope for the graph? (ii) In the Arrhenius Equation, what does the factor $e^{-Ea/RT}$ correspond to? 
20	Write down the structures and names of the products formed when D-glucose is treated with (i) Bromine water (ii) Hydrogen Iodide (Prolonged heating)
21	Arrange the following compounds in increasing order of their property as indicated: (i) CH_3COCH_3, $C_6H_5COCH_3$, CH_3CHO (reactivity towards nucleophilic addition reaction) (ii) Cl—CH_2—COOH, F—CH_2—COOH, CH_3—COOH (acidic character)

	OR Write the reactions involved in the following reactions: (i) Clemmensen reduction (ii) Cannizzaro reaction
	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.
22	(i) A first order reaction has a rate constant 1.15 x10^{-3} $s^{-1.}$ How long will 5g of this reactant take to reduce to 3g? (ii) A reaction is first order in A and second order in B. Write the differential rate equation. How is the rate affected when the concentrations of both A and B are doubled?
23	Give reasons for the following: a) The presence of $–NO_2$ group at ortho or para position increases the reactivity of haloarenes toward nucleophilic substitution reactions. b) p-dichlorobenzene has higher melting point than that of ortho or meta isomer. c) Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.
24	(a) Give evidence that $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5(SO_4)]Cl$ are ionization isomer (b) Predict the number of unpaired electrons in the square planar $[Pt(CN)_4]^{2-}$ ion. (c) Write the formula for the following coordination compound: Dichloridobis (ethane-1, 2-diamine) cobalt (III) ion
25	Following two figures show the behaviour of strong and weak electrolytes with change of concentration.  a) What is the effect of decreasing concentration on the molar conductivity of a weak electrolyte? b) What is meant by limiting molar conductivity? c) Which equation relates molar conductivity and concentration of a strong electrolyte?
26	a) Why cannot vitamin C be stored in our body? b) Which nucleic acid is responsible for carrying out protein synthesis in the cell. c) On electrolysis in acidic solution, amino acids migrate towards cathode while in alkaline solution they migrate towards anode. Why?
27	You are given four organic compounds “A”, “B”, “C” and “D”. The compounds “A”, “B” and “C” form an orange- red precipitate with 2,4 -DNP reagent. Compounds “A” and “B” reduce Tollen’s reagent while compounds “C” and “D” do not. Both “B” and “C” give a yellow precipitate when heated with iodine in the presence of NaOH. Compound “D” gives brisk effervescence with sodium bicarbonate solution. Identify “A”, “B”, “C” and “D” given the number of carbon atoms in three of these carbon compounds is three while one has two carbon atoms. Give an explanation for y our answer.
28	(a)Give names of the reagents to bring about the following transformations: (i) Ethanoic acid to ethanol

	(ii) Propane-1-ol to propanal (b) Complete the following reactions: $CH_3CH_2OH + H_2SO_4$ (443K) $\rightarrow$ OR (a) How will you distinguish between the following pairs of compounds? (i) Pentan-2-ol and pentan-3-ol (ii) Phenol and ethanol (b) Complete the following reactions: $CH_3\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_3 + HBr \rightarrow$
	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	Perhaps the earliest known coordination compound is the bright red alizarin dye first used in India and known to the ancient Persians and Egyptians. It is a calcium Aluminum chelate complex of hydroxyanthraquinone. The first scientifically recorded observation of a completely inorganic coordination compound is German chemist, physician, and alchemist Andreas Libavius's description in 1597 of the blue colour (due to $[Cu(NH_3)_4]^{2+}$) formed when lime water containing sal ammoniac (NH_4Cl) comes into contact with brass. Another example of a coordination compound is the substance Prussian blue, with formula $KFe[Fe(CN)_6]$, which has been used as an artist's pigment since the beginning of the 18th century. Another early example of the preparation of a coordination compound is the use in 1760 of a sparingly soluble compound, potassium hexachloroplatinate(2−), $K_2[PtCl_6]$, to refine the element platinum. The sustained and systematic development of modern coordination chemistry, however, usually is considered to have begun with the discovery by the French chemist B.M. Tassaert in 1798 that ammoniacal solutions of cobalt chloride, $CoCl_3$, develop a brownish mahogany colour. He failed to follow up on his discovery, however. It remained for others to isolate orange crystals with the composition $CoCl_3 \cdot 6NH_3$, the correct formulation of which is recognized to be $[Co(NH_3)_6]Cl_3$; this shows that the six ammonia molecules are associated with the cobalt(3+) ion and the positive charge is balanced by three chloride anions. The particularly significant feature of this observation was the recognition that two independently stable compounds (i.e., cobalt chloride and ammonia) could combine to form a new chemical compound with properties quite different from those of the constituent compounds. In the 19th century, as more complexes were discovered, a number of theories were proposed to account for their formation and properties. The most successful and widely accepted of these theories was the so-called chain theory (1869) of the Swedish chemist Christian Wilhelm Blomstrand, as modified and developed by the Danish chemist Sophus Mads Jørgensen. Jørgensen's extensive preparations of numerous complexes provided the experimental foundation not only for the Blomstrand-Jørgensen chain theory but for Alsatian-born Swiss chemist Alfred Werner's coordination theory (1893) as well. Blomstrand proposed that ammonia molecules could link together as —NH_3— chains, similar to —CH_2— chains in hydrocarbons. The number of NH_3 molecules associated with the metal (i.e., the length of the chain) depends on the metal and its oxidation state. Werner later explained this number more adequately with his concept of coordination number. Jørgensen proposed that atoms or groups that dissociated into ions in solution were bonded through the NH_3 chain, whereas those that did not were bonded directly to the metal ion. (i) Name the metal ion which give Prussian Blue colour in qualitative analysis. (ii) Who is known as 'father of coordination chemistry'? (iii) $CoCl_3 \cdot 6NH_3$ gives three moles of AgCl,write the formula and IUPAC name of the coordination compound. Write the coordination no. of metal. OR Write the name and formula of coordination compound which is used for treatment of cancer, Write the coordination no. of metal.
30	All chemical reactions involve interaction of atoms and molecules. A large number of atoms/molecules are present in a few gram of any chemical compound varying with their atomic/molecular masses. To handle such large number conveniently, the mole concept was introduced. All electrochemical cell reactions are also based on mole concept. For example, a 4.0 molar aqueous solution of NaCI is prepared and 500 mL of this solution is electrolysed.

	This leads to the evolution of chlorine gas at one of the electrode. The amount of products formed can be calculated by using mole concept. (i) How many moles of chlorine gas evolved? (ii) What weight of amalgam formed from this solution if cathode is a Hg electrode? (iii) Write the equation of electrolysis of aqueous sodium chloride. How many moles of electrons involved in the electrolysis? OR Write the equation of electrolysis of molten sodium chloride. In electrolysis of aqueous NaCl solution when Pt electrode is taken, which gas is liberated at cathode?
	SECTION E The following questions are long answer type and carry 5 marks each. All questions have an internal choice.
31	Attempt any five of the following: (i) Name a member of the lanthanoids series which is well known to exhibit +4 oxidation state. (ii) Actinoids contraction is greater from element to element than lanthanoids contraction. (iii) Which out of Lu $(OH)_3$ and $La(OH)_3$ is more basic and why? (iv) What is the effect of increasing pH on a solution of potassium dichromate? (v) Describe the oxidizing action of potassium dichromate and write the ionic equations for its reaction with: Iodide (vi) Why is the E^o value for the Mn^{3+}/Mn^{2+} couple much more positive than that for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}? Explain. (vii) Why Cu+ ion is not stable in aqueous solutions?
32	(i) A solution of glucose (molar mass = 180 g mol-1) in water is labelled as 10% by mass. What would be the molality and molarity of the solution? (Density of solution = 1.2 g mL-1) (ii) Define the following terms: (a) Azeotrope (b) Osmotic pressure (c) Colligative properties OR (i) On mixing liquid X and liquid Y, the volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution? What change in temperature would you observe after mixing liquids X and Y? (ii) Suman took two glasses of water from a water filter. She cools one glass in a fridge and warms the other glass on a stove. Which glass of water will hold more dissolved oxygen? (iii) At 25°C the saturated vapor pressure of water is 3.165 kPa (23.75 mm Hg). Find the saturated vapor pressure of a 5% aqueous solution of urea (carbamide) at the same temperature. (Molar mass of urea = 60.05 g mol–1)
33	(i) Give plausible explanation for : (a) Why are amines less acidic than alcohols of comparable molecular masses? (b) Why do primary amines have higher boiling points than tertiary amines? (c) Why are aliphatic amines stronger bases than aromatic amines

(ii) Arrange the following compounds in Increasing order of solubility in water :
$C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$

(iii)Describe Hofmann's bromamide reaction

OR

(a) Give the structures of A, B and C in the following reactions :

(*i*) $CH_3Br \xrightarrow{KCN} A \xrightarrow{LiA/H_4} B \xrightarrow[273\ K]{HNO_2} C$

(*ii*) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{Br_2+KOH} B \xrightarrow{CHCl_3+NaOH} C$

(*iii*) $CH_3CN \xrightarrow{H_2O/H^+} A \xrightarrow[\Delta]{NH_3} B \xrightarrow{Br_2+KOH} C$

(b) Arrange the following in the increasing order of their boiling point: $C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3N$

(c) Aniline does not undergo Friedel - Crafts reaction. Why?

MARKING SCHEME

1. (B)	**2.(C)**	**3. (a)**	**4(c)**
5. (d)	**6(c)**	**7(b)**	**8. (d)**
9(c)	**10(b)**	**11(a)**	**12(c)**
13(b)	**14(d)**	**15(c)**	**16(d)**

17. Ans: (i) Water will flow out of the cell and they will shrink as 1.2 % sodium chloride solution is hypertonic

(ii) Water will flow into the cell and they will swell as 0.4 % sodium chloride solution is hypotonic.

18. (a) m-dicholrobenzene < o-dicholrobenzene < p-dicholrobenze

symmetrical structure and close packing in para isomer ortho has a stronger dipole dipole interaction as compared to meta.

(b) The halogen atom because of its –I effect has some tendency to withdraw electrons from the benzene ring. As a result, the ring gets somewhat deactivated as compared to benzene and hence the electrophilic substitution reactions in haloarenes occur slowly and require more drastic conditions as compared to those in benzene.

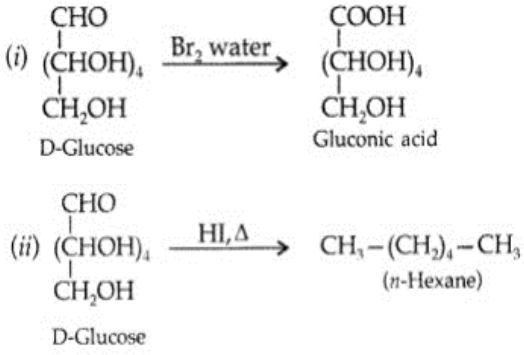
19. Exponential Form of Arrhenius Equation is $k=Ae^{-Ea/RT}$

k= Rate constant; A= Frequency factor Ea= Activation energy; R=Gas constant; T= temperature

(i) Intercept is lnA and Slope is -Ea /R

(ii) $e^{-Eo/RT}$ corresponds to the fraction of molecules having kinetic energy greater than Ea.

20.



21. (i) $C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO$ (Reactivity towards nucleophilic addition)

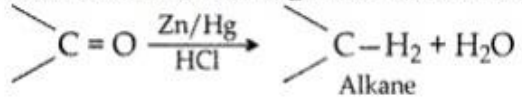
(ii) $CH_3—COOH < CH_2(Cl)—COOH < F—CH_2—COOH$

(Increasing acidic character)

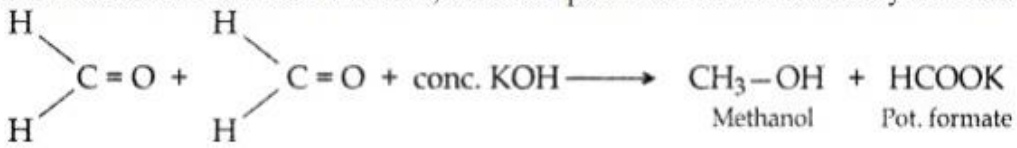
OR

Answer:

(i) Clemmensen reduction. The carbonyl group of aldehyde and ketones is reduced to CH_2 group on treatment with zinc amalgam and concentrated hydrochloric acid.



(ii) Cannizzaro reaction. Aldehydes, which do not have an a-hydrogen atom undergo self oxidation and reduction on treatment with cone, alkali and produce alcohol and carboxylic acid salt.



22.(i) From the question, we can write down the following information:

Initial amount = 5 g, Final amount = 3 g, Rate constant = 1.15 x 10-3 s -1

We know that for a first order reaction,

$$t = \frac{2.303}{k} \log \frac{[R_0]}{[R]} = \frac{2.303}{1.15 \times 10^{-3}} \log\left(\frac{5}{3}\right)$$

$$= 2.00 \times 10^3 \log(1.667)$$

$$= 2 \times 10^3 \times 0.2219$$

$$= 444 \text{ s.}$$

(ii)It is given that a reaction is first order in A and second order in B. (i) The differential rate equation is as follows: Rate = R =$k[A][B]^2$

When the concentrations of both A and B are doubled, rate becomes 8 times.

R'' = $k[2A][2B]^2$ = 2x2x2 $k[A][B]^2$ = 8R

23. a) The presence of nitro group at ortho- and para-positions withdraws the electron density from the benzene ring and thus facilitates the attack of the nucleophile on haloarene. The carbanion thus formed is stabilised through resonance. The negative charge appeared at ortho- and para- positions with respect to the halogen substituent is stabilised by –NO2 group.

b) The melting point of para isomer is quite higher than that of ortho or meta isomers. This is due to the fact that it has symmetrical structure and therefore, its molecules can easily pack closely in crystal lattice. As a result, intermolecular forces of attraction are stronger and therefore, greater energy is required to break its lattice and it melts at higher temperature.

c) $SOCl_2$ is preferred because in this case both the other products formed are gases (SO_2 and HCl) and escape readily leaving chloroethane.

24 (a) $[Co(NH_3)_5Cl]SO_4 + BaCl_2 \rightarrow BaSO_4$ (white ppt)

$[Co(NH_3)_5(SO_4)]Cl + AgNO_3 \rightarrow AgCl$ (white ppt)

(b) Pt = $5d^9\ 6s^1$ Pt (II) = $5d^8$, square planar geometry and dsp^2 hybridization.

(c) $[Co\ Cl_2\ (en)_2]^+$

25. a) When concentration of weak electrolyte becomes very low its degree of ionization rises sharply, there is a sharp increase in the ions in the solution hence the molar conductivity of a weak electrolyte rises steeply at low concentration .

b) The molar conductivity of a solution at infinite dilution is known as limiting molar conductivity. In other words, When the concentration of the electrolyte approaches zero, the molar conductivity is known as limiting molar conductivity.

c) Debye-Huckel-Onsagar equation, $\Lambda = \Lambda^\circ - A\sqrt{c}$ in which Λ is the molar conductance at concentration C, Λ° is the molar conductance at infinite dilution and A is a constant.

26. (a) Because it is soluble in water and readily excreted in urine and cannot be stored in our body.

(b) Ribonucleic acid, or RNA, is primarily engaged in the process of protein synthesis.

(c) In acidic solution, COO^- group of zwitter ion formed from α -amino acid is protonated and $NH3^+$ groups is left unchanged while in basic solution deprotonation converts NH_3^+ to NH_2 and COO^- is left unchanged.

27. A, B and C contain carbonyl group as they give positive 2,4 DNP test

A and B are aldehydes as aldehydes reduce Tollen's reagent C is a ketone, as it contains carbonyl group but does not give positive Tollen's test.

C is a methyl ketone as it gives positive iodoform test B is an aldehyde that gives positive iodoform test.

D is a carboxylic acid Since the number of carbons in the compounds A,B,C and D is three or two B is CH_3CHO as this is only aldehyde which gives a positive iodoform test.

The remaining compounds A, C and D have three carbons A is CH_3CH_2CHO, C is CH_3COCH_3 and D is CH_3CH_2COOH.

28. Ans: (a) (i) $LiAlH4/H3O^+$ (ii) PCC

(b) $CH3CH2OH + H2SO4\ (443K) \rightarrow CH2= CH2 + H2O$

OR

(a) (i) Pentan-2-ol respond to iodoform test and gives yellow ppt of iodoform but no reaction with pentan-3-ol.

(ii)Phenol respond to FeCl3 test & gives violet colour but no reaction with ethanol. Also, Iodoform test can be used.

(b) $CH3\text{-}CH2\text{-}CH2\text{-}O\text{-}CH3 + HBr \rightarrow CH3\text{-}CH2\text{-}CH2\text{-}OH + CH3\text{-}Br$

29. (i) Fe^{3+} (ii) Alfred Werner's

(iii)$[Co(NH_3)_6]Cl_3$, Hexaamminecobalt(III) chloride, C.N. – 6

OR

Cisplatin $\{cis\text{–}[Pt(NH_3)_2Cl_2])\}$, C.N. – 4

30. (i) $nNaCl=4\times500/1000=2$ mol

$\therefore\therefore$ $nCl2=1$ mol $Cl2 = 1$ mol

(ii) n_{Na} deposited = 2 mol

$\therefore\therefore$ n_{Na_Hg} formed = 2 mol

$\therefore\therefore$ Mass of amalgam formed = 2 x 223 = 446 g

(iii) $2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-$ $E° = -1.0$ V

$Na^+(l) + e^- \rightarrow Na(l)$ $E° = -2.71$V

$2H_2O \rightarrow O_2(g) + 4H^+ + 4e^-$ $E° = -1.42$ V

$2Cl^- \rightarrow Cl_2 + 2e^-$ $E = -1.36$V

2 moles of electrons involved in the electrolysis?

OR

(iii) $NaCl \rightarrow Na^+(l) + Cl^-(l)$

At cathode: reduction of $2Na^+(l) + e^- \rightarrow Na(l)$

At anode: oxidation of $2Cl^-(l) \rightarrow Cl_2(g) + 2e^-$

Net reaction is written as: $2Na^+(l) + 2Cl^-(l) \rightarrow 2Na(l) + Cl_2(g)$

In electrolysis of aqueous NaCl solution when Pt electrode is taken, H_2 gas is liberated at cathode.

31. (i) Cerium (Z = 58)

(ii) This is because of poor shielding by 5f electrons in actinoids in comparison with shielding of 4f electrons in lanthanoids.

(iii) $La(OH)_3$ is more basic than $Lu(OH)_3$ due to lanthanoids contraction

(iv) $Cr_2O_7^{2-} + H_2O \rightleftharpoons 2CrO_4^{2-} + 2H^+$

(v) $Cr_2O_7^{2-}+14H^++6I^-\rightarrow 2Cr^{3+}+3I_2+7H_2O$

(vi) Much larger third ionization energy of Mn (where the required change is d^5 to d^4 is mainly responsible for this.

(vii) This is because although energy is required to remove one electron from Cu+ to $Cu^{2+,}$ high hydration energy of Cu^{2+} compensates for it. Therefore, Cu^+ ion in an aqueous solution is unstable. It is disproportionate to give Cu^{2+} and Cu.

32. (i)

(i) Calculation of molality

Mass of glucose = 10 g

Moles of glucose = $\frac{10}{180}$ = 0.0556

(Molar mass of glucose = 180 g/mol)

Mass of water = 90 g

$$\therefore \text{Molality} = \frac{\text{Moles of glucose}}{\text{Mass of water}} \times 1000$$

$$= \frac{0.0556}{90} \times 1000$$

$$= 0.618 \text{ m}$$

(ii) Calculation of molarity

Moles of glucose = 0.0556 Mass

$$\text{Volume of solution} = \frac{\text{Mass}}{\text{Density}}$$

$$= \frac{100}{1.20} = 83.3 \text{ mL}$$

$$\text{Molarity} = \frac{\text{Moles of glucose}}{\text{Vol. of solution}} \times 1000$$

$$= \frac{0.0556}{83.3} \times 1000$$

$$= 0.667 \text{ M}$$

(ii) (a) The binary mixtures of liquids having same composition in liquid and vapour phase and boil at a constant temperature are called azeotropes.

(b) The excess of pressure which must be applied to the solution side to prevent the passage of solvent into it through a semipermeable membrane is called osmotic pressure.

(c) The properties of solutions which depend only on the number of solute particles in the solution but independent of their nature are called colligative properties.

OR

(i) The solution will show negative deviation from Raoult's law. Temperature will rise

(ii) The glass which is cooled in the fridge has high solubility .

(iii)

$W_B = 5$ g, $W_A = 95$ g, $M_B = 60.05$ g mol^{-1}, $M_A = 18$ g mol^{-1}, $p^o_A = 3.165$ kPa

Substituting the values in the expression

$$\frac{p^o_A - p}{p^o_A} = \frac{W_B \times M_A}{M_B \times W_A}, \text{ we get}$$

$$\frac{3.165 \text{ kPa} - p}{3.165 \text{ kPa}} = \frac{5 \text{ g} \times 18 \text{ g mol}^{-1}}{60.05 \text{ g mol}^{-1} \times 95 \text{ g}} = 0.015$$

$$p = 3.165 \text{ kPa} - 0.015 \times 3.165 \text{ kPa}$$

$$p = \mathbf{3.118 \text{ kPa}}$$

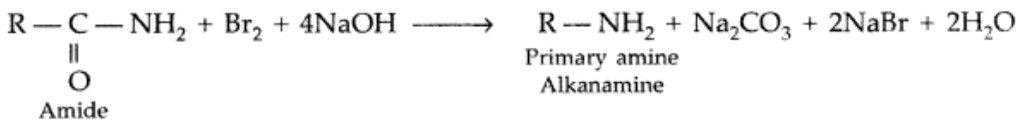
33. (i) a) Phenyl group is electron withdrawing, increases electron density on nitrogen whereas methyl group is electron donating group

b) intermolecular H-bonding in primary amines.

c) lone pair of electrons of N-atom in aromatic amines are involved in resonance with the benzene ring, so they are not available for donation. While N-atom in aliphatic amines can easily donate its lone pair of electrons

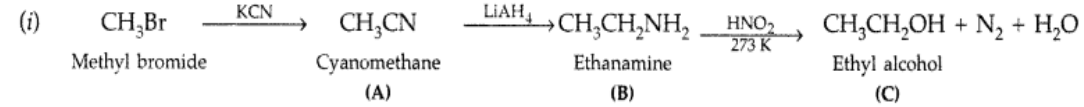
(ii) $C_6H_5NH_2 < (C_2H_5)_2NH < C_2H_5NH$

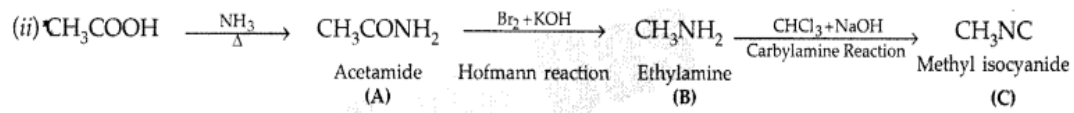
(iii) Hofmann's bromamide reaction : Primary amines can be prepared by treating an amide with Br_2 in an aqueous or alcoholic soln of NaOH.

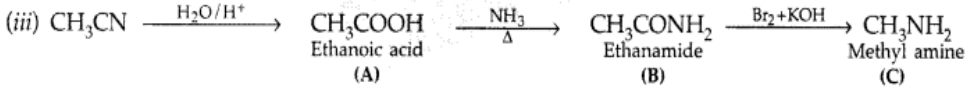


OR

(a)

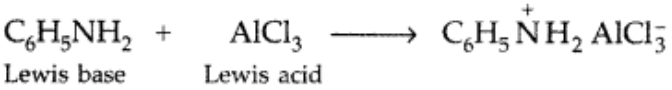






(b) Increasing order of boiling point :
$(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$

(c) Aniline being a Lewis base reacts with Lewis acid $AlCl_3$ to form a salt.



As a result, N of aniline acquires positive charge and hence it acts as a strong deactivating group for electrophilic substitution reaction. Consequently, aniline does not undergo Freidel Crafts reaction.

BLUE PRINT

S.N	Name of Chapter	Obj. Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-12

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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.

1. Reimer-Tiemann reaction is given by phenols when treated with alkali and chloroform. Which of the following statement is INCORRECT ?

a. The product of reaction is salicyldehyde.
b. If $CHCl_3$ is substituted by chloroform salicylic acid is formed.
c. It is electrophillic substitution reaction
d. Reaction does not occur in presence aq KOH.

2. Tertiary alkyl halides follow SN^1 mechanism for nucleophillic substitution rection generally. If reactant alkyl halide is optically active, the product will be:

a. A equimolar mixture of two enantiomers . b. Inversion of configuration .
c. Partial racemic mixture d. One enantiomer only.

3. Zr and Hf have almost similar atomic and ionic radii because of:

a. Lanthanoid contraction b. Actinoid contraction
c. Diagonal relationship d. Belong to same group

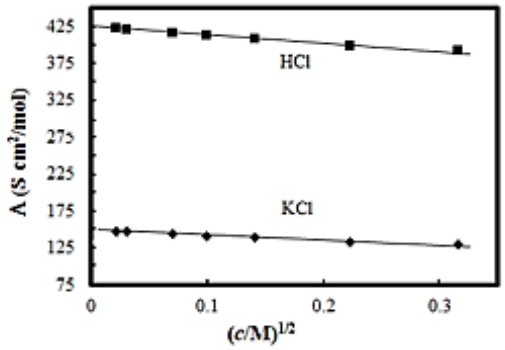
4. Rate for the reaction $X \rightarrow Y$ it is found that rate of reaction doubles when the concentration of X is increased four times .The order of reaction X is :

a. 0 b. ½
c. 2 d. 1

5. The esters are compounds having sweet smell ,undergo hydrolysis in presence of excess of water .If concentration of water is made limited ,Which of the following statement is CORRECT for the hydrolysis of esters ?

a. The reaction is pseudo first order reaction
b. It is 2^{nd} order reaction
c. The order is 1
d. The order can not be predicted.

6. The molar conductivity of CH_3COOH at infinite dilution is 390 Scm^2/mol. Using the graph and given information, the molar conductivity of CH_3COOK will be:



a. 100 Scm^2/mol b. 115 Scm^2/mol

c. 150 Scm^2/mol d. 125 Scm^2/mol

7. Arrange the following amines in the increasing order of their basic strength in aqueous solutions:
A: Dimethylamine, B: Methylamine, C: Trimethylamine

a. C<B<A b. A<B<C

c. A<C<B d. B<C<A

8. The No of stereoisomers of $[Pt(NH_3)_2Cl_2]$ are:

a. 1 b.2

c. 3 d. 0

9. What would be the major product of the following reaction?
$(CH_3)_3C\text{-}O\text{-}C_2H_5 + HI \rightarrow$

a. A= $(CH_3)_3COH$, B = C_2H_6 b. A= $(CH_3)_3COH$, B = C_2H_5I

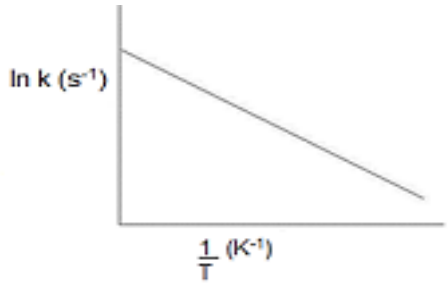
c. A= $(CH_3)_3C\text{-}I$, B = C_2H_5OH d. None of above

10 .Nitration of aniline yields substantial amount of m- nitroanilene due to?

a. NH_2 group is meta directing. b. anilinium ion formed is meta directing .

c. NH_2 group is ortho and para directing d..none of the above.

11. Arrhenius equation can be represented graphically as follows:



The (i) intercept and (ii) slope of the graph are:

a. (i) ln A (ii) Ea/R b. (i) A (ii) Ea

c. (i) ln A (ii) - Ea/R d. (i) A (ii) -Ea

12. The compound which will not reduce Fehling solution is:

a. ethanal

b. 2-methylpropanal

c . 2-methylpentanal

d . benzaldehyde

13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): All Alcohols on dehydrogenation yield aldehydes and ketones.

Reason (R): The vapours of alcohols are passed over Cu at 573 K for dehydrogenation..

Select the most appropriate answer from the options given below:

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.

14. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Nucleotide is phosphoester of nucleoside.
Reason (R): Nucleic acids are formed by combination of nucleotides.
Select the most appropriate answer from the options given below:
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.

15. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion: KMnO4 is purple coloured .
Reason:The colour of copound is due to partially filled d orbitls and d-d transition..
Select the most appropriate answer from the options given below:
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.

16. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): P^{Kb} value of aniline is more than methylamine.
Reason (R): Methyl amine has higher P^{Kb} value than ammonia.
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.

SECTION B

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

17.A first-order reaction takes 40 min for 30% decomposition. Calculate its half life time?

18. What is denaturation of proteins and what is the effect of denaturation on structure and function of protein?

19. Give reason for the following:
a. In aryl halides halogen atom is ring deactivating but ortho and para directing.
b. The product formed during $S_N1$reaction is a racemic mixture.
OR
a. How will you prepare ethyl isocyanide from a suitable compound with a suitable reagent?
b. Among isomers of Dibromobenzene, which isomer is expected to have highest melting point and why ?

20. Write the reaction which takes place in a button cell and explain that why, these cells operate at a constant voltage?

21. Explain why order of a reaction can be fractional while molecularity of reaction can not be fractional ?

SECTION C

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

22. a.If acetaldehyde, propane, propanone acetic acid and ethanol are arranged in increasing order of their boiling points ,which two compounds are expected third and last positions ?

b. A carbonyl compound molecular formula C_3H_6O having two functional isomers .One of the isomer reacts with HCN at higher rate than other .Write the structure of both isomers and mention reasons for higher reactivity of the isomer.

23.a.Polydentate ligands when co-ordinate with central metal the complex so formed more stable than the complex formed with unidentate ligand. identify the complex and give the reason for higher stability of such compounds.

b.What type of isomerism $[Co(NH_3)_5 (SO_4)]Cl$ is expected to exhibit and why ?

24. What happens when (give chemical equation for the following reactions)

a. Acetone treated with $NaBH_4$

b. Propanal is treated with Zn-Hg and HCl.

c. Propanoic acid treted with Cl_2 in presence of red P and water.

25 a) What is an ambidentate ligand ? Give two examples.

b) Draw diagram for spilliting of five d-orbitals in octahedral crystal field.

26. 18 gm of glucose dissolved in 1000 gm of water in a container .At what temperature this solution will boil under one atmospheric pressure? (Kb for water =0.52 K Kg mol^{-1}

27.Give reasons for **any 3** of the following observations:

a. Aniline is weaker base than ammonia.

b. Diazonium salt of aromatic amines are more stable than aliphatic amines.

c. Tertiary amines do not react with Hinsberg's reagent.

28. Write the structure of major product in each of following reaction :

a) $(CH_3)_3$ C-Br +KOH $\xrightarrow{ethanol-heat}$

b) $CH_3CH=C(CH_3)_2$ + HBr $\rightarrow$

c) $CH_3CH_2\ CH_2\ CH_2$-Br + NaI $\xrightarrow{acetone-heat}$

OR

a) What products will form when chlorobenzene reacts with ? (give chemical equation)

i) Na in presence of ethar ii) CH_3-Cl /anhyd $AlCl_3$

b) Why ,Grignard reagent should be prepared under anhydrous conditions.

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. Proteins are most abundant biomolecules of living system. The main sources of proteins are milk cheese pulses peanuts fish etc .These occur in every part of the body and formfundamental basis of the structure and functions of the life. The constituents of the proteinsare Alpha amino acids which are having amino groups and carboxylic acid group.These are also classified as essential and non essential depending on their synthesis.Alpha amino acids which constitute the proteins are usually colourless crystalline solids. These are water soluble compounds having high melting solids and behave like saltrather than simple amines or Carboxylic acids. Due to presence of specific groups , thesemolecule exist in the form of Zwitter ion. Except glycene other amino acid are opticallyactive. The amino acid may have D or L configurations depending on the position of theNH_2 group. Two amino acids combined to each other through a peptide Bond product so

formed is called dipeptide. When more than hundred amino acid combine to each other formpolypeptide and having higher molecular mass are called proteins generally.

a) What are the alphaamino acid called which our body can not synthesize? Give an example.

b) What makes an alpha amino acid acidic?

c) Draw structure of amino acid in which it shows amphoteric behavior and explain why does it show amphoteric behavior in this form ?

OR

What is a peptide bond? What is the difference between polypeptide and protein generally?

30. Solutions play very important role in our daily life. Alloys are homogeneous mixtures of two or more metals i.e. solutions of solid in solids.1 ppm of fluorides ions prevent tooth decay. All intravenous injections should be isotonic with our body fluid ,i.e. should have same concentration as that of blood plasma. Diabatic patients are more likely to have a heart attack or high blood pressure due to high level of glucose in their blood. Common salt increase blood pressure due to Na+ ions mix with blood .High intake of salts increase its concentration in cells and swell by absorption of water .

a) Which of the solution will have higher osmotic pressure and why?

i) 1 M urea ii)1 M NaCl

b) What will happen to blood cells if kept in hypertonic solution?

c)What is Van't Hoff factor? Calculate Van't Hoff factor for $K_3[Fe(CN)_6]$ if ionizes completely.

OR

What are abnormal molecular masses and give its causes?

SECTION E

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

31 a. How does the electrode potential vary with concentration of electrolyte and temperature?

b) What is limiting molar conductivity ?

b) E^0 cell for given redox reaction is 2.71V at 298 K

$Mg + Cu^{++}(0.01M) \rightarrow Mg^{++}(0.001M) + Cu$

Calculate E cell for the reaction

OR

a. Molar conductivity of substance "A" is 5.9×10^3 S/m and "B" is 1×10^{-16} S/m. Which of the two is most likely to be copper metal and why?

b. What is the quantity of electricity in Coulombs required to produce 4.8 g of Mg from molten $MgCl_2$? How much Ca will be produced if the same amount of electricity was passed through molten $CaCl_2$? (Atomic mass of Mg = 24 u, atomic mass of Ca = 40 u).

c. What is the standard free energy change for the following reaction at room temperature? Is the reaction spontaneous?

$Sn(s) + 2Cu^{2+}(aq) \longrightarrow Sn^{2+}(aq) + 2Cu^{+}(s)$

32.a) Give suitable reason for each of the following:

i) Propanone is less reactive than ethanal when treated with HCN.

ii) P^{Ka} of chloroacetic acid smaller than acetic acid.

iii) Carbonyl compounds undergo nucleophilic addition reactions.

b) Write chemical reaction for :

i) HVZ reaction ii)Stephen's reaction

OR

a) An organic compound (A) with molecular formula $C_9H_{10}O$ form 2,4-DNP derivative, reduce Tollens reagent and undergoes cannizaro ,reaction.On vigorous oxidation it gives 1,2 – Benzenedicarboxylic acid. Identify the organic compound and give reaction when it is treated with conc KOH solution.

b) Give a simple chemical test to distinguish between following pair of compounds.

i) butanal and butanone ii) acetophenone and benzophenone

c) How ethanal is converted to but-2-enal

33. Answer any five questions out of the following:

a. Cu^+ salts are unstable in aqueous solutions?

b. Scandium salts are white ?

c. In titration of Mohr salt versus potassium permanganate in acidic medium HCl is not used?

d. Eu^{++} is strongly reducing.

e. Actinoids show greater no oxidation states than lanthanoids .

f. La^{3+} (Z = 57) and Lu^{3+} (Z = 71) do not show any colour in solutions.

.g. Actinoids contraction greater than lanthanoid contraction.

MARKING SCHEME

SECTION A

Q1 to 16 each correct answer 1 mark

1. d
2. c
3. a
4. b
5. b
6. b
7. a
8. b
9. c
10. b
11. c (i) $l_n A$, (ii) $-E_A/R$
12. d
13. d
14. b
15. c
16. c

17 .k = 2.303/40 log 10/7 = 8.9 x $10^{-3}min^{-1}$ – 1mark

$t_{1/2}$ = 0.693/8.9x10^{-3} = 77.7 min - 1 mark

18 . Correct definition of Denaturation. -1 mark

Scondary and Tertiary Structures are destroyed and protein loses its biological activity. – 1Mark

19. a- Ring deactivation is due to –I effect of Halogen atom and ortho and para directing because of +R effect of halogen atom ortho and para directing.. 1mark

b- The carbocation formed in SN^1 reaction is planar and attack of nucleophile is almost equal from both sides of carbocation which resutls in racemic mixture. -1 mark

OR

a- From ethyl halide with reagent AgCN. -1mark

b- P-Dibromo Benzene has symmetric structure and well fits in crystal lattice. -1 mark

20. Zn + HgO $\rightarrow$ ZnO +Hg 1mark

In button cells the electrolyte is KOH whose concentration remains unchanged during cell reaction, hence Voltage remains constant. -1mark

21. Order of reaction based on concentration terms on which the rate of reaction actually depends which is experimentally observed. Hence can be 1,2,3 or any fraction. 1 mark

While the molecularity is based on No. of reacting species that collide simultaneously in a simple reaction to form product and the reacting species cannot be fractional. 1 mark

22.a Propane <acetaldehyde <acetone < ethyl alcohol < acetic acid increasing boiling point order .

iii- ethanol and v-acetic acid ½ x 2 = 1 mark

b. CH_3CH_2CHO and CH_3COCH_3 1 mark

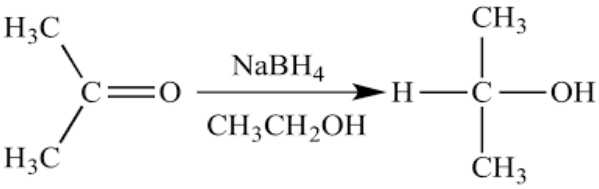
Aldeydes are more reactive than ketones towards nucleophilic addition (HCN) ½+1/2 mark

carbonyl carbon in aldehydes is more +ve charged due to +I effect one alkyl group and less steric hindrance in aldehydes. 1 mark

23.a. Chelate complex and due to ring formation bonding is strong and dissociate less. ½+1mark

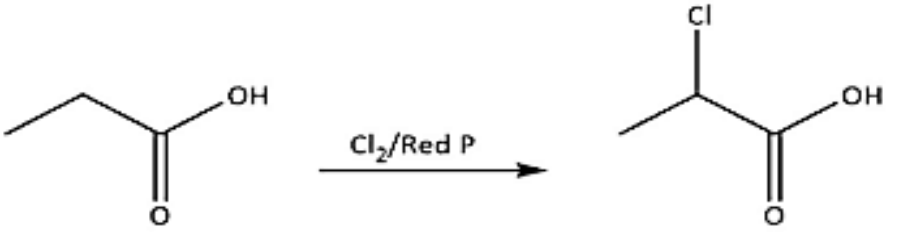
b.Ionization isomerism and due to exchange in position by sulphate and chloride ions. ½+1 mark

24a.



b. $CH_3\text{-}CH_2\text{-}CHO \xrightarrow{Zn\text{-}Hg/HCl} CH_3\text{-}CH_2\text{-}CH_3$

c.



Propanoic acid — 2-chloropropanoic acid

25. a- The ligand having two donar sites. 1/2Mark

Example like CN^- and NO_2^- -1/2 mark

b- Correct diagram and labelled properly. 1+1 marks

26.

$$\Delta T_b = \frac{K_b \, W_{solute} \cdot 1000}{M_{solute} \cdot W_{solvent in gm}} \qquad \frac{1}{2} \text{ mark}$$

$$\Delta T_b = \frac{0.52 \cdot 18 \times 1000}{180 \cdot 1000} \qquad 1 \text{ mark}$$

$$\Delta T_b = 0.052 \qquad \frac{1}{2} \text{ mark}$$

Boiling point of water $= 373.15 + 0.052$

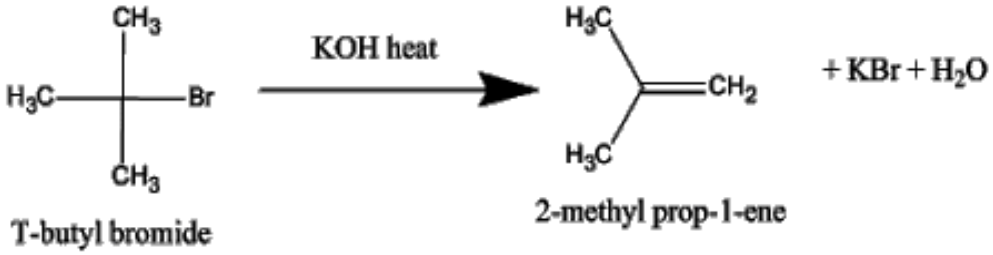
$= 373.202 \text{ K}$ 1 mark

27.a.The lone pair of NH_2 group takes part in resonance or anilinium ion is unstable as no resonating structure. 1 mark

b- Diazonium ion of aromatic amines is stable due to resonance while in alkyl diazonium ion resonance is not possible. 1 mark

c- The tertiary amine do not have any replacable H atom. 1 mark

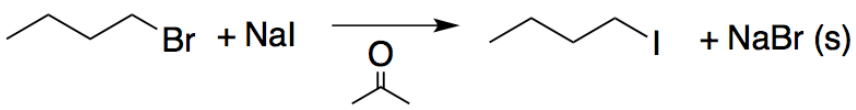
28.a.



T-butyl bromide — 2-methyl prop-1-ene

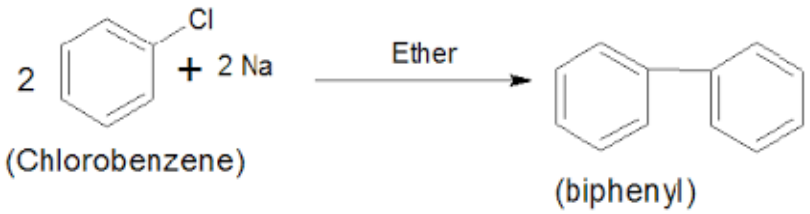
b. $CH_3\text{-}CH_2\text{=}C(CH_3)_2 + HBr \rightarrow CH_3\text{-}CH_2\text{-}C(Br)(CH_3)_2$

c.

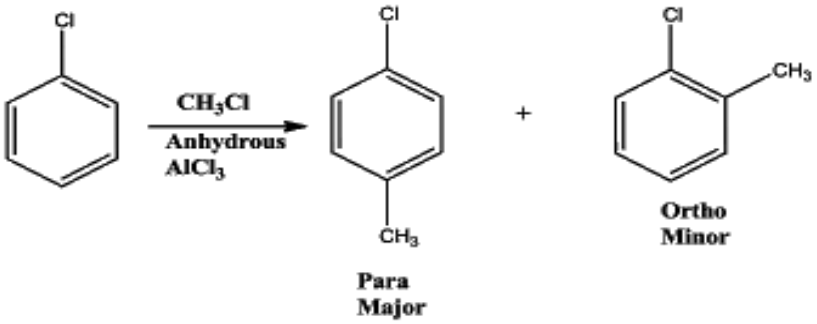


OR

a. i.



ii 1 mark



1 mark

iii.Grignard reagent react with water and form alkane. 1 mark

29 a. Essential α-amino acid are not synthesized in our body and to be taken through diet. ½ mark

Any example 1/2 mark

b- More no of –COOH groups than NH_2 groups -1mark

c- H_3N^+-CH(R)-COO^- In this form it can react with acids and base both .1mark

OR

Two or more α-amino acid are linked to each other through –CONH- bond-peptide bond. 1mark

Generally a poly peptide having more than 100 α-amino acid and molecular mass more than 10,000 u is called protein. 1-mark

30- 1M urea solution will have lower osmotic pressure than 1M NaCl as sodium chloride is electrolyte and ionize to Na^+ and Cl^- .1 mark

b. The blood cells will shrink 1 mark

c. correct definition 1 mark

i = 4/1 = 4 1 mark

OR

Discrepancies in molecular masses of substances by using a colligative properties. 1 mark

The cause of abnormal molecular masses are higher concentration, association and dissociation of solute in solution. 1 mark

31. a. electrode potential of an electrode increases with increase in concentration and temperature. 1 mark

b. Correct definition 1 mark

c. $E_{cell} = E^0_{cell} - 0.059/n \log (Mg^{++})/ (Cu^{++})$ 1 mark

$E_{cell} = 2.71 – 0.059/2 \log (0.001)/0.01$ 1 mark

$E_{cell} = 2.71 – 0.0295 \times (0 -1) = 2.71+0.0295 = 2.74$ V 1 mark

OR

a. “A” is copper; metals are conductors thus have high value of conductivity. 1 mark

b. $Mg^{2+} + 2e^- \rightarrow Mg$

1 mole of magnesium ions gains two moles of electrons or 2F to form 1 mole of Mg 24 g Mg requires 2 F electricity

4.8 g Mg requires 2 x4.8/24 = 0.4 F = 0.4 x96500 = 38600C 1 mark

$Ca^{2+} + 2e^-$ = Ca

2 F electricity is required to produce 1 mole =40 g Ca

0.4 F electricity will produce 8 g Ca 1 mark

c. $Sn(s) + 2Cu^{2+}(aq) \quad Sn^{2+}(aq) + 2Cu^{+}(s)$ F = 96500C, n=2,

$E^o cell = E^o cathode - E^o anode$

= 0.15 – (-0.14) = 0.29V 1 mark

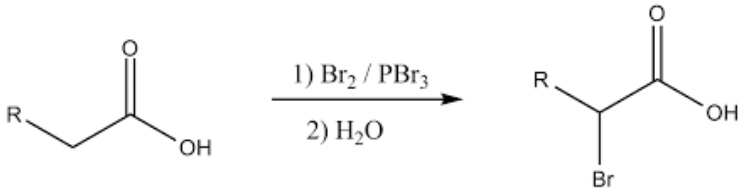
$\Delta G^o = -nFE^o cell = -2 \times 96500 \times 0.29 = -55970$ J/mol 1 mark

32. (i) Propanone is less reactive because it is ketone having more steric hindrance and less positively charged carbonyl carbon. 1 mark

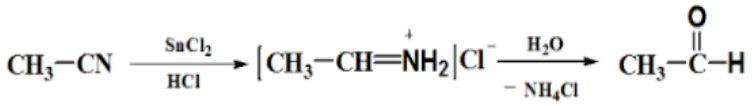
(ii) Chloroacetic acid is strong acid than acetic acid due to –I effect of Cl atom which helps in dispersal of –ve charge.

iii. positively charged carbonyl carbon and double bond between in carbonyl group. 1 mark

b. (i) 1 mark

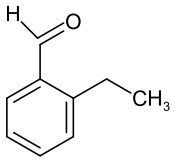


(ii) 1 mark

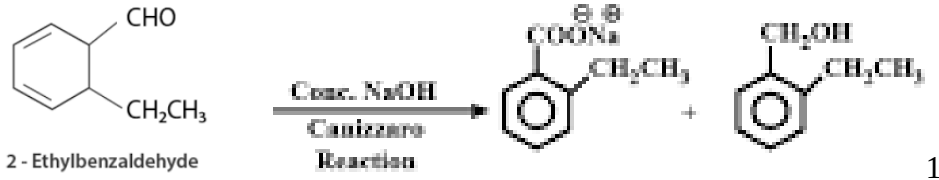


OR

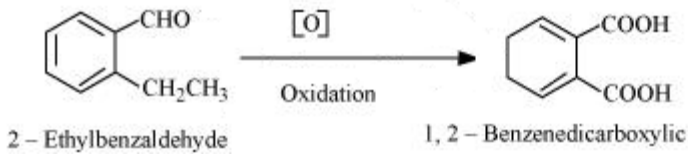
a. Compound is



1 mark



1 mark



b. (I) Butanal will give silver mirror test with Tollen's reagent or any other suitable test. 1 mark

(II) Acetophenone will give Iodoform test. 1 mark

c. $CH_3\text{-}CHO + NaOH \rightarrow CH_3\text{-}CH(OH)\text{-}CH_2CHO \xrightarrow{heat} CH_3\text{-}CH{=}CH\text{-}CHO$ 1mark

33. (a) Cu^+ ion disproportionate in aqueous solution because oxidizes to Cu^{++} and extra energy required is compensated by high hydration enthalpy of Cu^{++} ion. 1mark

(b) Sc shows only +3 oxidation state having empty d orbital no d-d transition. 1 mark

(c) $KMnO_4$ can oxidize 2 Cl^- ion to Cl_2. 1 mark

(d) Most stable Ox. State of Ln is +3 hence Eu^{++} oxidizes to Eu^{3+} and strongly reducing. 1 mark

(e) The energy of 5f, 6d and 7s are comparable and can easily promote electrons. 1 mark

(f) La^{3+} has empty d –orbitals while Lu^{3+} has completely filled f-orbitals. 1 mark

(g) Poor shielding effect of 5-f orbitals than 4-f. 1 mark

Blue Print

Unit No.	Name of Unit	Section-A		Section-B	Section-C	Section-D	Section-E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	L A	
II	Solutions				3 (1)	4 (1)		**7 (2)**
III	Electrochemistry	2 (2)		2 (1)			5 (1)	**9 (4)**
IV	Chemical Kinetics	3 (3)		4 (2)				**7 (5)**
VIII	d -and f -Block Elements	1 (1)	1 (1)				5 (1)	**7 (3)**
IX	Coordination Compounds	1 (1)			6 (2)			**7 (3)**
X	Haloalkanes and Haloarenes	1 (1)		2 (1)	3 (1)			**6 (3)**
XI	Alcohols, Phenols and ethers	2 (2)	1 (1)		3 (1)			**6 (4)**
XII	Aldehydes, Ketones and carboxylic acids				3(1)		5 (1)	**8 (2)**
XIII	Amines	2 (2)	1 (1)		3 (1)			**6 (4)**
XIV	Biomolecules		1 (1)	2 (1)		4 (1)		**7 (3)**
	Total	**12 (12)**	**4 (4)**	**10 (5)**	**21 (7)**	**8 (2)**	**15 (3)**	**70 (33)**

SET-13

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

General Instructions:

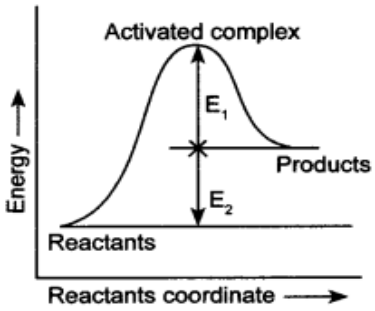
Read the following instructions carefully.

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 very 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 calculator is not allowed.

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark.

1. Consider Fig. and mark the correct option.



(a) Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.
(b) Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.
(c) Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.
(d) Activation energy of backward reaction is E_1 and product is more stable than reactant.

2. Standard solution of KNO_3 is used to make salt bridge because
(a) velocity of K^+ is greater than NO_3^- (b) velocity of NO_3^- is greater than K^+
(c) velocity of K^+ and NO_3^- is same. (d) KNO_3 is highly soluble in water.

3. The half-life of a reaction remains unchanged as the initial concentration of the reactant is doubled. The order of reaction is-
(a) 0.5 (b) 1 (c) 2 (d) 1.5

4. Which of the following statements is not correct?
(a) $La(OH)_3$ is less basic than $Lu(OH)_3$
(b) La is actually an element of transition series rather than Lanthanoids
(c) Atomic radius of Zr and Hf is same
(d) In Lanthanoid series, the ionic radius of Lu^{3+} is smallest

5.In an octahedral crystal field, the t_{2g} orbital are

(a) raised in energy by 0.4 Δo (b) lowered in energy by 0.4 Δo

(c) raised in energy by 0.6 Δo (d) lowered in energy by 0.6 Δo

6. Standard electrode potential of three metals X, Y and Z are -1.2 V, +0.5 V and -3.0 V respectively. The reducing power of these metals will be

(a) Y>X>Z (b) Z>X>Y

(c)X>Y>Z (d) Y>Z>X

7. Which type of isomerism is shown by the complex compounds. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$?

(a)Ionisation (b) Linkage (c) Co-Ordination (d) Optical

8. Identify the products of the following reaction:

Methyl alcohol + Ethyl magnesium bromide =?

a) CH_4 and CH_3OMgBr b) CH_4 and CH_3CH_2OMgBr

c) C_2H_6 and CH_3OMgBr d) C_2H_6 and CH_3CH_2OMgBr

9. What is the test to differentiate between penta-2-one and pentan-3-one?

(a) Iodoform test (b) Benedict's test

(c) Fehling's test (d) Aldol condensation test

10. Arrange the following compounds in increasing order of basicity:

CH_3NH_2, $(CH_3)_2$ NH, NH_3, $C_6H_5NH_2$

(a) $C_6H_5NH_2 < NH_3 < (CH_3)_2NH < CH_3NH_2$ (b) $CH_3NH_2 < (CH_3)_2NH < NH_3 < C_6H_5NH_2$

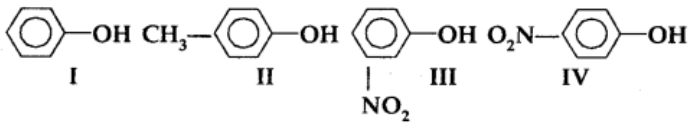
(c) $C_6H_5NH_2 < NH_3 < CH_3NH_2 < (CH_3)_2NH$ (d) $(CH_3)_2NH < CH_3NH_2 < NH_3 < C_6H_5NH_2$

11. An organic compound (X) was treated with sodium nitrite and HCl in ice cold conditions. Bubbles of nitrogen gas were seen coming out. The compound (X) may be

(a) a secondary aliphatic amine. (b) a primary aromatic amine

(c) a primary aliphatic amine (d) a tertiary amine

12. In the following compounds:



The order of acidity is

(a) III > IV > I > II (b) I > IV > III > II

(c) II > I > III > IV (d) IV > III > I > II

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below:

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 : Actinoids form relatively less stable complexes as compared to lanthanoids.

Reason : Actinoids can utilise their 5f orbitals along with 6d orbitals in bonding but lanthanoids do not use their 4f orbital for bonding.

14. Assertion: Glucose on acetylation gives pentaacetate.

Reason: It contains five –OH group

15. Assertion : Phenol is more reactive than benzene towards electrophilic substitution reaction.

Reason *:* In the case of phenol, the intermediate carbocation is more resonance stabilized.

16. Assertion : Acetanilide is less basic than aniline.
Reason **:** Acetylation of aniline results in decrease of electron density on nitrogen.

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 (i) What aspect of the reaction is influenced by the presence of catalyst which increases the rate of the reaction?

(ii) In some cases, it is found that a large number of colliding molecules have energy more than threshold energy, yet reaction is slow, why?

18. (a) How do you explain the amphoteric behaviour of amino acids?

(b)The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain

OR

Enumerate the reactions of D-glucose which cannot be explained by its open chain structure

19. Name the cell used for low current devices like hearing aids, watches etc. Also give the half cell reactions for such a cell?

20. a) Using IUPAC norms write the formula for the following: pentaamminenitrito-O- cobalt(III)

b) $Ti(H_2O)_6]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ is colourless. Why?

21. Arrange the following compounds in increasing order of their property as indicated :

(i) CH_3COCH_3, $C_6H_5COCH_3$, CH_3CHO (reactivity towards nucleophilic addition reaction)

(ii) Cl—CH_2—COOH, F—CH_2—COOH, CH_3—COOH (acidic character)

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.

22 a) Draw figure to show the splitting of d-orbitals in an octahedral crystal field.

b) $[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain why?

23 a) How will you bring about the following conversions?

(i) Ethanol to but-1-yne

(ii) Ethane to bromoethene

(iii) Propene to 1-nitropropane

OR

i)Although chlorine is an electron withdrawing group, yet it is ortho-, para-directing in electrophilic aromatic substitution reactions. Explain why it is so?

ii) Allyl chloride is hydrolyzed more readily than n-propyl chloride

iii)Vinyl chloride is hydrolyzed more slowly than ethyl chloride

24 Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at 25°C, assuming that it is completely dissociated.

25. Explain the following

(i) Williamson Synthesis

(ii) Kolbe's reaction

(iii) Reimer-Tiemann reaction

26 a) Explain why the pKb of aniline is more than that of methylamine

b) Give one chemical test to distinguish between the following pairs of compounds:

(i) Methylamine and dimethylamine

(ii) Secondary and tertiary amines

27 Account for the following:

(i) The C – Cl bond length in chlorobenzene is shorter than that in $CH_3 – Cl$.

(ii) Chloroform is stored in closed dark brown bottles

(iii) Which compound in each of the following pairs will react faster in SN2 reaction with—OH?

(a) CH_3Br or CH_3I

(b) $(CH_3)_3CCl$ or CH_3Cl

28. A first order reaction has rate constant of $1{\cdot}15 \times 10^{-3}\ s^{-1}$. How long will 5 g of this reactant take to reduce to 3g?

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/ TABLE carefully and answer the questions that follow.

29.

Solvent	b. p./K	K_b/K kg mol^{-1}	f. p./K	K_f/K kg mol^{-1}
Water	373.15	0.52	273.0	1.86
Ethanol	351.5	1.20	155.7	1.99
Cyclohexane	353.74	2.79	279.55	20.00
Benzene	353.3	2.53	278.6	5.12
Chloroform	334.4	3.63	209.6	4.79
Carbon tetrachloride	350.0	5.03	250.5	31.8
Carbon disulphide	319.4	2.34	164.2	3.83
Diethyl ether	307.8	2.02	156.9	1.79
Acetic acid	391.1	2.93	290.0	3.90

Answer the following questions as per the above table-

(a) Mention the solvent which has maximum value for cryoscopic constant. 1

(b) Mention the solvent which has the minimum value of Kb. 1

(c)What is cryoscopic constant? From the above table find out the solvent which has cryoscopic constant value less than acetic acid but greater than ethanol. 2

OR

45 g of ethylene glycol (C2H6O2) is mixed with 600 g of water. Calculate (a) the freezing point depression and (b) the freezing point of the solution

30. Disaccharides on hydrolysis with dilute acids or enzymes yield two molecules of either the same or different monosaccharides. The two monosaccharides are joined together by an oxide linkage formed by the loss of a water molecule. Such a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage. Sucrose: One of the common disaccharides is sucrose which on hydrolysis gives equimolar mixture of D-(+)-glucose and D-(-) fructose. These two monosaccharides are held together by a glycosidic linkage between C1 of α glucose and C2 of β -fructose. Since the reducing groups of glucose and fructose are involved in glycosidic bond formation, sucrose is a non- reducing sugar. Disaccharides Sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fructose. Since the laevorotation of fructose (–92.4) is more than dextrorotation of glucose (+ 52.5), the mixture is laevorotatory.

Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (–) and the product is named as invert sugar.

(i) Which of the following is an example of monosaccharide?

a) Galactose b) Sucrose

c) Lactose d) Maltose. 1

(ii) Which of the following is an example of disaccharide?

a) Glucose b) Fructose

c) Galactose d) Maltose . 1

OR

What are the hydrolysis products of Lactose

(iii) Give Haworth projection formula of sucrose showing glycosidic linkage . 2

SECTION E

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

31 a) Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration

b) The molar conductivity of 0.025 mol L^{-1} methanoic acid is 46.1 S cm^2 mol^{-1}. Calculate its degree of dissociation and dissociation constant Given $\lambda^{\circ}(H^+)$=349.6 S cm^2 mol^{-1} and $\lambda^{\circ}(HCOO^-)$ = 54.6 S cm^2 mol^{-1}

OR

Calculate the standard cell potentials of the galvanic cells in which the following reactions take place.

Also calculate ΔG° and equilibrium constant for the reaction

(a) $2Cr\ (s) + 3Cd^{2+}(aq) \longrightarrow 2Cr^{3+}(aq) + 3Cd\ (s)$

Given $E^{\circ}_{Cr^{3+}/Cr} = -0{\cdot}74\ V$; $E^{\circ}_{Cd^{2+}/Cd} = -0{\cdot}40\ V$

(b) $Fe^{2+}(aq) + Ag^{+}(aq) \longrightarrow Fe^{3+}(aq) + Ag\ (s)$

Given $E^{\circ}_{Ag^{+}/Ag} = 0{\cdot}80\ V$; $E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0{\cdot}77\ V$

32 . Attempt any five

(i) Name the element of 3d transition series which shows maximum number of oxidation states. Why does it show so?

(ii) Which transition metal of 3d series has positive $E^0_{(M2+/M)}$ value and why?

(iii) Out of Cr^{3+} and Mn^{3+}, which is a stronger oxidizing agent and why?

(iv) Name a member of the lanthanoid series which is well known to exhibit +2 oxidation state

(v) Complete the following equation : $MnO_4^- + 8H^+ + 5e^- \rightarrow$

(vi) Name one alloy which contains some of the lanthanoid metals. Mention its use.

(vii) Chromium is a typical hard metal while mercury is a liquid. Explain why?

33. 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.

a) Identify A,B and C

b) write the reactions involved

OR

a) Arrange the following compounds in increasing order of their boiling points.

CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$

b) Arrange the following compounds in increasing order of their reactivity in nucleophilic addition reactions.

Ethanal, Propanal, Propanone, Butanone

c)Describe the following:

(i) Acetylation

(ii) Cannizzaro reaction

(iii) Cross aldol condensation

MARKING SCHEME

Section A

1 (a) $E_a = E_1 + E_2$ and products are less stable due to higher energy.

2 c

3 b

4 a

5 b

6 b

7 a

8 c

9 a) Iodoform test

10 (c) $C_6H_5NH_2 < NH_3 < CH_3NH_2 < (CH_A)_2NH$

11(c) a primary aliphatic amine

12 D

13 C

14 A

15 A

16 A

Section B

17 (i) In the presence of catalyst, the rate of reaction increases because catalyst lowers down the activation energy and reaction become possible at lower temperature.

(ii) The colliding molecules may not be in proper orientation at the time of collision

18 (a) Due to dipolar or Zwitter ion structure, amino acids are amphoteric in nature. The acidic character of the amino acids due to the $-NH_3^+$ group and the basic character is due to the $-COO^-$ group.

(b)Amino acids have strong electrostatic attraction and hence have high melting points and highly soluble in water

OR

(i) Despite having aldehyde group, glucose does not give Schiff test and 2,4-DNP test.

(ii)Glucose does not react with sodium hydrogen bisulphite to form addition product.

(iii)The pentaacetate of glucose does not react with hydroxyl amine showing the absence of free -CHO group

19. mercury cell

Anode Reaction:

$$Zn(Hg) + 2OH^- \rightarrow ZnO(s) + H_2O + 2e^-$$

Cathode Reaction :

$$HgO + H_2O + 2e^- \longrightarrow Hg(l) + 2OH^-$$

20 a) $[Co(ONO)(NH_3)_5]^{2+}$

b) In $[Ti(H_2O)_6]^{3+}$, Ti^{3+} ion has one electron in d sub shell (lower energy t_{2g} d –orbital ie has the configuration $t_{2g}^1 e_g^0$) which can absorb light in the visible region resulting into d-d transition and show coloured . But Sc^{3+}has no d electron thus it is colorless.

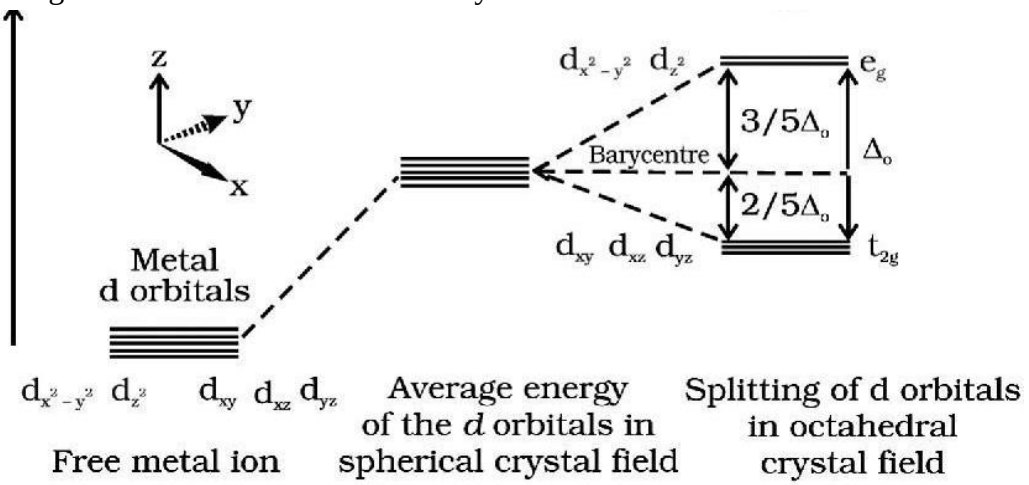
21. i) $C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO$ (Reactivity towards nucleophilic addition)

ii)) $CH_3—COOH < Cl—CH_2—COOH < F—CH_2—COOH$(acidic character)

Section C

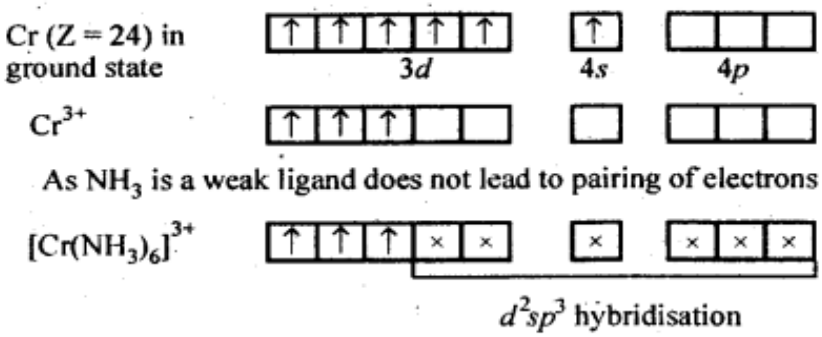
22(a)

splitting of d-orbitals in an octahedral crystal field

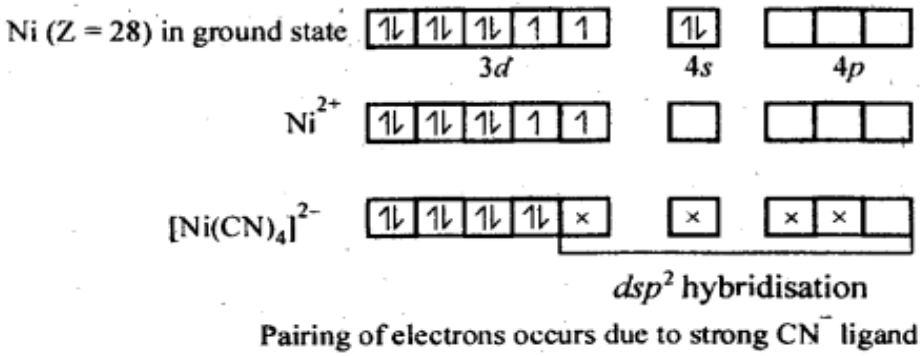


b)

The presence of three unpaired electrons in $[Cr(NH_3)_6]^{3+}$ explains its paramagnetic c



$[Ni(CN)_4]^{2-}$ is diamagnetic, since there is no unpaired electrons.



Pairing of electrons occurs due to strong CN^- ligand

23 i)

$$CH_3CH_2OH \xrightarrow{SOCl_2,\ Pyridine} CH_3CH_2Cl + SO_2 + HCl$$

Ethanol — Chloroethane

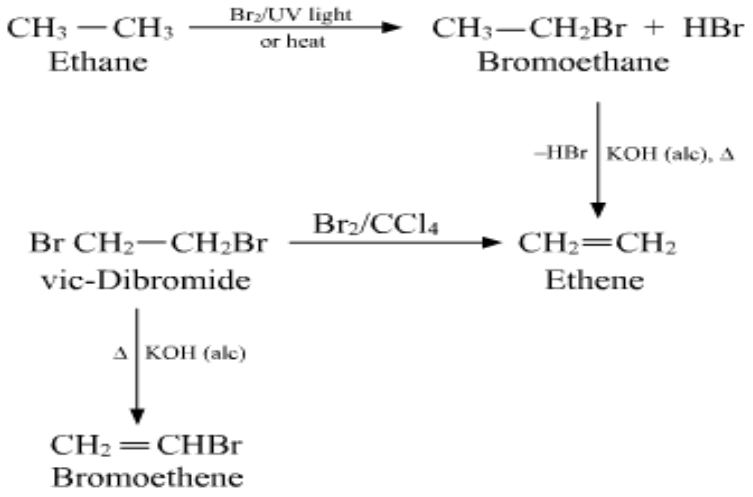
$$HC \equiv CH + NaNH_2 \xrightarrow{Liq.\ NH_3} HC \equiv C^-Na^+$$

Ethyne — Sodium acetylide

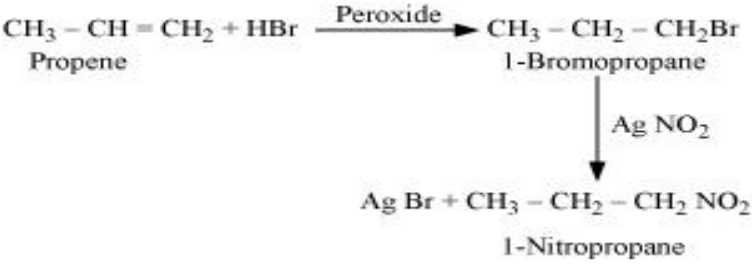
$$CH_3CH_2 - Cl + HC \equiv C^-Na^+ \longrightarrow CH_3CH_2C \equiv CH + NaCl$$

Chloroethane — But – 1 – yne

(ii)



(iii)



OR

i)Chlorine withdraws electrons through inductive effect and releases through resonance. Although Cl shows -1 effect but through resonance, Cl tends to stabilize the intermediate carbocation and the effect is more pronounced at ortho and para positions

ii) Allyl chloride show high reactivity as the carbocation formed by hydrolysis is stablised by reasonance while no such stablisation exist in n-Propyl chloride

iii) As a result of resonance C-Cl bond acquire double bond character in vinyl chloride . On the other hand C-Cl bond is pure single bond in ethyl chloride. Thus vinyl chloride undergoes hydrolysis more slowly than ethyl chloride.

24 Step I. Calculation of Van't Hoff factor

K_2SO_4 dissociates in water as :

$$K_2SO_4 \xrightarrow{(aq)} 2K^+(aq) + SO_4^{2-}(aq) \; ; \; \alpha = \frac{i-1}{n-1}$$

$$\alpha(\text{for complete dissociation}) = 1, n = 3 \; ; \; 1 = \frac{i-1}{3-1} \text{ or } i = 2 + 1 = 3$$

Step II. *Calculation of osmotic pressure* (π)

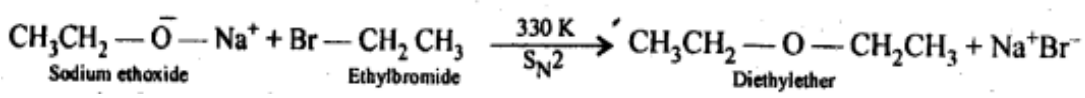
$$\text{Osmotic pressure } (\pi) = i\,C\,R\,T = \frac{i\,W_B\,RT}{M_B \times V}$$

$i = 3$; $W_B = 25$ mg $= 0{\cdot}025$ g ; $M_B = 2\times 39 + 32 + 4 \times 16 = 174$ g mol^{-1}; V = 2L ; T = 25°C = 298 K ; R = 0·0821 L atm K^{-1}mol^{-1}

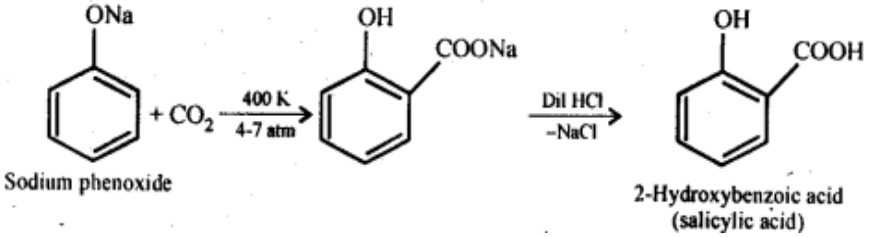
$$\pi = \frac{(3) \times (0{\cdot}025\text{g}) \times (0{\cdot}0821 \text{ L atm K}^{-1} \text{ mol}^{-1}) \times (298\text{K})}{(174 \text{ g mol}^{-1}) \times (2\text{L})}$$

$$= 5{\cdot}27 \times 10^{-3} \text{ atm.}$$

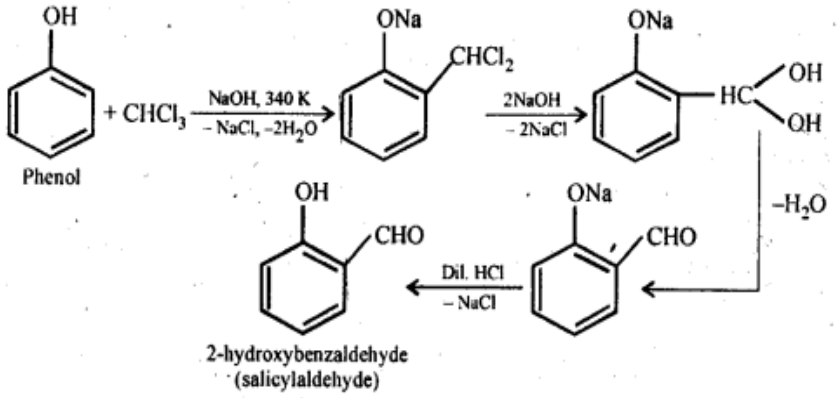
25 i) Williamson synthesis



ii) Kolbe reaction



iii) Riemer tiemann reaction



26 a)(i) In aniline, the lone pair of electrons on the N-atom is delocalized over the benzene ring. As a result, electron density on the nitrogen atom decreases. Whereas in CH_3NH_2, + I-effect of -CH_3 group increases the electron density on the N-atom. Therefore, aniline is a weaker base than methylamine and hence its pKb value is higher than that of methylamine.

b)

(*i*) Methylamine and dimethylamine can be distinguished by carbylamine test.

$$\underset{\text{1° Amine}}{CH_3NH_2} + CHCl_3 + 3KOH \xrightarrow{\Delta} \underset{\substack{\text{Methylisocyanide}\\\text{(offensive smell)}}}{CH_3NC} + 3KCl + 3H_2O$$

$$\underset{\text{2° Amine}}{(CH_3)_2NH} \xrightarrow[\Delta]{CHCl_3/KOH(alc)} \text{No reaction}$$

(*ii*) Secondary and tertiary amine can be distinguished by Liebermann's nitroamine test. Secondary amines gives Liebermann nitroamine test while tertiary amines do not.

$$\underset{\substack{\text{Diethylamine}\\\text{(2° Amine)}}}{(CH_3CH_2)_2NH} + HO-N=O \xrightarrow{HCl+NaNO_2} \underset{\text{Yellow colour}}{(CH_3CH_2)_2N-N=O} + H_2O$$

$$\underset{\substack{\text{Triethylamine}\\\text{(3° Amine)}}}{(CH_3CH_2)_3N} + HNO_2 \longrightarrow \underset{\substack{\text{Triethylammonium nitrite}\\\text{(Soluble)}}}{[(CH_3CH_2)_3NH]^+NO_2^-}$$

27 . (i) In haloalkanes, the halogen atom is attached to sp^3-hybridized carbon while in haloarenes it is attached to sp^2 -hybridized carbon whose size is smaller than sp3 orbital carbon. Therefore C – Cl bond in chloro-benzene is shorter than alkyl chloride.

(ii) $CHCl_3$ is stored in dark coloured bottles to cut off light because $CHCl_3$ is slowly oxidised by air in presence of light to form an extremely poisonous gas, carbonyl chloride, popularly known as phosgene.

(iii) (a) CH_3I: Because Iodide is better leaving group than bromide.

(b) CH_3Cl : Carbon atom leaving group is less hindered.

28. For the first order reaction

$$t = \frac{2.303}{k} \log \frac{a}{(a-x)}$$

$$a = 5\ g\ ;\ (a-x) = 3\ g\ ;\ k = 1{\cdot}15 \times 10^{-3}\ s^{-1}$$

$$t = \frac{2.303}{(1{\cdot}15 \times 10^{-3} s^{-1})} \log \frac{(5g)}{(3g)} = \frac{2.303}{(1{\cdot}15 \times 10^{-3} s^{-1})} (\log 5 - \log 3)$$

$$= \frac{2.303}{(1{\cdot}15 \times 10^{-3} s^{-1})} (0{\cdot}6990 - 0{\cdot}4771)$$

$$= \frac{2.303}{(1{\cdot}15 \times 10^{-3} s^{-1})} \times 0{\cdot}2219 = \mathbf{444\ s}$$

Section D

29 (a) Carbon tetrachloride

(b) water

(c) definition,carbon disulphide

OR

Depression in freezing point is related to the molality, therefore, the molality of the solution with respect to ethylene glycol = moles of ethylene glycol mass of water in kilogram Moles of ethylene glycol = 1 45 g 62 g mol− = 0.73 mol Mass of water in kg = 1 600g 1000g kg− = 0.6 kg Hence molality of ethylene glycol = 0.73 mol 0.60 kg = 1.2 mol kg–1 Therefore freezing point depression, ÄTf = 1.86 K kg mol–1 × 1.2 mol kg–1 = 2.2 K Freezing point of the aqueous solution = 273.15 K – 2.2 K = 270.95 K

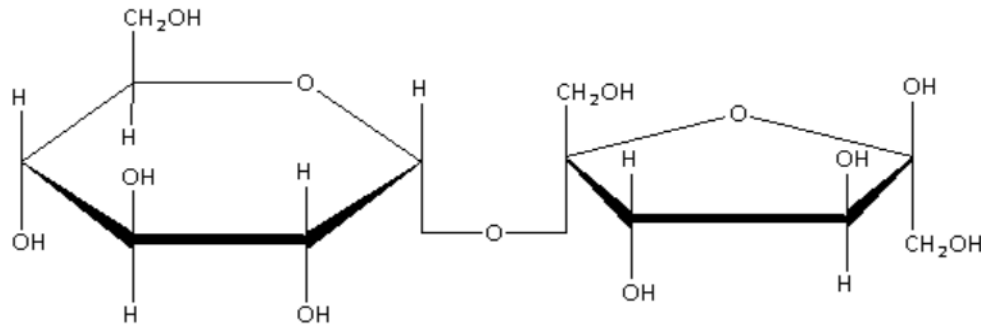
30: i) a

ii) d

OR

Hydrolysis of lactose gives D-glucose and D-galactose

iii)



SECTION E

31 (a) (i) Conductivity: Conductivity decreases with decrease in concentration both, for weak and strong electrolytes due to the decrease in the number of ions per unit volume that carry the current in a solution.

(ii) Molar conductivity: The value of molar conductivity increases with dilution and attains a maximum value at infinite dilution. On dilution, though k(kappa) decreases but volume increases much more hence molar conductivity increase because

$$\Lambda_m = \kappa V$$

conductivity decreases where as molar conductivity increases with dilution

(b)

$$\Lambda^\circ_m(HCOOH) = \lambda^\circ(H^+) + \lambda^\circ(HCOO^-)$$
$$= 349.6 + 54.6$$
$$= 404.2\ S\ cm^2\ mol^{-1}$$
$$\Lambda^C_m = 46.1\ S\ cm^2\ mol^{-1}$$

$$\therefore \quad \alpha = \frac{\Lambda^C_m}{\Lambda^\circ_m} = \frac{46.1}{404.2} = 0.114$$

	$HCOOH \rightleftharpoons$	$HCOO^-$	+ H^+
Initial conc.	c	0	0
at equi,	$c(1-\alpha)$	$c\alpha$	$c\alpha$

$$\therefore \quad K_a = \frac{c\alpha.c\alpha}{c(1-\alpha)} = \frac{c\alpha^2}{1-\alpha}$$
$$= \frac{0.025\times(0.114)^2}{1-0.114} = 3.67\times10^{-4}$$

OR

(a) Calculation of E°_{cell},

$$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode} = -0{\cdot}40 - (-0{\cdot}74) = +\ \mathbf{0{\cdot}34\ V}$$

Calculation of ΔG°,

$$\Delta G^\circ = -nF\,E^\circ_{cell} = -(6\ mol) \times (96500\ C\ mol^{-1}) \times (0{\cdot}34\ V)$$
$$= -196860\ CV = -196860\ J = \mathbf{-196{\cdot}86\ kJ}$$

Calculation of Equilibrium Constant (K_c)

$$\Delta G^\circ = -2{\cdot}303\ RT \log K_c$$

$$\log K_c = \frac{(-)\,\Delta G^\circ}{2{\cdot}303\ RT} = (-)\frac{(-)\,196860}{2{\cdot}303 \times 8{\cdot}314 \times 298} = 34{\cdot}501$$

$$K_c = \text{Antilog}\ (34{\cdot}501) = \mathbf{3{\cdot}17 \times 10^{34}}$$

(b) Calculation of E°_{cell},

$$E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode} = (0{\cdot}80 - 0{\cdot}77) = \mathbf{0{\cdot}03\ V}$$

Calculation of ΔG°,

$$\Delta G^\circ = -nF\,E^\circ_{cell} = -(1\ mol) \times (96500\ C\ mol^{-1}) \times (0{\cdot}03\ V)$$
$$= -2895\ CV = -2895\ J = \mathbf{-2{\cdot}895\ kJ}$$

Calculation of Equilibrium Constant (K_c)

$$\Delta G^\circ = -2{\cdot}303\ RT \log K_c$$

$$\log K_c = (-)\frac{(-\Delta G^\circ)}{2{\cdot}303\ RT} = (-)\frac{(-)2895}{2{\cdot}303 \times 8{\cdot}314 \times 298} = 0{\cdot}5074$$

$$K_c = \text{Antilog}\ (0{\cdot}5074) = \mathbf{3{\cdot}22}$$

32 (i) Mn has the maximum number of unpaired electrons present in the d-subshell (5 electrons). Hence, Mn exhibits the largest number of oxidation states, ranging from +2 to +7.

(ii) Copper has positive $E^0_{(Cu2+/Cu)}$ value because of its high enthalpy of atomization and low enthalpy of hydration. The high energy required to oxidise Cu to Cu^{2+} is not balanced by its hydration energy.

(iii) Cr^{2+} has the configuration $3d^4$ which easily changes to d^3 due to stable half filled t_{2g} orbitals. Therefore Cr^{2+} is reducing agent, it gets oxidized to Cr^{3+}. While Mn^{2+} has stable half filled d^5 configuration. Hence Mn^{3+} easily changes to Mn^{2+} and acts as oxidising agent

. (iv) Europium is well known to exhibit +2 oxidation state

. (v) $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$

(vi) Alloys are homogeneous mixtures of metals with metals or non-metals. Misch metal (pyrophoric alloy) consists of lanthanoid metal Ce= 40.5%, neodymium 44%, iron 4-5% and traces of S, C, Ca and Al. Mischmetal is used to make bullets, shells and light flints.

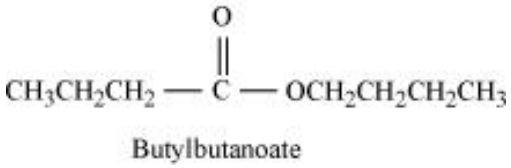
(vii) Chromium has five unpaired d electrons in the d-subshell ($3d^5\ 4s^1$). Hence, metallic bonds are very strong. In mercury all the d-orbitals are fully filled ($3d^{10}\ 4s^2$). Hence, the metallic bonding is very weak.

33) An organic compound A with molecular formula $C_8H_{16}O_2$ gives a carboxylic acid (B) and an alcohol (C) on hydrolysis with dilute sulphuric acid. Thus, compound A must be an ester. Further, alcohol C gives acid B on oxidation with chromic acid. Thus, B and C must contain equal number of carbon atoms.

Since compound A contains a total of 8 carbon atoms, each of B and C contain 4 carbon atoms. Again, on dehydration, alcohol C gives but-1-ene. Therefore, C is of straight chain and hence, it is butan-1-ol.

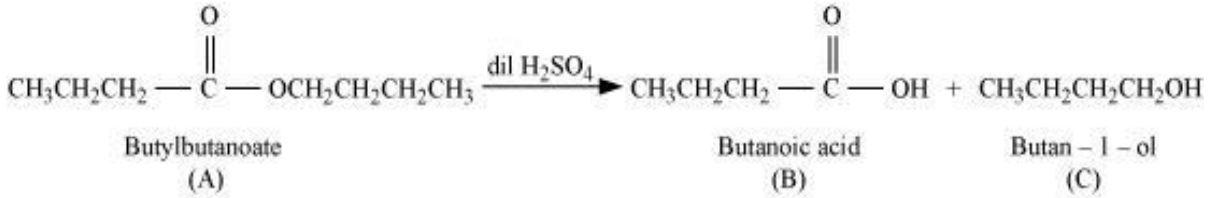
On oxidation, Butan-1-ol gives butanoic acid. Hence, acid B is butanoic acid.

Hence, the ester with molecular formula $C_8H_{16}O_2$ is butylbutanoate

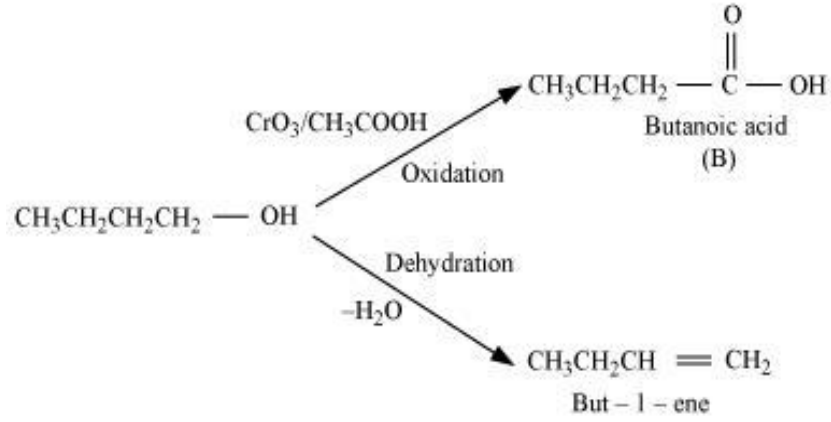


Butylbutanoate

All the given reactions can be explained by the following equations



Butylbutanoate (A) | Butanoic acid (B) | Butan – 1 – ol (C)



OR

a) The molecular masses of the given compounds are in the range 44 to 46. CH_3CH_2OH undergoes extensive intermolecular H-bonding, resulting in the association of molecules.

Therefore, it has the highest boiling point. CH_3CHO is more polar than CH_3OCH_3 and so CH_3CHO has stronger intermolecular dipole − dipole attraction than CH_3OCH_3· $CH_3CH_2CH_3$ has only weak van der Waals force. Thus, the arrangement of the given compounds in the increasing order of their boiling points is given by:

$CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CHO < CH_3CH_2OH$

b) The +I effect of the alkyl group increases in the order:

Ethanal < Propanal < Propanone < Butanone

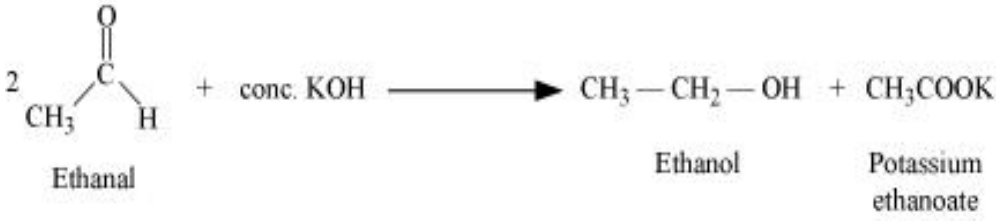
The electron density at the carbonyl carbon increases with the increase in the +I effect. As a result, the chances of attack by a nucleophile decrease. Hence, the increasing order of the reactivities of the given carbonyl compounds in nucleophilic addition reactions is:

Butanone < Propanone < Propanal < Ethanal

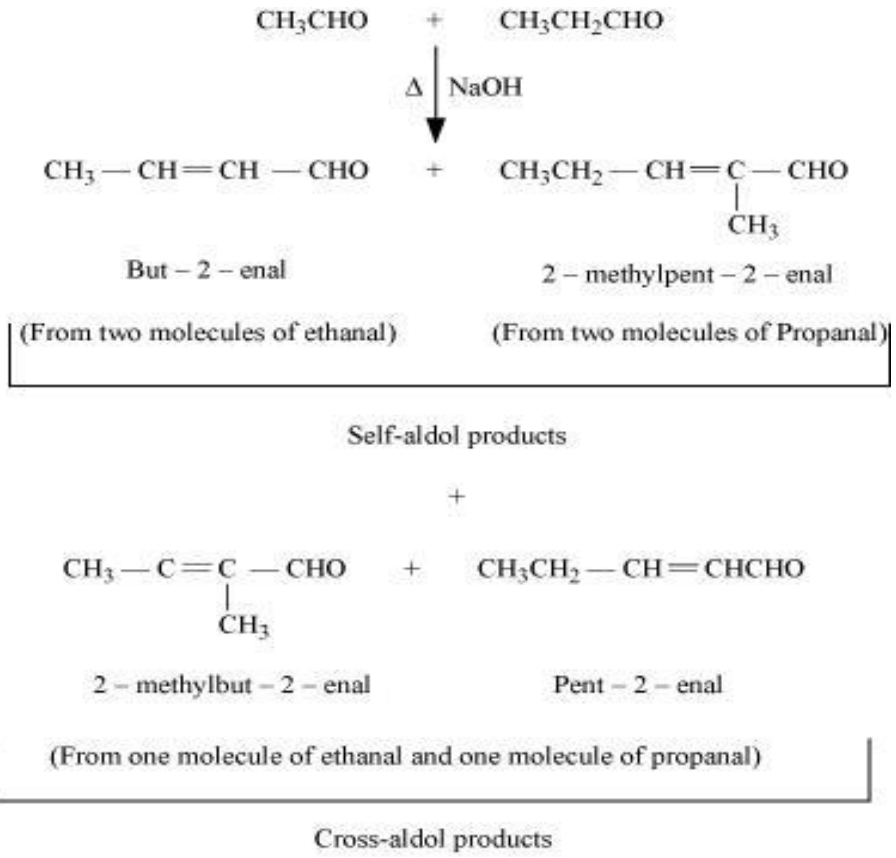
c) i)

$$\underset{\text{Ethanol}}{CH_3CH_2OH} + \underset{\text{Acetyl Chloride}}{CH_3COCl} \xrightarrow{\text{Pyridine}} \underset{\text{Ethyl acetate}}{CH_3COOC_2H_5} + HCl$$

(ii)



(iii)



BLUE PRINT

S.N	Name of Chapter	Objective Type Q (1)	Very short answer Q(2)	Short answer Q(3)	Case Based Q.(4)	Long Answer Q(5)	Total marks
1	Solution	2(1)	1(2)	1(3)			7
2	Electrochemistry	4(1)				1(5)	9
3	Chemical kinetics	2(1)	1(2)	1(3)			7
4	D &f block elements	2(1)				1(5)	7
5	Coordination Compd.	1(1)	1(2)		1(4)		7
6	Haloalkanes & Haloarenes	1(1)	1(2)	1(3)			6
7	Alcohols. Phenols, Ethers	1(1)	1(2)	1(3)			6
8	Aldehyde, ketone,carboxylic acid	3(1)				1(5)	8
9	Amines			2(3)			6
10	Biomolecules			1(3)	1(4)		7
	Total	16(1)	5(2)	7(3)	2(4)	3(5)	33(70)

SET-14

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

General Instructions:

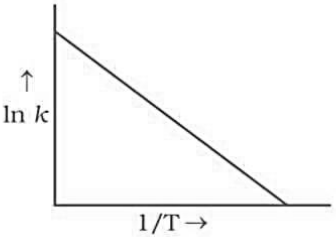
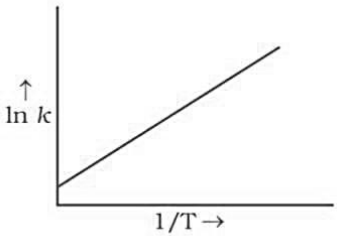
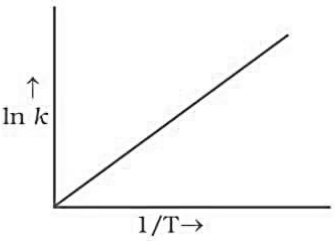
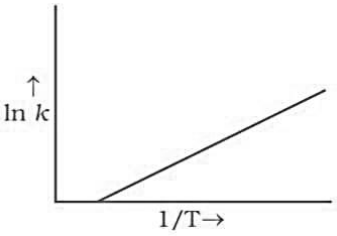
Read the following instructions carefully.

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 very 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 calculator is not allowed.

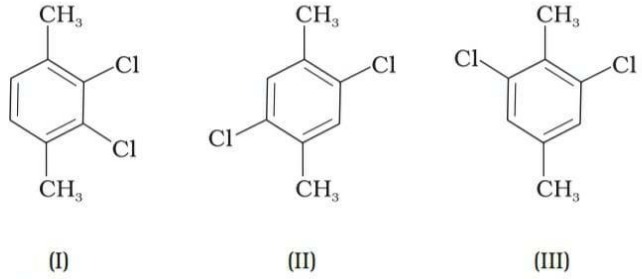
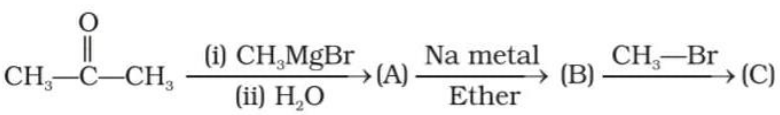
SECTION A

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

1	The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called _____. (i) Cell potential (ii) Cell emf (iii) Potential difference (iv) Cell voltage
2	Metallic radii of some transition elements are given below. Which of these elements will have highest density? Element Fe Co Ni Cu Metallic radii/pm 126 125 125 128 (i) Fe (ii) Ni (iii) Co (iv) Cu
3	Compound Ph-o-co-ph can be prepared by the reaction of _____. (i) Phenol and benzoic acid in the presence of NaOH (ii) Phenol and benzoyl chloride in the presence of pyridine (iii) Phenol and benzoyl chloride in the presence of ZnCl2 (iv) Phenol and benzaldehyde in the presence of palladium
4	Sucrose (cane sugar) is a disaccharide. One molecule of sucrose on hydrolysis gives _____. (i) 2 molecules of glucose (ii) 2 molecules of glucose + 1 molecule of fructose (iii) 1 molecule of glucose + 1 molecule of fructose (iv) 2 molecules of fructose

5	According to Arrhenius equation rate constant k is equal to $A\, e^{-Ea/RT}$. Which of the following options represents the graph of ln k vs 1/T (i)  (ii)  (iii)  (iv) 
6	What is the correct order of reactivity of alcohols in the following reaction? $R—OH + HCl \xrightarrow{anhy.\ ZnCl_2} R—Cl + H2O$ (i) 1° > 2° > 3° (ii) 1° < 2° > 3° (iii) 3° > 2° > 1° (iv) 3° > 1° > 2°
7	Which of the following statements is not correct about order of a reaction. (i) The order of a reaction can be a fractional number. (ii) Order of a reaction is experimentally determined quantity. (iii) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction. (iv) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.
8	Toluene reacts with a halogen in the presence of iron (III) chloride giving ortho and para halo compounds. The reaction is (i) Electrophilic elimination reaction (ii) Electrophilic substitution reaction (iii) Free radical addition reaction (iv) Nucleophilic substitution reaction
9	Which of the following reactions are disproportionation reactions? (a) $Cu^{+} \rightarrow Cu^{2+} + Cu$ (b) $3MnO_4^{-} + 4H^{+} \rightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$ (c) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$ (d) $2MnO_4^{-} + 3Mn^{2+} + 2H_2O \longrightarrow 5MnO_2 + 4H^{+}$ (i) a, b (ii) a, b, c (iii) b, c, d (iv) a, d
10	Benzyl amine may be alkylated as shown in the following equation : $C_6H_5CH_2NH_2 + R—X \longrightarrow C_6H_5CH_2NHR$ Which of the following alkyl halides is best suited for this reaction through SN_1 mechanism? (i) CH_3Br (ii) C_6H_5Br (iii) $C_6H_5CH_2Br$ (iv) C_2H_5Br
11	Phenol is less acidic than _____. (i) ethanol (ii) o-nitro phenol (iii) o-methyl phenol (iv) o-methoxy phenol

12	In Clemmensen Reduction carbonyl compound is treated with _____. (i) Zinc amalgam + HCl (ii) Sodium amalgam + HCl (iii) Zinc amalgam + Nitric acid (iv) Sodium amalgam + HNO_3
13	Two statements are given below - one labeled Assertion (A) and the other labeled Reason (R). Assertion (A): E^o Ag^+/Ag increases with increase in concentration of Ag+ ions. Reason (R): E^o Ag^+/Ag has a positive value Which of the following is correct? (a) Both A and R are true, and R is a 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.
14	Two statements are given below - one labeled Assertion (A) and the other labeled Reason (R). Assertion (A): Like bromination of benzene, bromination of phenol is also carried out in the presence of Lewis acid. Reason : Lewis acid polarises the bromine molecule Which of the following is correct? (a) Both A and R are true, and R is a 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.
15	Two statements are given below - one labeled Assertion (A) and the other labeled Reason (R). Assertion (A): The two strands of DNA are complementary to each other. Reason (R): Adenine forms H-bonds with Guanine and Thymine forms H-bonds with Cytosine. Which of the following is correct? (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.
16	Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Assertion : The α-hydrogen atom in carbonyl compounds is less acidic. Reason : The anion formed after the loss of α-hydrogen atom is resonance stabilised. Which of the following is correct? (a) Both A and R are true, and R is a 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.
	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	Which of the following compounds will have the highest melting point and why?  (I) (II) (III)
18	How do you explain the presence of all the six carbon atoms in glucose in a straight chain?
19	Match the items of Column I and Column II. Column I — Column II (i) Mathematical expression for rate of reaction — (a) rate constant (ii) Rate of reaction for zero order reaction is equal to — (b) rate law (iii) Units of rate constant for zero order — (c) order of reaction is same as that of slowest step (iv) Order of a complex reaction is determined by — (d) rate of a reaction
20	Write the reactions involved in the following: (i) Hell-Volhard Zelinsky reaction (ii) Decarboxylation reaction OR Carboxylic acids contain carbonyl group but do not show the nucleophilic addition reaction like aldehydes or ketones. Why?
21	20 ml of liquid A is mixed at certain temperature with 20 ml of liquid B and the resulting volume is 39.90 ml.What do you conclude?
	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
22	(a) Unlike dry cell, the mercury cell has a constant cell potential throughout its useful life. Why? (b) Solutions of two electrolytes 'A' and 'B' are diluted. The Λ_M of 'B' increases 1.5 times while that of A increases 25 times. Which of the two is a strong electrolyte? Justify your answer.
23	Complete the following sequence. 
24	Explain why- (a) p-nitrophenol is more acidic than phenol. (b) alcohols and ethers of comparable molecular mass have different boiling points? (c)The carbon-oxygen bond in phenol is slightly stronger than that in methanol. Why?

25	(a) When 1 mol $CrCl_3 \cdot 6H_2O$ is treated with excess of $AgNO_3$, 3 mol of AgCl are obtained. What would be the formula of the complex . (b) Write the correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ (c) Which isomerism is shown by the compounds $[Co(SO_4)(NH_3)_5]Br$ and $[Co(SO_4)(NH_3)_5]Cl$.
26	(a) In a reaction if the concentration of reactant A is tripled, the rate of reaction becomes twenty seven times. What is the order of the reaction? (b) The rate of the chemical reaction doubles for and increase of 10 K in absolute temperature from 298 K. Calculate E_a.
27	(a) Why must vitamin C be supplied regularly in diet? (b) Sucrose is dextrorotatory but the mixture obtained after hydrolysis is laevorotatory. Explain. **OR** Define: (a)- Peptide linkage (b)- Denaturation of protein (c)-Primary structure of protein
28	(a) tert-Butyl bromide reacts with aq. NaOH by SN_1 mechanism while n-butyl bromide reacts by SN_2 mechanism. Why? (b) Discuss the nature of C–X bond in the haloarenes.
	Section D The following questions are case -based questions. Each question has an internal choice and carries 4 marks
29	The process of chemical decomposition of the electrolyte by the passage of electricity through its molten and dissolved state is called electrolysis the process of electrolysis can be explained the basis of theory of ionization when an electrolyte is dissolved in water it splits up in two charged particle called ions the positively charged ions are called cations while the negatively charged ions are called an anions .These ions are free to move about its aqueous solution. When electric current is pass through the solution the ions respond to the applied potential difference and their movement is directed towards oppositely charged electrodes the cations move towards the negatively charged electrode while anions move towards the positively charge electrodes the formation of product at the respectively electrode is due to oxidation at the anode and reduction due to cathode. The product of electrolysis generally depend on the following factors -nature of material being electrolysed, types of electrodes being used ,Kinetic barrier and over voltage reactions .Electrode involve reduction process at its surface computing reduction potential. The one with higher E^o cell and reduction potential will preferentially takes place at cathode .For example during the electrolysis of aqueous solution of sodium chloride there is possibility of reaction of Na ions and reduction of water molecule the reduction of water will preferably takes place and hydrogen gas is obtained instead of sodium. (a) Predict the product of electrolysis is in an aqueous solution of $AgNO_3$ with silver electrode. (b) Name two metals which remain inert during electrolysis. (c)State faraday's first law and what amount of electricity required for electrolytic conversion of 1 mole of nitrobenzene to aniline.

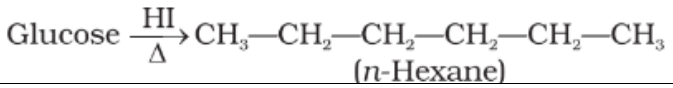
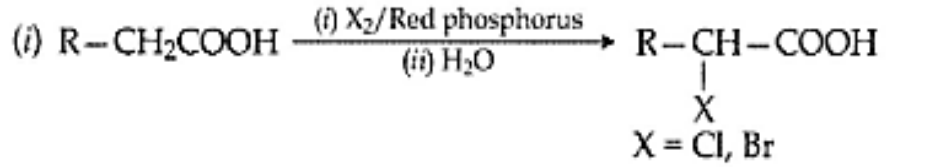
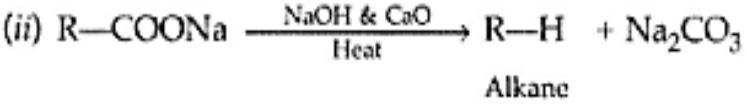
	OR If a current of 0.5 amp flows through a metallic wire for 2 hours then how many electrons flow through the wire .(F=96487C)
30	Read the passage given below and answer the following questions: For understanding the structure and bonding in transition metal complexes,the magnetic properties are very helpful. Low spin complexes are generally diamagnetic because of pairing of electrons, whereas high spin complexes are usually paramagnetic because of presence of unpaired electrons.Larger the number of unpaired electrons, stronger will be the para magnetism.However magnetic behaviour of a complex can be confirmed from magnetic moment measurement Magnetic moment $\mu=\sqrt{n(n+2)}$ B.M. where n = number of unpaired electrons. Greater the number of unpaired electrons, more will be the magnetic moment. Metal carbonyl is an example of coordination compounds in which carbon monoxide (CO) acts as ligand. These are also called homoleptic carbonyls. These compounds contain both σ and π character. Some carbonyls have metal-metal bonds. The reactivity of metal carbonyls is due to (i) the metal centre and (ii) the CO ligands. CO is capable of accepting an appreciable amount of electron density from the metal atom into their empty π or π^* orbitals. These types of ligands are called π-accepter or π-acid ligands. These interactions increases the Δ_o value. (a) What is the oxidation state of metal in [$Mn_2(CO)_{10}$] ? (b) Give two examples of ambidentate ligands (c) Explain synergic bonding in carbonyl compounds. OR Discuss with the help of VBT the Magnetic nature and hybridisation in $[Co(NH_3)_6]^{+3}$
	Section E The following questions are long answer type and carry 5 marks each. All questions have an internal choice.
31	(a) A hydrocarbon 'A', (C_4H_8) on reaction with HCl gives a compound 'B', (C_4H_9Cl), which on reaction with 1 mol of NH_3 gives compound 'C', ($C_4H_{11}N$). On reacting with $NaNO_2$ and HCl followed by treatment with water, compound 'C' yields an optically active alcohol, 'D'. Ozonolysis of 'A' gives 2 mols of acetaldehyde. Identify compounds 'A' to 'D'. Explain the reactions involved. (b) Give a chemical test to distinguish between aniline and ethylamine. **OR** (a)Complete the reaction $\rightarrow$(i) $C_6H_5NH_2 + CHCl_3 + alc.KOH \rightarrow$ (ii) $C_6H_5N_2Cl + KI \rightarrow$ (b) Convert (i) 2-phenylpropanamide into 2-phenylethanamide? (ii) An aryl nitro compound to an amine (iii) benzene diazonium chloride to phenol
32	(i) Differentiate between molarity and molality of a solution. How does a change in temperature influence their values? (ii) Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250.0 g of water. (K_b for water = 0.512 K kg mol^{-1}, molar mass of NaCl = 58.44 g mol^{-1}) OR (a) Define the following terms: (i) Mole fraction (ii) Van't Hoff factor

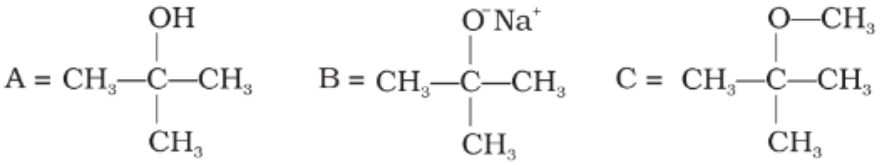
	(b) 100 mg of a protein is dissolved in enough water to make 10.0 mL of a solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C, what is the molar mass of protein? (R = 0.0821 L atm. mol^{-1} K^{-1} and 760 mm Hg = 1 atm
33	(a) When chromite ore, $FeCr_2O_4$, is fused with NaOH in the presence of air, a yellow-coloured compound (A) is obtained, which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms an orange coloured crystalline compound (C). (i) Write the formulae of the compounds (A), (B) and (C). (ii)Write one use of compound (C). (b) Account for the following: (a)The transition metals and their compounds act as good catalysts. (b)The lowest oxide of transition metal is basic,whereas the highest is amphoteric/acidic. OR (a) Write the preparation of following: (i) $KMnO_4$ from K_2MnO_4 (ii)Na_2CrO_4 from $FeCr_2O_4$ (iii) $Cr_2O_7^{2-}$ from CrO^{4-} (b) Assign suitable reasons for the following: (i) The Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to their +3 state. (ii) In the 3d series from Sc (Z = 21) to Zn(Z = 30) the enthalpy of atomisation of Zn is the lowest.

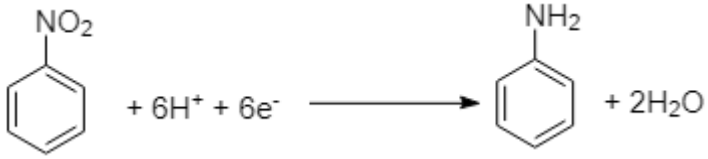
MARKING SCHEME

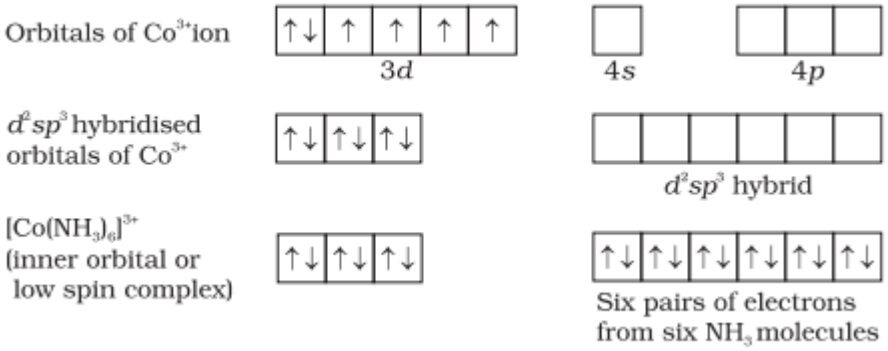
SECTION A

Q 1 TO 16 EACH CORRECT ANSWER 1 MARK.

ANS		
1	(ii) Cell emf	**1**
2	(iv) Cu	**1**
3	(ii) Phenol and benzoyl chloride in the presence of pyridine.	**1**
4	(iii) 1 molecule of glucose + 1 molecule of fructose	**1**
5	**(i)**	**1**
6	(iii) 3° > 2° > 1°	**1**
7	(iii) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction	**1**
8	(ii) Electrophilic substitution reaction	**1**
9	(i) a, b	**1**
10	(iii) $C_6H_5CH_2Br$	**1**
11	(ii) o-nitro phenol	**1**
12	(i) Zinc amalgam + HCl	**1**
13	(b) Both A and R are true, but R is not the correct explanation of A.	**1**
14	(d) A is false, but R is true.	**1**
15	(c) A is true, but R is false.	**1**
16	(d) A is false, but R is true.	**1**
	SECTION B	
17	II, due to symmetry of para-positions; it fits into crystal lattice better than other isomers.	1+1
18	On prolonged heating with HI, glucose gives n-hexane. 	1+1
19	(i) → (b) (ii) → (a) (iii) → (d) (iv) → (d)	**2**
20	**Ans:**   **OR** The carbonyl carbon of carboxylic group is **less electrophilic** than carbonyl carbon in aldehydes and ketones and hence nucleophilic addition reactions of aldehydes and ketones do not takes place with carboxylic acids	**1+1**
21	V_A=20 ml V_B=20 ml Total volume=20 After mixing resulting volume=39.90 ml As ΔV_{mixing} is negative the solution shows negative deviation and $\Delta H_{mixing} < 0$	**1+1**

	SECTION C	
22	**(**a) Ions are not involved in the overall cell reaction of mercury cells. (b) Electrolyte 'B' is strong. As on dilution the number of ions remains the same, only interionic attraction decreases therefore increase in Λm is small.	**1+2**
23		**1+1+1**
24	(a) Nitro group of phenol produces - I and - R effect. Because of these two effects - NO2 group is electron withdrawing in nature. So, the electron density in the O - H bond of p - nitrophenol decreases relative to the O - H bond of phenol. (b)due to the presence of intermolecular hydrogen bonding in alcohols. (c) C - O bond of phenol acquires some partial double bond character while the C - O bond of methanol is purely single bond Therefore, the carbon-oxygen bond in phenol is slightly stronger than that of methanol.	**1+1+1**
25	(a) $[Cr(H_2O)_6]Cl_3$ (b)Diamminedichloridoplatinum (II) (c)Ionization isomerism	**1+1+1**
26	(a) Rate of any elementary reaction can be represented as $r=k[A]^n$ After changing concentration to its triple value A = 3A, r becomes 27r $27r=k[3A]^n$ $(3)^3=(3)^n$ Hence, n=3 Order of reaction is three. (b)Initial temperature, T1=298 K Final temperature, T2=298+10=308 K Calculation of activation energy If K1 and K2 are rate constant at temperature T1 and T2 then, $\log k2/k1=Ea/2.303R(T2-T1/T1T2)$ $\Rightarrow Ea=\log k2/k1\times 2.303R(T1T2/T2-T1)$ $k2=2k1 \quad R=8.314\ J\ K^{-1}\ mol^{-1}$ $\Rightarrow Ea=\log 2\times 2.303\times 8.314\times 298\times 308/308-298$ $\Rightarrow Ea=0.301\times 2.303\times 8.314\times 298\times 308/10\ J\ mol^{-1}$ $=52897\ J\ mol-1=52.89\ kJ\ mol^{-1}$: Ea is 52.89 kJ mol−1	**1+2**
27	a) Vitamin C is water soluble hence, they are regularly excreted in urine and can not be stored in our body, so, they are supplied regularly in diet. (b) Sucrose is dextrorotatory but the mixture obtained after hydrolysis is levorotatory because,Hydrolysis of sucrose (dextrorotatory) gives dextrorotatory glucose and levorotatory fructose.Since the levorotation of fructose (−92.4∘) is more than dextrorotation of glucose (+52.5∘), hence the overall mixture is levorotatory. Thus, the hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to levo (−). Or (a) Peptide linkage- the linkage –CO-NH- which unites various amino acid units in a peptide molecule is called peptide linkage.	**1+2** **(1+1+1)**

	(b) Denaturation of protein-The process that brings about changes in physical as well as biological properties of the proteins is called denaturation of protein. (c) Primary structure of protein -It refers to the sequence in which amino acids are arranged in protein.	
28	(a) Reaction of alkyl bromides with aq. NaOH takes place as nucleophillic substitution reaction Tertiary butyl bromide forms tertiary butyl carbocation.As tertiary butyl carbocation is more stable, it undergoes first nucleophilic substitution (S_N^1) reaction.As n-butyl carbocation allows less hindrance around the central atom, it undergoes second nucleophilic substitution (S_N^2) reaction. (b) The C-X bond in haloarenes is polarized, . Due to high electronegativity of halogen it attracts the electron cloud more towards itself and thus gains slight negative charge, As halogens need only one electron to achieve their nearest noble gas configuration, only one sigma bond is formed between one carbon and one halogen atom. , the C-X bond length in haloarenes increases from fluorine to astatine and bond dissociation strength decrease. Resonance structures of alkyl halide may be drawn.	**1+2**
29	(a) Ag^+ ions are reduced at the cathode. Ag metal gets oxidized at the anode. (b) Pt, gold ,graphite ,(any two) (c))The amount of substance that undergoes a chemical reaction at an electrode during electrolysis is proportional to the quantity of electricity passed through an electrolyte. $m \propto Q$  From reduction of nitrobenzene to aniline, six electrons are required. As we know 1 mole $e^- \longrightarrow$ 1 Faraday charge (96500 C) then 6F charge is required to reduce 1 mole of nitrobenzene. **OR** I= 0.5 A t = 2 hours = 2 × 60 × 60 s = 7200 s Thus, Q = It = 0.5 A × 7200 s = 3600 C We know that $96487\,C = 6.023 \times 10^{23}$ number of electrons. Then, $3600\ C = \frac{6.023 \times 10^{23} \times 3600}{96487}$ number of electrons $= 2.25 \times 10^{22}$ number of electrons Hence, 2.25×10^{22} number of electrons will flow through the wire.	**1+1+2**
30	**(**i) zero (ii)CN and NO_2 (iii) The metal-carbon bond in a metal carbonyl is characterised by both σ and π. The synergic action of the metal-ligand link strengthens the binding between the carbonyl molecule and the metal. A lone pair of electrons on the carbonyl carbon must be donated into a vacant orbital of metal to form the M-C sigma bond. In contrast, to form the M-C π bond, a lone pair of electrons must be donated from a filled d orbital of metal to the vacant antibonding π∗ orbital of	**1+1+2**

	carbon monoxide. Synergic bonding describes this back bonding ability that helps to stabilise the metal-ligand contact. OR  Hybridisation d^2sp^3 inner orbital complex,paramagnetic,octahedral geometry**.**	
31	A gives two moles of CH_3CHO on ozonolysis A = CH_3-CH=CH-CH_3 CH_3-CH=CH-CH_3+HCl → CH_3-CH_2-CH(Cl)-CH_3 B = CH_3-CH_2-CH(Cl)-CH_3 CH_3-CH_2-CH(Cl)-$CH_3 \xrightarrow{NH_3}$ CH_3-CH_2-CH(NH_2)-CH_3 C=CH_3-CH_2-CH(NH_2)-CH_3 CH_3-CH_2-CH(NH_2)-$CH_3 \xrightarrow{NaNO_2+HCl+H_2O}$ CH_3-CH_2-CH(OH)-CH_3 D =CH_3-CH_2-CH(OH)-CH_3 optically active (b) Azo dye test **OR** (a) (i) $C_6H_5NH_2$ + $CHCl_3$ + alc.KOH → C_6H_5NC+KCl+H_2O (ii) $C_6H_5N_2Cl$ + KI → C_6H_5I + KCl (b) (i)NaOH /Br_2 (ii)H_2/Ni or any other reducing agent. (iii)$C_6H_5N_2Cl$+H_2O	**½+1/2+ 1/2+1/2 (FOR A,B,C, D) 2FOR REAC TIONS** **1** **(2+3)**
32	Molality is the number of moles of solute per 1000 g of solvent, whereas molarity is the number of moles of solute per 1000 ml of the solution. Molality is represented as m, whereas molarity is represented as M. Molarity changes with change in temperature because of change in volume. On the other hand, there is no effect of temperature on the molality of the solution. $\Delta Tb = i\ Kb \times 1000 \times W2\ W1 \times M2$ NaCl dissociates as: NaCl → Na+ + Cl– ∴ i = 2 W2 = 15.0 g, W1 = 250.0 g, M2 = 58.44 g mol-1 Kb = 0.512 K kg mol-1 . ∴ $\Delta Tb = 2 \times 0.512 \times 1000 \times 15.0 / 250.0 \times 58.44 = 1.05°C$ ∴ Boiling point of solution = 100 + 1.05 = 101.5°C **OR** (i) (a) Mole fraction is the ratio of number of moles of one component to the total number of moles In a mixture. For example, in a binary mixture containing n1 and n2 moles of two components, Mole fraction of one component, $x_1 = n_1 / n_1+n_2$ Mole fraction of second component, $x_2 = n_2 / n_1+n_2$ (b) van't Hoff factor is the ratio of the normal molar mass to the observed or abnormal molar mass of a solute in a solution due to association or dissociation.	**1+1** **1+1+ 1** **1+1+1+ 2**

	$i = \frac{\text{Normal molar mass}}{\text{Abnormal molar mass (due to dissociation or association)}}$ (ii) Osmotic pressure, $\pi = cRT = \frac{w_2}{M_2 V}RT$ or $M_2 = \frac{w_2}{\pi V}RT$ $w_2 = 100 \times 10^{-3}$g, R = 0.0821 L atm mol^{-1}, T = 298 K $\pi = \frac{13.3}{760}$atm, $V = \frac{10}{1000}$L $M_2 = \frac{100 \times 10^{-3} \times 0.0821 \times 298}{\frac{13.3}{760} \times \frac{10}{1000}}$ $= \frac{100 \times 0.0821 \times 298 \times 760 \times 1000}{10^3 \times 13.3 \times 10}$ = 13980.45 g mol^{-1}	
33	(a) When chromite ore **$FeCr_2O_4$** is fused with **NaOH** in presence of air, a yellow coloured compound obtained is **sodium chromate Na_2CrO4 (A).** **$FeCr_2O_4+NaOH+O_2 \rightarrow Na_2CrO_4+Fe_2O_3+H_2O$** This chromate with acidification with **H2SO4** forms **sodium dichromate** (**B**), sodium sulphate and water. **$Na_2CrO_4+H_2SO_4 \rightarrow Na_2Cr_2O_7+Na_2SO_4+H_2O$** Sodium dichromate with **KCl** forms an orange crystalline compound **potassium dichromate (C)** . **$Na_2Cr_2O_7+KCl \rightarrow K_2Cr_2O_7+NaCl$** Use of(C) 1 in making chromic acid or in volumetric analysis (b) Due to variable oxidation state and tendency to provide suitable surface for reaction. **(c)** In low oxidation state of the metal , some of the valence electrons of the metal atom are not involved in bonding. Hence it can donate electrons and behave as a base. On the other hand, in higher oxidation state of the metal, valence electrons are involved in bonding and are not available **OR** (i) $K_2Mno_4+Cl_2 \rightarrow KMnO_4 + KCl$ (ii) $FeCr_2O_4+NaOH+O_2 \rightarrow Na_2CrO_4+Fe_2O_3+H_2O$ (iii) $CrO_4^{2-}+H^+ \rightarrow Cr_2O_7^{2-}$ (b) (i) Half-filled and fully-filled orbitals are more stable. Therefore, Mn in (+2) state has a stable d^5 configuration. Fe^{2+} has $3d^6$ configuration and by losing one electron, its configuration changes to a more stable $3d^5$ configuration. Therefore, Fe^{2+} easily gets oxidized to Fe^{+3} oxidation state. (ii) Due to the absence of unpaired electrons, the inter-atomic electronic bonding is the weakest in Zn and as a result, it has the least enthalpy of atomization	**3+1+1**

Blue Print

2023-24

Unit No.	Name of Unit	Sec-A		Sec- B	Sec- C	Sec- D	Sec- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions			1 (2)			1 (5)	**2 (7)**
II	Electrochemistry	1 (1)	1 (1)		1 (3)	1 (4)		**4 (9)**
III	Chemical Kinetics	2 (2)		1 (2)	1 (3)			**4 (7)**
IV	d -and f -Block Elements	2 (2)					1 (5)	**3 (7)**
V	Coordination Compounds				1 (3)	1 (4)		**2 (7)**
VI	Haloalkanes and Haloarenes	1 (1)		1 (2)	1 (3)			**3 (6)**
VII	Alcohols, Phenols and ethers	2 (2)	1 (1)		1 (3)			**4 (6)**
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)	1 (2)	1 (3)			**5 (8)**
IX	Amines	1 (1)					1 (5)	**2 (6)**
X	Biomolecules	1 (1)	1 (1)	1 (2)	1 (3)			**4 (7)**
Total		**12 (12)**	**4 (4)**	**5 (10)**	**7 (21)**	**2 (8)**	**3 (15)**	**33 (70)**

SET-15

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time:3 Hours**

General Instructions:

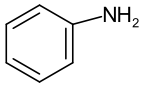
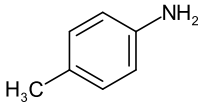
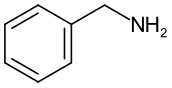
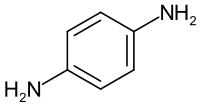
Read the following instructions carefully.

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 very 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 calculator 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.

1. Among the following which is the strongest base?

(A)  (B)  (C)  (D) 

2. $KMnO_4$ acts as an oxidizing agent in alkaline medium. When alkaline KMnO4 is treated with KI, iodide ion is oxidised to _____

(A) I_2 (B)IO^- (C)IO_3^- (D) IO_4^-

3. Rate law for the reaction A + 2B $\longrightarrow$ C is found to be.

Rate = K[A][B]

Concentration of reactand 'B' is doubled, keeping the concentration of 'A' constant the value of rate constant will be.

(A) The same (B) doubled (C) Quadrupled (D) halved

4. The reaction: $2N2O5 \rightarrow 2N_2O4+O2$

(A) Bimolecular and first order (B) Unimolecular and second order
(C) Bimolecular and second order (D) Unimolecular and first order

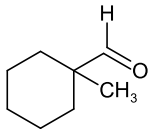
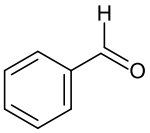
5. Interstitial compounds are formed when small atoms are trapped inside the crystal lattice of metals. Which of the following is not the characteristic property of interstitial compounds.

(A) They have high melting point in comparison to pure metals.
(B) They are very hard.
(C) They retain metallic conductivity.
(D) They are chemically very reactive.

6. Williamson's synthesis of preparing dimethyl ether is a/an.

(A) S_N1 reaction (B) Elimination reaction
(C) S_N2 reaction (D) Nucleophile addition reaction

7. Cannizzaro's reaction is not given by…….

(A)  (B)  (C) HCHO (d) CH_3CHO

8. The reaction,

$$\mathbf{RCN + SnCl_2 + HCl \rightarrow RCH = NH \xrightarrow{H_3O^+} RCHO}$$

Is known as

(a) Étard reaction
(b) Haloform reaction
(c) Gattermann- Koch reaction
(d) Stephen reaction

9. Reaction of 1-phenyl-2 chloropropane with alcoholic KOH gives mainly.

(A) 1- phenylpropene (B) 3- phenylpropene
(C) 1-phenylpropan-3-ol (D) 1- phenylpropan-2-o1

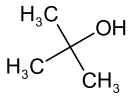
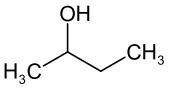
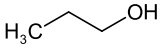
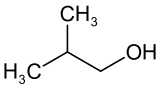
10. The quantity of charge required to obtain one mole of aluminum from AI_2O_3 is _____

(A) 1 F (B) 6F (C) 3F (D) 2F

11. Disaccharides that are reducing in nature are.

(A) Sucrose and lactose (B) Sucrose and maltose
(C) Lactose and maltose (D) Sucrose, lactose and maltose

12. Lucas reagent produces cloudiness immediately with

(A)  (B)  (C)  (D) 

13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Addition reaction of water to but-1-ene in acidic medium yields butan-2-o1.

Reason (R): Addition of water in Acidic medium proceeds through the formation of primary carbanion.

(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.

14. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Carboxylic acids have higher boiling liquids than aldehydes, ketones and even alcohols of comparable molecular masses.

Reason (R): More extensive association of carboxylic acid molecules through intermolecular hydrogen bonding is responsible for the high boiling point of carboxylic acid.

(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.

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Vitamins A, D, E and K are stored in liver and adipose tissue.

Reason (R): Vitamins A, D, E and K are should in fats and oils.

(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.

16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Rate of reaction increase with increase in temperature.

Reason (R): Number of collisions increases with increase in temperature.

(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.

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 would be the molar mass of a compound if 6.21 g of it dissolved in 24.0 g of chloroform to form a solution that has a boiling point of 68.04°C. The boiling point of pure chloroform is 61.7°C and the boiling point elevation constant, Kb for chloroform is 3.63°C/m.

18. Give reasons for the following.

(i) Aquatic species are more comfortable in cold water than warm water.

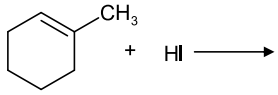
(ii) At higher altitudes people suffer from anoxia resulting in inability to think.

19. Write use for each of the following.

(i) DDT (ii) Iodoform

OR

Complete the following reactions.

(i) 

(ii) $CH_3CH_2CH= CH_2 + HBr \rightarrow$

20. How will you convert the following?

(i) Ethanal to 2- hydroxypropanoic acid

(iii) Toluene to benzoic acid.

21. What is difference between fibrous protein and globular protein? Give example.

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.

22. (a) State the condition for reverse osmosis.

(b) At 300 K, 36g of glucose present in a liter of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bar at the same temperature, what would be its concentration?

23. (i) write the formula of the following coordination compounds. Iron (III) hexacyanoferrate (II)

(ii) What type of isomerism is exhibited by the complex $[Co(NH_3)_5Cl]SO_4$

(iii) Write the hybridization and number of unpaired electrons in the complex $[CoF_6]^{3-}$ (Atomic number of Co=27)

24. The resistance of a conductivity cell, when filled with 0.05M solution of an electrolyte x,is 100 Ω at 40 °C. The same conductivity cell filled with 0.01 M solution of electrolyte y,has a resistance of 50 Ω. The conductivity of 0.05 M solution of electrolyte x is $1.0x10^{-4}$ S cm^{-1} calculate

(i) Cell constant

(ii) Conductivity of M y solution.

(iii) Molar conductivity of 0.01M y solution.

25. What happen when?

(i) Chlorobenzene is treated with $Cl_2/FeCl_3$?

(ii) Ethyl chloride is treated with $AgNO_2$?

(iii) 2- bromopentane is treated with alcoholic KOH?

26. Write the chemical equation to illustrate the following name reactions. (Any two)

(i) Wolff-kishner reduction

(ii) Aldol condensation

(iii) Cannizzaro reaction

27. (i) what is the correct structure of D- (+) – glucose?

(ii) Glucose on oxidation with HNO_3 give a dicarboxylic acid called saccharic acid. What does this result indicate?

(iii) The pentaacetate of glucose does not react with H_2N-OH what does this result indicate.

28. Draw the structure and name the product formed, if the following alcohols are oxidised. Assuming that an excess on oxidizing agent is used.

(i) $CH_3CH_2CH_2CH_2OH$

(ii) 2- butanol

(iii) 2-methyl-1-propanol

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. Alfred Werner's theory postulated the use of two types of linkage (primary and secondary), by a metal atom/ion in a coordination compound. He predicted the geometrical shapes of a large number of coordination entities using the property of isomerism. The valence Bond theory (VBT) explains the formation, magnetic behavior and geometrical shapes of coordination compounds. If, however, fails to describe the optical properties of these compounds. The crystal field theory (CFT) explains the effect of different crystals fields (provided by the ligands taken as point charges) on the degeneracy or d-orbital energies of the central metal atom/ion.

Answer the following questions.

(i)When a coordination compound $NiCl_2.6H_2O$ is mixed with $AgN0_3$ solution two moles of AgCl are precipitated per mole of the compound. Write the structural formula of the complex.

(ii) Why s-orbital does not show preference to any direction?

(iii)Using valance bond theory, predict the geometry and magnetic nature of

(a) $[Ni(CO)_4]$ (b) $[Fe(CN)_6]^{3-}$

OR

(iii) How many geometrical isomers are possible in the following coordination entities?

(a) $[Cr(C_2O_4)_3]^{3-}$ (b) $[Co(NH_3)_3Cl_3]$

30. In first- order reaction in which the rate- limiting step is the protonation of the reactant, the sorption of the reactant dominates the rates. Identical intrinsic rates of reactions were observed for the cracking of alkanes over zeolites of different structure types and after post-synthesis treatments. Compensation relations were observed, which shows that the differences in kinetic parameters are caused by the sorption characteristics of the reactants. A better fit between reactant and pore wall increases the heat of absorption, and decreases the apparent reaction barrier.

Reactions that depend on the stability of the adsorbed reactive intermediates will have a different dependence on zeolite structure and Si/Al ratio, which is shown by the kinetic parameters of the dehydrogenation of alkanes. There is no simple dependence of zeolitic acid strength and the rate of reaction in either of these types of reactions.

Answers the following questions given below

I. Give the example of first order reaction.

II. Plot the graph between log $[R_O]/[R]$ vs time(t) for a first order reaction.

III. (a) Give the mathematical expression for the half-life of a first order reaction and also give the unite of rate constant.

(b) Time required to decompose SO_2Cl_2 to half of its initial amount is 60 min. If the decomposition is a first order reaction, calculate the rate constant of the reaction.

OR

A first order reaction takes 40 min for 30% decomposition calculate the rate constant.

SECTION E

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

31. Attempt any five of the following.

(a). Which of the following are amphoteric oxides?

Mn_2O_7, CrO_3 Cr_2O_3, CrO, V_2O_5 , V_2O4

(b). Calculate the 'spin only magnetic moment of $M^{2+}(aq)$ ion. (z=27)

(c). Why are the E^o Values of Mn, Zn More negative than expected?

(d). Draw the structure of manganate ion and permanganate ion.

(e). Why there is striking similarities (horizontal and vertical) among successive members of the transition series?

(f). Why Zn^{2+} salts are white, while Ni^{2+} salts are blue?

(g). Name the element showing maximum number of oxidation states among the first series of transition metals from Sc(Z=21) to Zn(Z=20).

32.(i)State Kohlrausch law.

(ii) Calculate the emf of the following cell at 298 K

$Al(s)|Al^{3+}$ (0.15M) |Cu2+(0.025M)Cu(s)

(Given: $E_{(A1^{3+}/A1)}$= - 1.66V, $E_{(Cu^{2+}/cu)}$=0.34V

Log 0.15 = - 0. 8239, log 0.025 – 1.6020)

OR

A. Calculate the time to deposit 1.5 g of silver at cathode when current of 1.5 A was passed through the solution of Ag NO_3. (Molar mass of Ag=108 $gmol^{-1}$,1 f = 96500 C mol^{-1}

B. Calculate emf of the following cell at 25°C:

$Fe/Fe^{2+}(0.001M)$ //$H^+(1M)/H_2(g)$ (1 bar)/Pt(s)

$E^0(Fe^{2+}/Fe)$ =0.44V, $E^0(H^+/H_2)$=0.00V

C. What type of cell is mercury cell. Why is it more advantageous than dry cell?

33.(a) Give reasons for the following.

(i) Aniline does not undergo Friedel-Crafts reaction.

(ii) Acetylation of aniline reduces its activation effect.

(b) Arrange the following.

(i) In the decreasing order of pK_b values

$C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$.

(ii)In the increasing order of basic strength

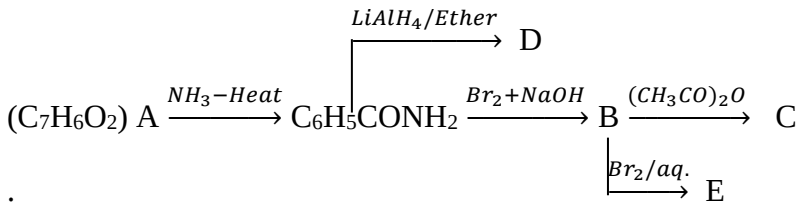
CH_3NH_2, $C_6H_5NH_2$, $C_6H_5CH_2NH_2$ and $(CH_3)_3N$.

(iii)In the increasing order of basic strength.

Aniline, p-nitroaniline, p-toluidine

OR

An aromatic compound *'A'* of molecular formula $C_7H_6O_2$. undergoes a series of reactions as shown below. Write the structures of *A, B, C, D* and *E* in the following reactions.



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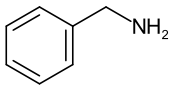
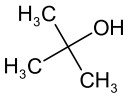
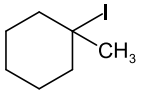
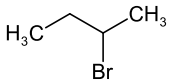
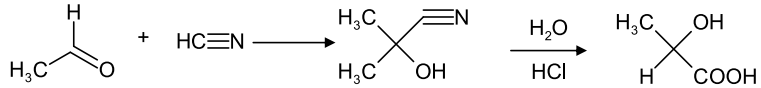
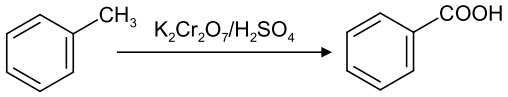
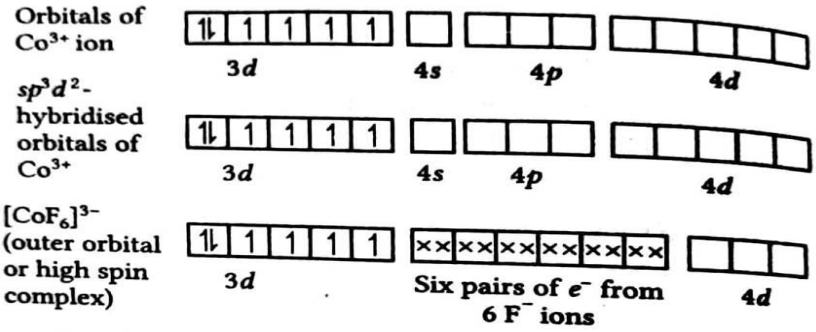
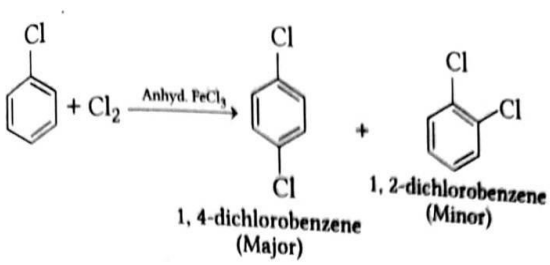
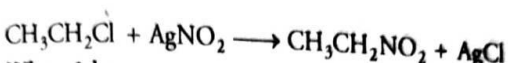
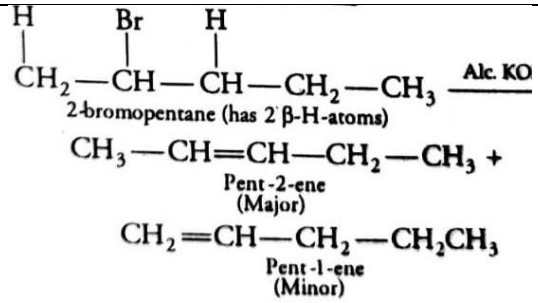
Marking Scheme
Subject: Chemistry Theory (043)
Class: XII 2023 – 24

Section A	
1.	 (c)
2.	(c) IO_3^-
3.	(b) Doubled
4.	(a) Bimolecular and first order
5	(d) They are chemically very reactive
6	(c) S_N2 reaction
7	(d) CH_3CHO
8	(d) Stephen reaction
9	(d)1-phenylpropan-2-ol
10	(c)3 F
11	(c) Lactose and maltose
12	 **(a)**
13.	(C) A is true, but R is false
14.	(A) both A and R are true, and R is correct explanation of A
15	B) both (A) and (R) true but (R) is not correct explanation of (A)
16	(A) both A and R are true, and R is correct explanation of A
17	w_2=6.21g, w_1=24.0g T_b=68.04 ^OC, T^o_b=61.7^oC and K_b=3.63^OC/m $\Delta T_b = T_b - T^o_b$= 68.04^OC - 61.7^OC = 6.34^oC $\Delta Tb = \frac{K_b \times w_2 \times 1000}{M_2 \times w_1}$ $M_2 = \frac{3.63 \times 6.21 \times 1000}{6.34 \times 24}$ = 148.15 g mol^{-1}
18	(i)Aquatic species are more comfortable in cold water than warm water because amount of dissolved oxygen decreases with the rise in temperature(per unit area) in accordance with Henry's law. Hence, species do not get sufficient oxygen. (ii)At higher altitudes people suffer from anoxia resulting in inability to think because at higher altitudes, the partial pressure of oxygen is less than that at ground level. This leads to low concentration of oxygen in the blood and tissues of people.
19.	(i)Powerful insecticide (ii)As an antiseptic **OR**  (i)  (ii)
20	(i) Ethanal to 2- hydroxy propanoic acid  2- Hydroxypropanoic acid

	(ii) Toluene to benzoic acid  Toluence Benzoic acid
21	Fibrous proteins have thread or fiber like structures and are insoluble in water, whereas globular proteins have spherical shape and are soluble in water. **Fibrous protein** Keratin and myosin. **Globular protein** Insulin and albumin
22	(i) pressure applied on the solution should be larger than osmotic pressure (ii) $\pi = CRT = n/V\ RT = W_2 \times RT/M_2 \times V$ For both solutions, R, T and V are constant. ❖ In the first case, (M_2 =180 for glucose) $4.98 = 36/180 \times R \times 300/V$ In the second case, $1.52 = W_2/M_2V \times R \times 300$ On dividing Eq. (ii) by Eq. (i) we get W_2/M_2V or C = 0.061 mol L^{-1}
23	**(i) Iron (III) hexacyanoferrate (II) has formula—** **$Fe_4[Fe(CN)_6]_3$** **ii) $[Co(NH_3)_5Cl]SO_4$ exhibit ionisation isomerism.** **Its ionisation isomer is $[Co(NH_3)_5SO_4]Cl$** **ii) $[CoF_6]^{3-}$: Oxidation state of cobalt is +3.**  **Six pairs of electrons one from each F^- ion occupy the six hybrid orbitals. Thus, the complex has octahedral geometr (sp^3d^2).**
24	(i) Cell constant, G· =Resistance (R) × conductivity (K) $= 100 \times 1.0 \times 10^{-4} = 10^{-2}\ cm^{-1}$ (ii) Conductivity of solution y, K= CELL CONSTANT/Resistance = $10^{-2}/50 = 2\times10^{-4}$ S cm^{-1} (iii) Molar conductivity of solution y, $\Lambda_m = k\times1000/Molarity = 2\times10^{-4} \times1000/0.01 = 20\ S\ cm^2\ mol^{-1}$
25.	**(i)**  **(ii)**  (iii) When 2-bromopentane is treated with alcoholic KOH, it undergoes dehydrohalgenation. This is in accordance to Saytzeff.



26 **(i)Wolff- Kishner reduction** In this method the aldehyde or ketone is heated with hydrazine and KOH or NaOH in high boiling solvent such as ethylene glycol. It is used when carbonyl compounds are sensitive to acids.

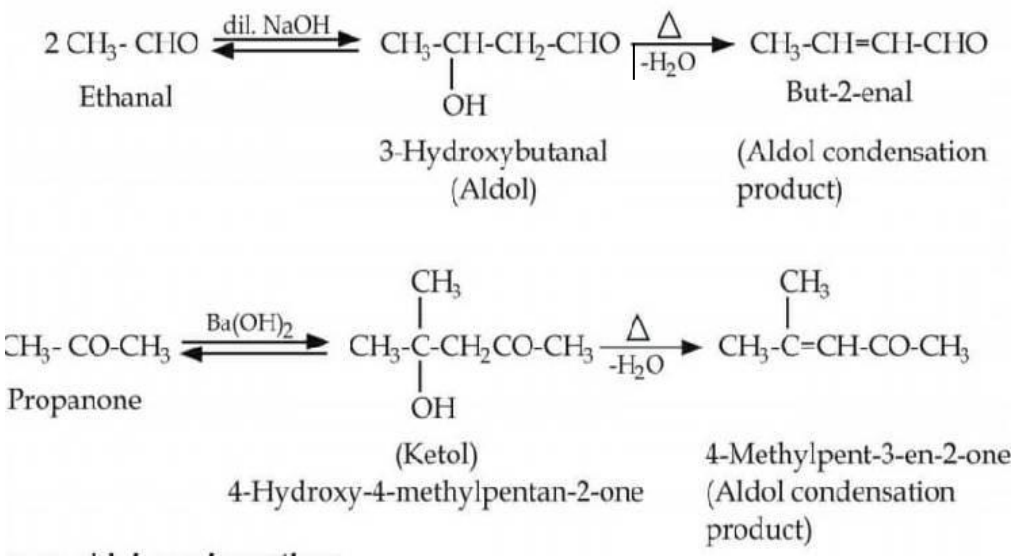
$$>C = O + H_2N\text{-}NH_2 \xrightarrow{-H_2O} >C = N\text{-}NH_2 \xrightarrow{KOH/\Delta} >CH_2 + N_2$$

ii) Aldol reaction

Aldehydes and ketones having at least one hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form β-hydroxyaldehydes (aldol) or β -hydroxy ketones (ketol) respectively. This is known as **Aldol reaction** The name aldoi is derived from the names of two functional groups aldehyde and alcohol present in the products.

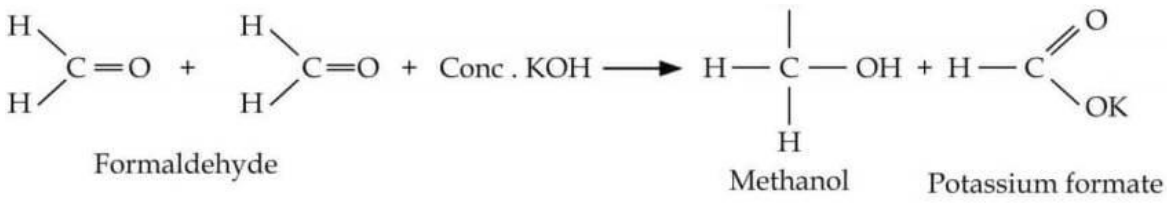
Aldol condensation.

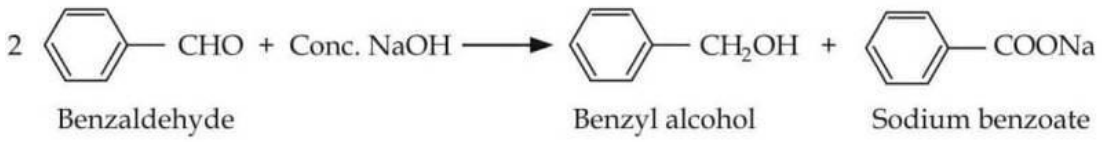
The aldol and ketol readily lose water to give α,β unsaturated carbonyl compound which are aldol condensation products and the reaction is called **aldol condensation**



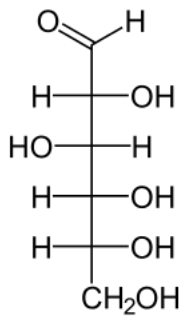
(iii) cannizzaro reaction:

aldehydes which do not have an a- hydrogen atom, undergo self oxidation and reductation (disproportion) reaction on treatment with concentrated alkali. In this reaction, one molecule of the aldehyde is reduced to alchol while another is oxidized to carboxylic acid salt.





27 (i)



D-Glucose

(ii) Glucose on oxidation with HNO_3 gives saccharic acid, This indicates the presence of a one primary alcoholic (-OH) group in glucose.

(iii) The pentaacetate of glucose dose not react with Hydroxylamine which shows the absence of free **Aldehydic** (---CHO) **group.**

28

(i) $CH_3CH_2CH_2CH_2OH \xrightarrow{[O]} CH_3CH_2CH_2COOH$

(ii) $CH_3CH(OH)\text{-}CH_2CH_3 \xrightarrow{[O]} CH_3\text{-}COCH_2CH_3$

(iii) $CH_3\ CH(CH_3)CH_2OH \xrightarrow{[O]} CH_3CH(CH_3)COOH$

29 (i)The structure formal of the complex is $[Ni(H_2O)_6]Cl_2$

(ii) (b) The s-orbital is spherically symmetrical in shape, so it dose not show preference to any direction

It is same from all the directions.

(iii) a) $[Ni(CO)_4]$

Geometry ———— Tetrahedral

Magnetic behavior ——— Diamagnetic

(b) $[Fe(CN)_6]^{3-}$

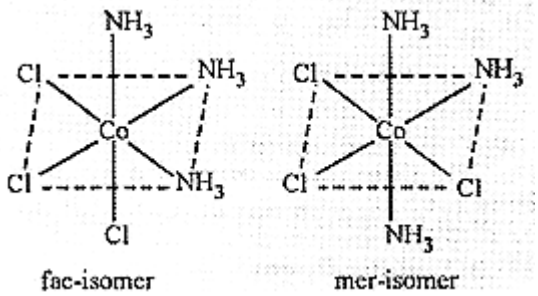
Geometry———— Octahedral

Magnetic begaviour – Paramagnetic

OR

(i) No geometrical isomer is possible.

(ii) Two geometrical isomers are possible for $[Co(NH_3)_3CI_3]$.



fac-isomer mer-isomer

30 (i) All natural and artificial radioactive decay of unstable nuclei takes place by first order kinetics.

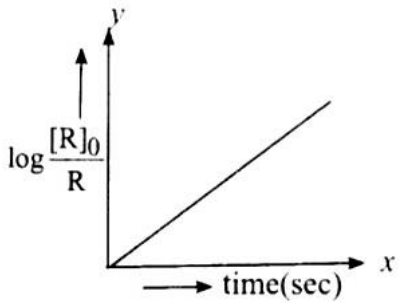
$^{226}_{88}Ra \rightarrow {}^{4}_{2}He + {}^{222}_{86}Rn$

Hydrogenation of ethene and decomposition of N_2O_5 and N_2O are also the example of first order reactions.

(ii) for the first order reaction,

$k = \frac{2.303}{t} \log \frac{[R_o]}{[R]}$

If we plot a graph between $\log[R_0] / R_0]$ vs t we get a straight line with the slope = K/2.303 as show below



Slope = k/2.303

(iii) a. for first order reaction,

$t_{1/2} = \frac{0.693}{k}$

And unit of k is s^{-1}

(b) rate constant (k) = 0.0693/ 60 min = $1.925 \times 10^{-4}\ s^{-1}$

OR

$[R_0]=100$, $[R]=100 - 30 - 70$, t = 40min

$k = 2.303/t \log [R_0]/[R]$

$= 2.303/40 \log 100/70 = 2.303/40 * 0.1548$

$\therefore k = 8.91 * 10^{-3}\ min^{-1}$

31 (a) V_2O_5 and Cr_2O_3 are amphoteric oxides because both react with alkalies as well as acids.

(b) Magnetic moment $\mu = \sqrt{n(n+2)}$ BM

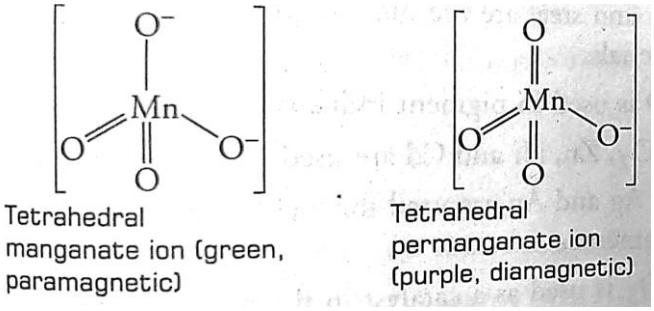
Electronic configuration of M = $[Ar]3d^7 4s^2$

$M^{2+} = [Ar]3d^7 4s^0$

So, μ = 3.89 BM

(c) Negative E^- values of Mn^{2+} and Zn^{2+} are related to stabilities of half filed and completely Filed configuration respectively.

(d)



Tetrahedral manganate ion (green, paramagnetic)

Tetrahedral permanganate ion (purple, diamagnetic)

(e) This is because of the fact that along a horizontal row, electrons enters an incomplete inner shell while outer shell remains unchanged. In vertical columns, similarities are due to similar electronic configurations.

(f) Electronic configuration of Zn^{2+} = $3d^{10} 4s^0$

Electronic configuration of Ni^{2+} = $3d^8 4s^0$

Compounds that contains unpaired electrons are coloured

(g) Mn (Manganese) shows the maximum number of oxidation states.

Electronic configuration of Ni^{2+} = $3d^8 4s^0$

Compounds that contain unpaired electrons. (Ni^{2+})are coloured

(h) Mn (Manganese) shows the maximum number of oxidation states.

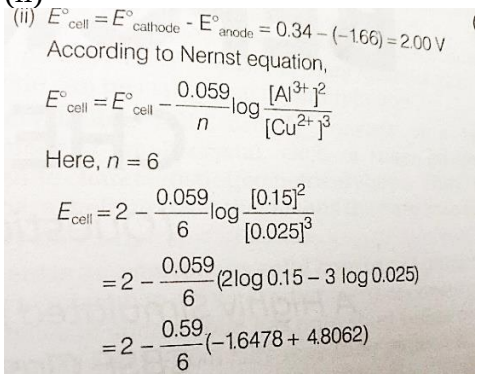
32 Kohlraush Law: It states that "limiting molar conductivity of an electrolyte is the sum of the individual contribution of the cation and the anion of the electrolyte".

e.g. $\lambda^o_{m\,(NaCl)} = \lambda^o_{Na^+} + \lambda^o_{Cl^-}$

where $\lambda^o m$ (NaCl) is the molar conductivity of NaCl and $\lambda^o\ Na^+$ and $\lambda^o\ Cl^-$ are limiting molar conductivity of sodium and chloride ions respectively.

In general, if an electrolyte produces v_+ cations and v_- anions, the above equation becomes

(ii)



(ii) $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode} = 0.34 - (-1.66) = 2.00\ V$

According to Nernst equation,

$$E^\circ_{cell} = E^\circ_{cell} - \frac{0.059}{n}\log\frac{[Al^{3+}]^2}{[Cu^{2+}]^3}$$

Here, $n = 6$

$$E_{cell} = 2 - \frac{0.059}{6}\log\frac{[0.15]^2}{[0.025]^3}$$

$$= 2 - \frac{0.059}{6}(2\log 0.15 - 3\log 0.025)$$

$$= 2 - \frac{0.59}{6}(-1.6478 + 4.8062)$$

= 2 - 0.0311 = 1.9689 V

OR

(i)

$Ag^+ + e^- \longrightarrow Ag$

108 g of Ag are deposited by 96500 C

$\therefore$ 1.5g of Ag will be deposited by $\frac{96500}{100} \times 1.5 = 1340.27C$

$$t = \frac{Q}{I} = \frac{1340.27}{1.5} = 893.5\ s$$

(ii)

$Fe_{(s)} + 2H^+_{(aq)} \rightarrow Fe^{2+}_{(aq)} + H_{2(g)}$

$\therefore n = 2$

$E^0_{cell} = 0.44\ V$

Nernst equation

$$E_{cell} = E^0_{cell} - \frac{0.059}{2}\log\frac{[Fe^{2+}]}{[H^+]^2}$$

$$E_{cell} = 0.44V - \frac{0.059}{2}\log\frac{(0.001\,M)}{(1M)^2}$$

$$= 0.44\ V - \frac{0.059}{2}\log(10^{-3})$$

= 0.44 V – 0.0885 V

= 0.3515 V

(iii)Primary cell. It has efficiency and its voltage remains constant over a longer period.

33. (a) (i) Aniline being a lewis base , reacts with the lewis acid $AlCl_3$ used in Friedel – Crafts reaction and produces a salt , hence not show Friedel – Crafts reaction .

$C_6H_5.NH_2 + AlCl_3 \rightarrow C_6H_5.NH_2^+AlCl_3^-$ (SALT)

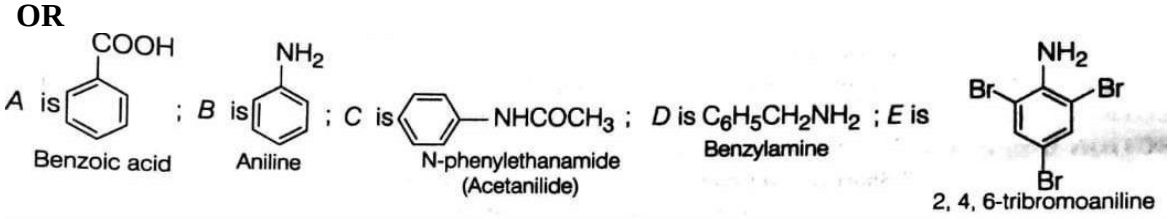
Due to electron withdrawing effect of the acetyl group, the lone pair of electrons on N –atom is attracted by group. As a result lone pair of electrons on N-atom is not exclusively available for donation to the benzene ring and hence, activating effect of the $-NH_2$ group is reduced .

(b) (i) $C_6H_5NH_2 > C_6H_5NHCH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$

(ii) $C_6H_5NH_2 < C_6H_5CH_2NH_2 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

(iii) p –nitroanilline < aniline< p - toluidine

OR



Blue Print

2023-24

Unit No.	Name of Unit	Section-A		Section- B	Section- C	Section- D	Section- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions			2 (4)	1(3)			**3 (7)**
II	Electrochemistry	1 (1)			1 (3)		1(5)	**3 (9)**
III	Chemical Kinetics	2 (2)	1(1)			1(4)		**4 (7)**
IV	d -and f -Block Elements	2 (2)					1 (5)	**3 (7)**
V	Coordination Compounds				1 (3)	1 (4)		**2 (7)**
VI	Haloalkanes and Haloarenes	1 (1)		1 (2)	1 (3)			**3 (6)**
VII	Alcohols, Phenols and ethers	2 (2)	1 (1)		1 (3)			**4 (6)**
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)	1 (2)	1 (3)			**5 (8)**
IX	Amines	1 (1)					1 (5)	**2 (6)**
X	Biomolecules	1 (1)	1 (1)	1 (2)	1 (3)			**4 (7)**
Total		**12 (12)**	**4 (4)**	**5 (10)**	**7 (21)**	**2 (8)**	**3 (15)**	**33 (70)**

SET-16

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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

1.The half-cell reactions with their appropriate standard reduction potentials are

(i) $Pb^{2+} + 2e^- \rightarrow Pb$ $E° = -0.13$ V (ii) $Ag^+ + e^- \rightarrow Ag$ $E° = +0.80$ V

Based on the above data, which of the following reactions will take place?

(a) $Pb^{2+} + 2Ag \rightarrow 2Ag^+ + Pb$ (b) $2Ag + Pb \rightarrow 2Ag^+ + Pb^{2+}$

(c) $2Ag^+ + Pb \rightarrow Pb^{2+} + 2Ag$ (d) $Pb^{2+} + 2Ag^+ \rightarrow Pb + Ag$

2.A reaction in which reactants (R) are converted into products (P) follows second order kinetics. If concentration of R is increased by four times,what will be the increase in the rate of formation of P?

(a) 9 times (b) 4 times

(c) 16 times (d) 8 times

3.The unit of rate constant for the reaction $2H_2 + 2NO \rightarrow 2H_2O + N_2$ which has rate = $K[H_2][NO]^2$, is

(a) mol $L^{-1}s^{-1}$ (b) s^{-1}

(c) $mol^{-2}\ L^2\ s^{-1}$ (d)mol L^{-1}

4. Which of the following d-block element has half-filled penultimate as well as valence subshell?

(a) Cu (b) Au

(c) Ag (d) Cr

5. Reactivity of transition elements decreases almost regularly from Sc to Cu because of

(a) lanthanoid contraction (b) regular increase in ionisation enthalpy

(c) regular decrease in ionisation enthalpy (d) increase in number of oxidation states.

6. When propanal reacts with 2-methylpropanal in presence of NaOH, four different products are formed. The reaction is known as

(a) aldol condensation (b) cross aldol condensation

(c) Cannizzaro reaction (d) HVZ condensation

7.The addition of HCN to carbonyl compounds is an example of

(a) nucleophilic addition (b) electrophilic addition

(c) free radical addition (d) electrometric addition

8. Which of the following can exist as zwitter ion?

(a) p-Aminoacetophenone (b) Sulphanilic acid

(c) p-Nitroaminobenzene (d) p-Methoxyphenol

9.Which of the following bases is not present in DNA?

(a) Adenine (b) Thymine

(c) Cytosine (d) Uracil

10.Which of the following compounds are gem-dihalides?

(a) Ethylidene chloride (b) Ethylene dichloride

(c) Methyl chloride (d) Benzyl chloride

11.The process of converting alkyl halides into alcohols involves

(a) addition reaction (b) substitution reaction

(c) dehydrohalogenation reaction (d) rearrangement reaction

12.What is the correct order of reactivity of alcohols in the following reaction?

R-OH + HCl $\longrightarrow$ 2 R-Cl + H_2O (In presence of $ZnCl_2$)

(a) 1° > 2° > 3° (b) 1° < 2° > 3°

(c) 3° > 2° > 1° (d) 3° > 1° > 2°

13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): The electrode potential of SHE is zero

Reason(R): In SHE HCl 1M and H_2 gas at one bar pressure is taken.

(a) Both assertion and reason are correct and reason is the correct explanation of the assertion

(b) Both assertion and reason are correct and reason is not the correct explanation of the assertion

(c) Assertion is correct but reason is incorrect

(d) Assertion is wrong Reason is correct.

14 Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A) : : p-nitrophenol is more acidic than phenol.

Reason(R) : Nitro group helps in the stabilisation of the phenoxide by dispersal of negative charge due to resonance.

Select the most appropriate answer from the options given below:

(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.

15. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion(A): Carbonyl compounds take part in nucleophilic addition reactions.

Reason(R) : These reactions are initiated by nucleophilic attack at the electron deficient carbon atom.

Select the most appropriate answer from the options given below:

(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.

16. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion(A): Polysaccharides are called non-sugars.

Reason(R): Carbohydrates which yield a large number of monosaccharide units on hydrolysis are called polysaccharides.

Select the most appropriate answer from the options given below:

(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

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.(a)Plot a graph between vapour pressure and mole fraction of a solution obeying Raoult's Law at constant temperature?

(b) Define cryoscopic constant?

18. For the reaction R→P, the conc. of reactant changes from 0.03M to 0.02M in 25 min. Calculate average rate of the reaction using the unit of time in second.

19. Haloalkanes react with KCN to form alkyl cyanides as main product while AgCN forms isocyanides as the main product. Explain.

20(a). . Name the reagent which is used to convert allyl alcohol to propanol.

(b) Name the aldehyde which does not give Fehling solution test.

OR

Give a chemical test to distinguish between the following pairs: -

(a) Phenol and benzoic acid

(b) Benzaldehyde and Acetophenone

21. What is the difference between a nucleoside and a nucleotide?

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.

22: Calculate the emf of the cell in which the following reaction takes place:

$$Ni_{(s)} + 2Ag^{+}(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag_{(s)}$$

Given that

$$E^{\ominus}_{(cell)} = 1.05V$$

23. The reaction between A and B is first order with respect to A and zero order with respect to B. Fill in the blanks in the following table:

Experiment	[A] mol L^{-1}	[B] mol L^{-1}	Initial rate mol L^{-1} min^{-1}
I	0.1	0.1	2.0×10^{-2}
II	-	0.2	4.0×10^{-2}
III	0.4	0.4	-
IV	-	0.2	2.0×10^{-2}

24 (a). Out of 2-chloroethanol and ethanol which is more acidic and why? (any three)

(b)Suggest a reagent for conversion of ethanol to ethanol

(c)Out of o-nitrophenol and p-nitrophenol, which is more volatile? Explain.

(d) Arrange the following compounds in increasing order of acidity and give a suitable explanation: Phenol, o-nitrophenol, o-cresol

25.(a). Write chemical equation to illustrate following name reactions: -

(i) Cannizzaro's reaction

(ii) Hell-Volhard-Zelinsky reaction.

(b) Arrange the following:C_6H_5COOH, FCH_2COOH, NO_2CH_2COOH (decreasing order of their acidic character)

26.(a)Write the formula for the coordination compound Tetraamineaquachloridocobalt(III) chloride

(b)Why a solution of $[Ni(H_2O)_6]^{2+}$ is green while a solution of $[Ni(CN)_4]^{2-}$ is colourless? (At.no. Ni = 28)

(c) Write electronic configuration of $[Cu(NH_3)_6]^{2+}$ on the basis of crystal field splitting theory.

27.(a) Name the poisonous compound obtained when chloroform is exposed to air, in presence of sunlight.

(b) Haloalkanes react with aq. KOH to form alcohols but react with alc. KOH to form alkenes. Why?

28. (a)Name the vitamin whose deficiency causes 'pernicious anaemia'.

(b) Name the protein and its shape present in oxygen carrier in human body.

(c) What type of linkage is present in nucleic acid?

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.Both conductivity and molar conductivity changes with the concentration. Conductivity always decreases with concentration for both weak and strong electrolytes. This is because the no of ions per unit volume that carry the current in solution decreases on dilution. Molar conductivity decreases with increase in concentration. This is because the total volume V of solution containing one mole of electrolyte also increases. Molar conductivity can be defined as the conductance of the electrolyte solution kept between the electrodes of a conductivity cell at unit distance but having large area of cross section large enough to accommodate sufficient volume of solution that contains one mole of electrolyte. For strong electrolytes molar conductivity increases slowly and reaches maximum value. For weak electrolytes. it increases sharply with dilution and reaches maximum value.

Answer the following questions:

(a)What is the effect of decreasing concentration on the conductivity of an electrolyte.?

OR

Describe the characteristic of variation of molar conductivity with dilution for strong electrolytes.

(b)Define the term molar conductivity.

(c)The molar conductivity of a 1.5M solution of an electrolyte is found to be 138.9 $Scm^2\ mol^{-1}$. Calculate the conductivity of this solution.

30. **Read the passage given below and answer the questions that follow :**

Valence bond theory considers the bonding between the metal ion and the ligands as purely covalent. On the other hand, crystal field theory considers the metal -ligand bond to be ionic arising from electrostatic interaction between the metal ion and the ligands. In coordination compounds, the interaction between the ligand and the metal ion causes the five d -orbitals to split -up. This is called crystal field splitting and the energy difference between the two sets of energy level is called crystal field splitting energy. The crystal field splitting energy (Δo) depends upon the nature of the ligand. The actual configuration of complexes is divided by the relative values of Δo and P (pairing energy). If $\Delta o < P$, then complex will be high spin. If $\Delta o > P$, then complex will be low spin.

Answer the following questions:

(a) CO is a stronger ligand than NH_3 why?

(b) How the crystal field splitting energy for octahedral (Δo) and tetrahedral (Δt) complex is related?

(c) On the basis of crystal field theory, what will be the electronic configuration of d^5 in the given two situations: (i) $\Delta o > P$ and (ii) $\Delta o < P$

OR

Using crystal field theory, calculate magnetic moment of central metal of $[FeF_6]^{4-}$

SECTION E

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

31. Attempt any five of the following:

(a)Cu^+ is not stable in aqueous solution. Why?

(b)Which is a stronger reducing agents Cr^{2+} or Fe^{2+} and why?

(c)Arrange the following increasing order of acidic character: CrO_3, CrO, Cr_2O_3

(d)Calculate the 'spin only' magnetic moment of $M^{2+}(aq)$ ion. (Z=27)

(e) Why do Zr and Hf exhibit almost similar properties?

(f) Why are Zn, Cd and Hg not regarded as transition elements?

(g) There is, in general an increase in density of element from Ti (Z=22) to Cu (Z=29).

32. (a)Why is the boiling point elevated when a non – volatile solute is dissolved in a liquid?**.**

(b) The vapour pressure of CS_2 at 500ºC is 854 mm Hg .A solution of 2.0g sulphur in 100g of CS_2 has a vapour pressure of 848.9 mm Hg .Calculate the formula of sulphur molecule.

(c) Define the following terms:

(i) Mole fraction

(ii) Molality

OR

(a)State Henry's law and mention its important application?

(b) The partal pressure of ethane over a solution containing 6.56×10^{-3} g of ethane is 1 bar. If the solution contains 5.00×10^{-2}g of ethane, then what shall be the partial pressure of the gas?

33 (a)A compound (X) having formula C_3H_7NO reacts with Br_2 in the presence of NaOH to give another compound (Y). Compound (Y) reacts with HNO_2 to form ethanol and N_2 gas . Identify (X) and (Y) . Write the reaction involved.

$$X\ (C_3H_7NO) + Br_2 \xrightarrow{NaOH} Y \xrightarrow{HNO_2} CH_3CH_2OH + N_2$$

(b) Explain why?

(i) Aniline does not undergo Friedel – Craft's reaction.

(ii) Reduction of nitro compound to aniline using iron scrap and HCl is preferred.

OR

(a) Account for the following:

(i) Aromatic amines cannot be prepared by Gabriel Phthalimide synthesis.

(ii) During acylation of amines, pyridine is added.

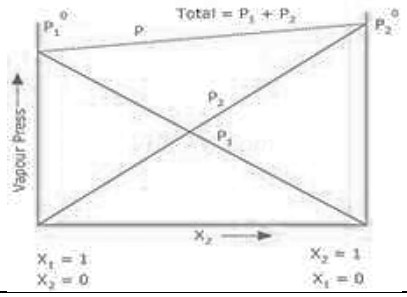
(b)Write structure of N- Ethyl -2- pentanamine

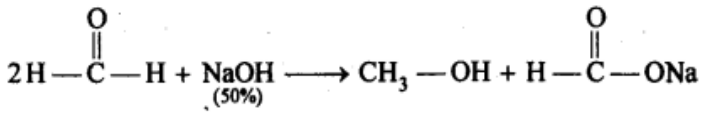
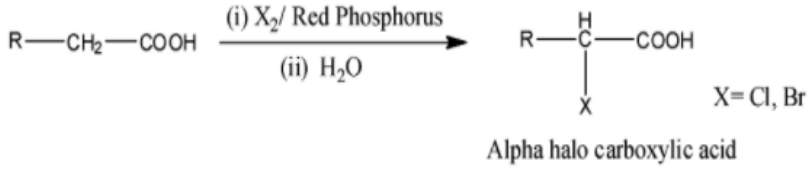
(c) Complete the following reactions:

(i) $C_6H_5N_2Cl+H_3PO_2+H_2O\rightarrow$

(ii) $C_6H_5N_2Cl+C_2H_5OH\rightarrow$

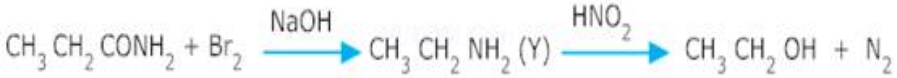
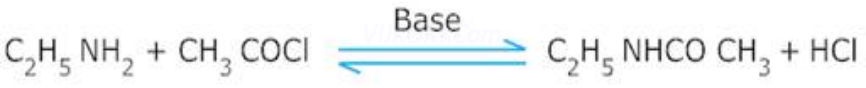
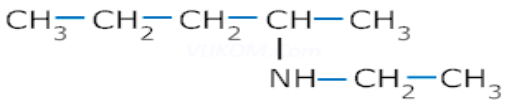
MARKING SCHEME

	SECTION A	1
1	C	1
2	C	1
3	C	1
4	D	1
5	B	1
6	B	1
7	A	1
8	B	1
9	D	1
10	A	1
11	B	1
12	C	1
13	B	1
14	A	1
15	A	1
16	B	1
	SECTION B	
17 (a)		1
17(b)	When 1 mole of a solute (that neither dissociates nor associates) is dissolved in 1kg of solvent, the depression in freezing point is called cryoscopic constant	1
18.	$Rate_{av} = - \Delta[R]/ \Delta t$ 1/2 = - (0.02-0.03) /25x60 =-[-0.01] 1500 = $6.66x10^{-6}$ m/s	1 1
19.	KCN is ionic in nature and provides cyanide ions in solution. Although both carbon and nitrogen atoms are in a position to donate electron pairs, the attack takes place mainly through carbon atom and not through nitrogen atom since C—C bond is more stable than C—N bond. However, AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the main product.	
20(a) (b) (a) (b)	PCC (Pyridinium Chlorochromate) Benzaldehyde. **OR** Benzoic acid reacts with $NaHCO_3$ giving CO_2gas with effervescence whereas phenol does not. Acetophenone on reacting with hot $NaOH/I_2$ gives yellow ppt of CHI_3 while Benzophenone does not	1 1 1 1
21.	A nucleoside is formed by the attachment of a base to position of sugar. Nucleoside = Sugar + Base. On the other hand, all the three basic components of nucleic acids (i.e., pentose sugar, phosphoric acid, and base) are present in a nucleotide. Nucleotide = Sugar + Base + Phosphoric	1 1

	SECTION C	
22.	Applying Nernst equation, we have: $E_{(cell)} = E^{\circ}_{(cell)} - \frac{0.0591}{n}\log\frac{[Ni^{2+}]}{[Ag^{2}]^{+}}$ $= 1.05 - \frac{0.0591}{2}\log\frac{(0.160)}{(0.002)^2}$ $= 1.05 - 0.02955\log\frac{0.16}{0.000004}$ = 1.05 – 0.02955 log 4 × 104 = 1.05 – 0.02955 (log 10000 + log 4) = 1.05 – 0.02955 (4 + 0.6021) = 0.914 V	1 1 1
23.	**Rate law expression :** **Rate = k [A]^1 [B]^0 = k [A]** **R_1 = 2·0 × 10^{-2} mol L^{-1} min^{-1}** **= k [0·1] mol L^{-1}** **∴ k = 0·2 min^{-1}** **R_2 = 4·0 × 10^{-2} mol L^{-1} min^{-1}** **= (0·2 min^{-1}) [A]** **∴ [A] = 0·2 mol L^{-1}** **R_3 = Rate = k [A]** **= (0·2 min^{-1}) (0·4 mol L^{-1})** **= 0·08 mol L^{-1} min^{-1}**	1 1 1
24(a)	2-Chloroethanol, due to –I effect of chlorine atom.	1
(b)	CrO_3, Pyridine and HCl (Pyridinium chlorochromate)	
(c)	Ortho nitrophenol, because intramolecular hydrogen bonding in hydrogen bonding in *p*-nitrophenol.	1
(d)	Increasing order of acidity: *o*-cresol < phenol <*o*-nitrophenol **Explanation** In substituted phenols, the presence of electron withdrawing groups, enhance the acidic strength of phenol whereas, electron releasing groups decrease the acidic strength of phenol.	1
25(a)	**Cannizzaro's reaction**	
(i)		1
(ii)	**Hell-Volhard-Zelinsky reaction**  Alpha halo carboxylic acid	1
(b)	NO_2-CH_2-COOH> F-CH_2-COOH >C_6H_5COOH	1
26.(a)	$[Co(NH_3)_4(H_2O)Cl]Cl_2$	1
(b)	In $[Ni(H_2O)_6]^{2+}$ complex, *d-d* transitions are taking place.	1
(c)	In $[Cu(NH_3)_6]^{2+}$, oxidation state of Cu = +2,Cu^{2+} = $3d^9$ $3d^9$ = t ^{6}2g e^{3}g	1
27.(a)	Phosgene	1
(b)	KOH is a strong base, so it completely ionizes in aqueous solution. OH– ions are strong nucleophile, so it replaces the halogen atoms and form alcohols. In contrast, an alcoholic solution of KOH contains alkoxide (R-O) ions which	2

	being a much stronger base than (OH-) ions preferentially eliminates a molecule of HCl from the alkyl chloride to form an alkene.	
28 (a)	Deficiency of vitamin B12 (cyanocobalamin) causes the disease pernicious anaemia.	1
(b)	Globular protein and its shape is spherical	1
(c)	Phosphodiester linkage.	1
	SECTION D	
29. a)	Conductivity of an electrolyte decreases with decrease in concentration. **OR** For strong electrolytes, molar conductivity slowly increases with dilution.	1
(b)	Molar conductivity is defined as the conducting power of all the ions produced by one gram mole of an electrolyte in a solution.	1
(c)	C = 1.5 M, Λ_m = 138.9 S cm2 mol-1 $\Lambda_m = (K\times1000)/c$ $\therefore K = (\Lambda_m \times C)/1000 = (138.9\times1.5)/1000 = 0.20835$ S cm^{-1}	2
30.(a)	Ans. because in case of CO back bonding takes place in which central atom uses its filled d orbital with empty π * molecular orbital of CO.	1
	$\Delta t \approx 4/9\Delta o$	1
(b)	If $\Delta o > P = t_{2g}^{5} eg^{0}$ If $\Delta o < P = t_{2g}^{3} e_g^{2}$	1+1
	OR	
(c)	In the complex $[FeF_6]^{4-}$,Fe is in +2 oxidation state and Fe^{2+} has the electronic configuration $3d^6$ So,in $[FeF_6]^{4-}$ has 4 unpaired electrons. (n=4)	
	For $[FeF_6]^{4-}$,	1
	Magnetic moment = $\mu = \sqrt{n(n+2)}$ BM $= \sqrt{4(4+2)} = 4.9$ BM	1
	SECTION E	
	(Any Five)	1 x 5
31(a)	In aqueous solution Cu+ undergoes disproportionation to form a more stable Cu^{2+}ion. $2Cu^{+}(aq) \rightarrow Cu^{2+}(aq) + Cu(s)$ The higher stability of Cu^{2+} in aqueous solution is due to its greater negative $\Delta_{hyd}H$ than that of Cu+. It compensates the second ionisation enthalpy of Cu involved in the formation of Cu^{2+} ions.	
(b)	Cr^{2+} is a stronger reducing agent than Fe^{2+} because after the loss of one electron Cr^{2+} becomes Cr^{3+} which has more stable t_{2g}^{3} (half filled) configuration in medium like water.	
(c)	$CrO < Cr_2O_3 < CrO_3$. Higher the oxidation state, more will be acidic character Ans. Electronic configuration of the M^{2+} ion (Z=27) would be M^{2+}(aq): (Ar) $3d_7$	
(d)	It would contain three unpaired electrons. The 'spin only' magnetic moment is given by the relation: $\mu = \sqrt{n(n+2)}$ BM = $\sqrt{3(3+2)}$ BM = 3.87 BM	
(e)	Zr and Hf have similar ionic size due to its lanthanoid contraction. So they exhibit similar properties.	
(f)	Zn, Cd, Hg neither in their ground state nor in oxidized state have partially filled d-orbital. Thus they are not regarded as transition elements.	
(g)	Because of decrease in atomic size from titanium to copper.	
32.(a)	When a non – volatile solute is added the vapour pressure decreases and the solution is heated to a higher temperature, increasing the boiling point.	1

(b)	$P_A^\circ = 854$ mm $P_A = 848.m$, $W_B = 2.0g$, $W_A = 100\ g\ M_B = ?$ $M_A = 12+2(32) = 76\ g/mol\ /CS^2)$ $\frac{P_A^0 - P_A}{P_A^0} = \mathrm{X_B} = \frac{W_B}{M_B} / \frac{W_A}{M_A}$ $M_B = W_B \times \frac{W_A}{M_A} \times \frac{P_A^0}{P_A - P_A}$ = $2 \times \frac{100}{76} \times \frac{854}{854-848.9}$ = 254.5 g/mol. Let the formula = Sx $X \times 32 = 254.5\ g/mol$ X= $\frac{254.5}{32}$ = 7.95 = 8. = Formula = S_8	2
(c)	**(i) Mole fraction:** The mole fraction of a component in a mixture is defined as the ratio of the number of moles of the component to the total number of moles of all the components in the mixture.	1
	(ii) Molality : Molality (m) is defined as the number of moles of the solute per kilogram of the solvent.	1
	OR	
(a)	Henry's law states that partial pressure of a gas in the vapour phase is proportional to the mole fraction of the gas in the solution. If *p* is the partial pressure of the gas in the vapour phase and *x* is the mole fraction of the gas, then Henry's law can be expressed as: $p = K_H x$ Where, K_H is Henry's law constant **Applications of Henry's law** - Bottles are sealed under high pressure to increase the solubility of CO_2 in soft drinks and soda water.	1+1
(b)	Molar mass of ethane $(C_2H_6) = 2\times12+6\times1$ = 30 g mol^{-1} ∴Number of moles present in 6.56×10^{-3} g of ethane = $\frac{6.56\times10^{-3}}{30}$ = $2.187\times10-4$mol	
	Let the number of moles of the solvent be *x*. According to Henry's law, $p = K_H x$	1
	1 bar $= K_H \frac{2.187\times10^{-4}}{2.187\times10^{-4}+x}$	1
	1 bar = $= K_H \frac{2.187\times10^{-4}}{x} (\text{Sin cex} >> 2.187\times10^{-4})$ $K_H = \frac{x}{2.187\times10^{-4}}$ bar	1

33.(a)	Since Y gives ethanol and N_2 gas with HNO_2, therefore it is $CH_3CH_2NH_2$. Ethan amine (Y) is formed on reacting (X) with Br_2 and NaOH; Therefore X is $CH_3CH_2CO\,NH_2$. Therefore X= $CH_3CH_2CONH_2$ Y = $CH_3CH_2NH_2$ The reactions are –  	1 1 1 1
(b)	(i) During Friedel Craft's reaction, aniline forms salt with aluminium chloride, the catalyst of reaction due to which nitrogen acquires a positive charge and acts as a strong deactivating group for further reaction. (ii) For reduction of nitro compounds to aniline, iron scrap and HCl is preferred because $FeCl_2$formed gets hydrolysed to release HCl during the reaction & therefore only a small amount of HCl is required to initiate the reaction.	1
	OR	
(a)		
(i)	Aromatic amines cannot be prepared by Gabriel pythalimide synthesis as aryl halides do not undergo nucleophilic substitution with the anion formed by pythalimide.	1
(ii)	Acylation of amines is carried out in presence of pyridine or another base stronger than amines as it removes HCl so formed and shifts the equilibrium in forward direction.	1
(b)	 	1
		
(c)(i)	$C_6H_5N_2Cl+H_3PO_2+H_2O \rightarrow C_6H_6+ H_3PO_3+N_2+HCl$	1
(ii)	$C_6H_5N_2Cl+C_2H_5OH \rightarrow C_6H_6+CH_3CHO+ N_2+HCl$	1

Blue Print 2023-24

Unit No.	Name of Unit	Section-A		Section- B	Section- C	Section- D	Section- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions			1 (2)			1 (5)	**2 (7)**
II	Electrochemistry	1 (1)	1 (1)		1 (3)	1 (4)		**4 (9)**
III	Chemical Kinetics	2 (2)		1 (2)	1 (3)			**4 (7)**
IV	d -and f -Block Elements	2 (2)					1 (5)	**3 (7)**
V	Coordination Compounds				1 (3)	1 (4)		**2 (7)**
VI	Haloalkanes and Haloarenes	1 (1)		1 (2)	1 (3)			**3 (6)**
VII	Alcohols, Phenols and ethers	2 (2)	1 (1)		**1 (3)**			**4 (6)**
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)	**1 (2)**	1 (3)			**5 (8)**
IX	Amines	1 (1)					1 (5)	**2 (6)**
X	Biomolecules	1 (1)	1 (1)	1 (2)	1 (3)			**4 (7)**
Total		**12 (12)**	**4 (4)**	**5 (10)**	**7 (21)**	**2 (8)**	**3 (15)**	**33 (70)**

SET-17

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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.

Q1. The cell constant of a conductivity cell _____.

(a) changes with change of electrolyte.
(b) changes with change of concentration of electrolyte.
(c) changes with temperature of electrolyte.
(d) remains constant for a cell.

Q2. Which of the following expressions is correct for the rate of reaction given below?

$$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \longrightarrow 3Br_2(aq) + 3H_2O(l)$$

(a) $\frac{\Delta[Br^-]}{\Delta t} = 5\frac{\Delta[H^+]}{\Delta t}$ (b) $\frac{\Delta[Br^-]}{\Delta t} = \frac{6}{5}\frac{\Delta[H^+]}{\Delta t}$

(c) $\frac{\Delta[Br^-]}{\Delta t} = \frac{5}{6}\frac{\Delta[H^+]}{\Delta t}$ (d) $\frac{\Delta[Br^-]}{\Delta t} = 6\frac{\Delta[H^+]}{\Delta t}$

Q3. Rate law for the reaction A + 2B → C is found to be Rate = k [A][B] Concentration of reactant 'B' is doubled, keeping the concentration of 'A' constant, the value of rate constant will be_____.

(a) the same
(b) doubled
(c) quadrupled
(d) halved

Q4. Generally transition elements form coloured salts due to the presence of unpaired electrons. Which of the following compounds will be coloured in solid state?

(a) Ag_2SO_4 (b) CuF_2
(c) ZnF_2 (d) Cu_2Cl_2

Q5. Which of the following statements is not correct?

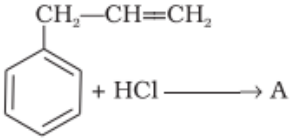
(a) Copper liberates hydrogen from acids.

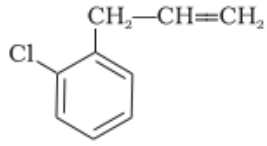
(b) In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine.

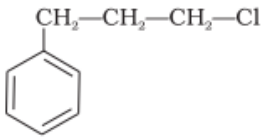
(c) Mn^{3+} and Co^{3+} are oxidising agents in aqueous solution.

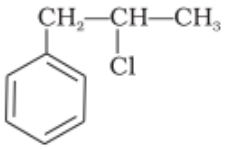
(d) Ti^{2+} and Cr^{2+} are reducing agents in aqueous solution.

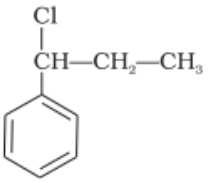
Q6. What is 'A' in the following reaction?



(a) 

(b) 

(c) 

(d) 

Q7. Arrange the following compounds in increasing order of boiling point. Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol

a) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol

b) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol

c) Pentan-1-ol, butan-2-ol, butan-1-ol, propan-1-ol

d) Pentan-1-ol, butan-1-ol, butan-2-ol, propan-1-ol

Q8. CH_3CH_2OH can be converted into CH_3CHO by _____.

(a) catalytic hydrogenation (b) treatment with $LiAlH_4$

(c) treatment with pyridinium chlorochromate (d) treatment with $KMnO_4$

Q9. The correct order of increasing acidic strength is _____.

(a) Phenol < Ethanol < Chloroacetic acid < Acetic acid

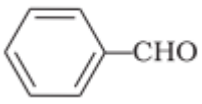
(b) Ethanol < Phenol < Chloroacetic acid < Acetic acid

(c) Ethanol < Phenol < Acetic acid < Chloroacetic acid

(d) Chloroacetic acid < Acetic acid < Phenol < Ethanol

Q10. Cannizaro's reaction is not given by _____

(a) 

(b) 

(c) HCHO (d) CH_3CHO

Q11. Hoffmann Bromamide Degradation reaction is shown by _____.

(a) $ArNH_2$ (b) $ArCONH_2$ (c) $ArNO_2$ (d) $ArCH_2NH_2$

Q12. Each polypeptide in a protein has aminoacids linked with each other in a specific sequence. This sequence of amino acids is said to be _____.

(a) primary structure of proteins.

(b) secondary structure of proteins.

(c) tertiary structure of proteins.

(d) quaternary structure of proteins.

In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements and reason explains the assertion.

(b) Assertion and reason both are correct statements but reason does not explain

(c) Assertion is correct statement and reason is wrong statement.

(d) Assertion is wrong statement and reason is correct statement.

Q13. Assertion : Vitamin D can be stored in our body.
Reason : Vitamin D is fat soluble vitamin.

Q14. Assertion : The α-hydrogen atom in carbonyl compounds is less acidic.
Reason : The anion formed after the loss of α-hydrogen atom is resonance stabilized.

Q15. Assertion : Bond angle in ethers is slightly less than the tetrahedral angle.
Reason : There is a repulsion between the two bulky (—R) groups.

Q16. Assertion : Electrolysis of NaCl solution gives chlorine at anode instead of O_2 .
Reason : Formation of oxygen at anode requires overvoltage.

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.

Q17 . Explain the following statements:

(a) Why are aquatic species more comfortable in cold water in comparison to warm water?

(b) Sprinkling of salt help in clearing the snow covered roads in hilly areas?

Q18. For a first order reaction, show that time required for 99% completion is twice the time required for the completion of 90% of reaction.

Q19. (a)Out of $C_6H_5CH_2Cl$ and $C_6H_5CHClC_6H_5$, which is more easily hydrolysed by aqueous KOH .

(b) p-Dichlorobenzene has higher m.p. than those of o- and m-isomers.Justify

Q20. 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) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$, $CH_3CH_2CH_2COOH$ (acid strength)

OR

How will you prepare the following compounds from benzene? You may use any inorganic reagent and any organic reagent having not more than one carbon atom

(a) Methyl benzoate (b) m-Nitrobenzoic acid

Q21. Name the sugar present in milk. How many monosaccharide units are present in it? What are such oligosaccharides called?

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.

Q22. Three electrolytic cells a,b,c containing solutions of znso4, agno3 and cuso4,respectively are connected in series. A steady current of 1.5 amperes was passed through them until 1.45 g of silver deposited at the cathode of cell b. How long did the current flow? What mass of copper and zinc were deposited?

Q23. The half-life for radioactive decay of 14C is 5730 years. An archaeological artifact containing wood had only 80% of the 14C found in a living tree. Estimate the age of the sample.

Q24. (a) Draw structures of geometrical isomers of $[Fe(NH_3)_2(CN)_4]^-$

(b) The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9 BM. Predict the geometry of the complex ion ?

(c) Explain chelate effect.

Q25. Complete the following :

(a) $CH_3CH_2CH_2Cl + NaI \xrightarrow{\text{dry acetone}}$

(b) $(CH_3)_3CBr + KOH \xrightarrow{KOH/ALCOHOL}$

(c) $CH_3CH = C(CH_3)_2 + HBr \rightarrow$

Q 26. Attempt any two

(a) Give the equations of reactions for the preparation of phenol from cumene.

(b) Write chemical reaction for the preparation of phenol from chlorobenzene.

(c) Write the mechanism of hydration of ethene to yield ethanol.

Q27. Write the structures of the following compounds.

(a) a-Methoxypropionaldehyde

(b) 3-Hydroxybutanal

(c) 2-Hydroxycyclopentane carbaldehyde

Q28.(a) Why cannot vitamin C be stored in our body?

(b) What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?

(c) When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained. What does this fact suggest about the structure of RNA?.

SECTION -D

The following questions are case -based questions. Each question has an internal choice and carries 4 marks.Read the paragraph and answer the questions that follows.

Q29. Several transition metal compounds show a transition from the low-spin (LS) to the high-spin (HS) electronic state with increasing temperature The cooperative nature of the transition is usually parametrised by an interation constant gamma, the origin of which is still under discussion. In the frame of the lattice expansion mode, the Interaction gamma is attributed to the elastic interaction between the spin-changing ions as a result of the deformation of the crystal accompanying the transition

(a) Why are low spin tetrahedral complexes not formed?

(b) Low spin configuration are rarely observed in tetrahedral coordination entity

(c) Define the following terms with a suitable example of each

(i) Polydentate ligand

(i) Homoleptic complex

OR

Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for d4 ion if $\Delta_o < P$

Q30. Rahul set-up an experiment to find resistance of aqueous KCl solution for different concentrations at 298 K using a conductivity cell connected to a Wheatstone bridge. He fed the Wheatstone bridge with a.c. power in the audio frequency range 550 to 5000 cycles per second. Once the resistance was calculated from null point he also calculated the conductivity *K* and molar conductivity Λ_m and recorded his readings in tabular form.

S.NO.	Conc.(M)	K S cm^{-1}	Λm S cm^2mol^{-1}
1	1.00	111.3 X 10^{-3}	111.3
2	0.10	12.9X 10^{-3}	129.0
3	0.01	1.41 X 10^{-3}	141.0

Answer the following questions :

(a) Why does conductivity decrease with dilution ?

(b) If $\Lambda m0$ of KCl is 150.0 S cm^2mol^{-1}, calculate the degree of dissociation of 0.01MKCl.

(c) If Rahul had used HCl instead to KCl then would you expect the Λm values to be more or less than those per KCl for a given concentration. Justify.

OR

(c) Amit a classmate of Rahul repeated the same experiment with CH3COOH solution instead of KCl solution. Give one point that would be similar and one that would be different in his observations as compared to Rahul.

Section E

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

Q31. Explain any five

(a) Transition metals and many of their compounds show paramagnetic behaviour.

(b) The enthalpies of atomisation of the transition metals are high.

(c) The transition metals generally form coloured compounds.

(d) Transition metals and their many compounds act as good catalyst

(e) Of the *d*4 species, Cr^{2+} is strongly reducing while manganese(III)is strongly oxidising.

(f) Cobalt(II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidized

(g) The highest oxidation state is exhibited in oxoanions of a metal.

.

Q 32. a) (1) Why is boiling point of 1M NaCl solution more than that of IM glucose solution?

(ii) A nonvolatile solute 'X' (molar mass = 50 g mol^1) when dissolved in 78g of benzenereduce its vapour pressure to 90%.. Calculate the mass of X dissolved in the solution.

(iii) Calculate the boiling point elevation for a solution prepared by adding 10g of $MgCl_2$ to 200gm of water assuming $MgCl_2$ is completely dissociated (K, for Water = 0.512 K kg mol^{-1}, Molar mass $MgCl_2$ is 95g mol^{-1})

OR

b) (i) Why is the value of Van't Hoff factor for ethanoic acid in benzene close to 0.5?

(ii) Determine the osmotic pressure of a solution prepared by dissolving 2.32 x 10^{-2} of K_2SO_4 in 2Lof solution at 25 °C, assuming that K_2SO_4, is completely dissociated. (R=0.082 L atm K^{-1} mol^{-1}, Molar mass K_2SO_4 =174g mol^1)

(iii)When 25.6g of sulphur was dissolved in 1000g of benzene, the freezing point lowered by 0.512K. Calculate the formula of sulphur (S_x).

(K_f for benzene = 5.12 K kg mol-1, Atomic mass of Sulphur = 32g mol^{-1})

Q33.(a) Give one chemical test to distinguish between the following pairs of compounds.

(i) Secondary and tertiary amines

(ii) Ethylamine and aniline

(b) How will you convert:

(i) Ethanoic acid into methanamine
(ii) Hexanenitrile into 1-aminopentane
(iii) Methanol to ethanoic acid
OR
(a) Account for the following:
(i) p*Kb* of aniline is more than that of methylamine.
(ii) Ethylamine is soluble in water whereas aniline is not.
(b) Accomplish the following conversions:
(i) Nitrobenzene to benzoic acid
(ii) Benzene to *m*-bromophenol
(iii) Benzoic acid to aniline

MARKING SCHEME

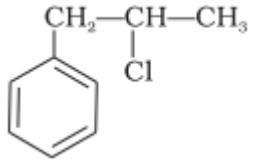
Q1. (d) remains constant for a cell.

Q2 (c) $\frac{\Delta[Br^-]}{\Delta t} = \frac{5}{6}\frac{\Delta[H^+]}{\Delta t}$

Q3 (a) the same

Q4 (b) CuF_2

Q5. (a)Copper liberates hydrogen from acids.



Q6. (c)

Q7 (a)Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol

Q8. (c) treatment with pyridinium chlorochromate

Q9. (c) Ethanol < Phenol < Acetic acid < Chloroacetic acid

Q10 (d) CH_3CHO

Q11. (b) $ArCONH_2$

Q12. (a) primary structure of proteins

Q13. (a)

Q14. (d)

Q15. (d)

Q16 . (a)

SECTION B

Q17. (a) At a given pressure the solubility of oxygen in water increases with decrease in temperature. Presence of more oxygen at lower temperature makes the aquatic species more comfortable in cold water. [1]

(b) When salt is spread over snow covered roads, snow starts melting from the surface because of the depression in freezing point of water and it helps in clearing the roads. [1]

Q18. 4 X ½

For a first order reaction ; $t = \frac{2.303}{k}\log\frac{a}{a-x}$

Ist case : $a = 100\%\ n = 99\%\ ; (a-x) = (100-99) = 1\%$

$$t_{99\%} = \frac{2.303}{k}\log\frac{100}{1} = \frac{2.303}{k}\log 10^2$$

$$= \frac{2.303 \times 2}{k} = \frac{4.606}{k} \quad \ldots(i)$$

IInd case : $a = 100\%\ ; x = 90\ \%\ (a-x) = (100-90) = 10\%$

$$t_{90\%} = \frac{2.303}{k}\log\frac{100}{10} = \frac{2.303}{k}\log 10 = \frac{2.303}{k} \quad \ldots(ii)$$

Dividing eqn. *(ii)* by eqn. *(i)*,

$$\frac{t_{(99\%)}}{t_{(90\%)}} = \frac{4.606}{k} \times \frac{k}{2.303} = \mathbf{2.}$$

Q19. (a) $C_6H_5CHClC_6H_5$ [1]

(b)due to symmetrical structure. [1]

Q20. (a) correct ans [1]

(b) correct ans. [1]

Q21. Lactose, two monosaccharide units are present. Such oligosaccharides are called disaccharides. [1/2, ½,1]

SECTION -C

Q22. [3/2, 3/2]

According to the reaction:

$$Ag^{+}_{(aq)} + e^{-} \longrightarrow Ag_{(s)}$$
$$108\ g$$

i.e., 108 g of Ag is deposited by 96487 C.

Therefore, 1.45 g of Ag is deposited by = $\frac{96487 \times 1.45}{108}$ C

= 1295.43 C

Given,

Current = 1.5 A

$\therefore$ Time $= \frac{1295.43}{1.5}$ s

= 863.6 s

= 864 s

= 14.40 min

Again,

$$Cu^{2+}_{(aq)} + 2e^{-} \longrightarrow Cu_{(s)}$$
$$63.5\ g$$

i.e., 2 × 96487 C of charge deposit = 63.5 g of Cu

Therefore, 1295.43 C of charge will deposit $= \frac{63.5 \times 1295.43}{2 \times 96487}$ g

= 0.426 g of Cu

$$Zn^{2+}_{(aq)} + 2e^{-} \longrightarrow Zn_{(s)}$$
$$65.4\ g$$

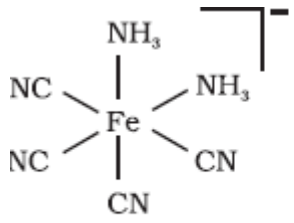
i.e., 2 × 96487 C of charge deposit = 65.4 g of Zn

Therefore, 1295.43 C of charge will deposit $= \frac{65.4 \times 1295.43}{2 \times 96487}$ g

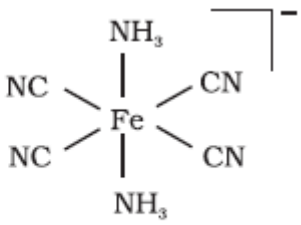
= 0.439 g of Zn

Q23. formula ⋅ correct substitution ⋅ correct ans with proper unit [1,1,1]

Q.24 (a) [1,1,1]



cis



trans

(b) Since the coordination number of Mn2+ ion in the complex ion is 4, it will be either tetrahedral (*sp*3 hybridisation) or square planar (*dsp*2 hybridisation). But the fact that the magnetic moment of the complex ion is 5.9 BM, it should be tetrahedral in shape rather than square planar because of the presence of five unpaired electrons in the *d* orbitals.

(c) proper explanation

Q25.

(a) $CH_3CH_2CH_2I$ [1,1,1]

(b) $(CH_3)_2C=CH_2$

(c) $CH_3CH_2CBr(CH_3)_2 + HBr$

Q26. (a) correct equation [1,1,1]

(b)correct equation

(c) Correct equations

Q27. (a) Correct structure [1,1,1]

(b) Correct structure

(c) Correct structure

Q28. (a) as it is soluble in water therefore excreted out in urine [1,1,1]

(b) When a nucleotide from the DNA containing thymine is hydrolyzed, the products are thymine β-D-2-deoxyribose and phosphoric acid.

(c) RNA is single stranded.

SECTION -D

Q29 (a) due to low CFSE [1,1,1,1]

(b)The orbital splitting energies Δt are not sufficiently large for forcing pairing of electrons in the tetrahedral coordination entity formation.

(c) (i) proper definition

(ii) proper definition

OR

Proper definition. $t_2g^3\ eg^1$

Q30. (a) Conductivity decreases with dilution because it depends upon the number of ions present in the solution. When dilution increases number of available ions decreases. Hence, conductivity decreases. [1,1,1,1]

(a) Correct solution

(b) Correct reason

OR

(c) (i) correct reason

(ii) correct reason

Section E

Q31. (a) due to unpaired electrons [5x 1]

(b) due to strong metallic bonding, high effective nuclear charge and large no of umpaired electrons.

(c) d-d transition of electrons in visible region of spectrum

(d) Large surface area/ variable oxidation states

(e) Cr^{2+} is reducing as it involves change from d^4 to d^3, the latter is more stable configuration(t_2g^3)Mn(III) to Mn(II) is from $3d^4$ to $3d^5$ again $3d^5$ is an extra stable configuration.

(f) Due to CFSE, which more than compensates the 3rd IE.

(g) More electronegative nature and its ability to form multiple bonds.

Q32 (a) (i) van't Hoff factor for NaCl is 2, elevation in boiling point is a colligative property therefore it is more for NaCl. [1,2,2]

(ii) ans ,w 5.55 gms

(iii) ans , Tb 273.80 K

OR

(b) (i) it undergoes dimerization.

(ii) ans 4.89X 10^{-3} atm

(iii) S_8

Q33. (a) (i) correct equation and observation of Hinsberg's test [5 x 1]

(ii) correct equation and observation of Azo dye test

(b)(i) correct equation

(ii) correct equation

(iii) correct equation

OR

(a) (i) aniline is less basic because of delocalization of lone pair of electrons of nitrogen on benzene ring while methylamine is more basic due to inductive effect of methyl group.

(ii) due to intermolecular H bonding of ethylamine with water.

(b) (i) correct equation

(ii) correct equation

(iii) correct equation

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Unit No.	Name of Unit	Section-A		Section- B	Section- C	Section- D	Section- E	Total
		1 Mark		2 Marks	3 Marks	4 Marks	5 Marks	
		MCQ	A-R	VSA	SA	Case Based	LA	
I	Solutions			1 (2)			1 (5)	**2 (7)**
II	Electrochemistry	1 (1)	1 (1)		1 (3)	1 (4)		**4 (9)**
III	Chemical Kinetics	2 (2)		1 (2)	1 (3)			**4 (7)**
IV	d -and f -Block Elements	2 (2)					1 (5)	**3 (7)**
V	Coordination Compounds				1 (3)	1 (4)		**2 (7)**
VI	Haloalkanes and Haloarenes	1 (1)		1 (2)	1 (3)			**3 (6)**
VII	Alcohols, Phenols and ethers	2 (2)	1 (1)		**1 (3)**			**4 (6)**
VIII	Aldehydes, Ketones and carboxylic acids	2 (2)	1 (1)	**1 (2)**	1 (3)			**5 (8)**
IX	Amines	1 (1)					1 (5)	**2 (6)**
X	Biomolecules	1 (1)	1 (1)	1 (2)	1 (3)			**4 (7)**
Total		**12 (12)**	**4 (4)**	**5 (10)**	**7 (21)**	**2 (8)**	**3 (15)**	**33 (70)**

SET-18

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator 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.

1.	The charge required for the reduction of 1 mol of $Cr_2O_7^{-2}$ to Cr^{+3} (a) 1F (b) 3F (c) 5F (d) 6F	1
2.	In a gaseous reaction on reducing the volume to 1/3, rate of reaction increases 27 times. The order of reaction is (a) zero order (b) first order (c) second order (d) third order	1
3	For a first order reaction the relation between $t_{3/4}$ and $t_{1/2}$ is (a) $t_{3/4} = t_{1/2}$ (b) $t_{3/4} = 2 \times t_{1/2}$ (c) $t_{1/2} = 2 \times t_{3/4}$ (d) none of the above	1
4.	Which of the following has maximum magnetic moment? (a) Fe^{2+} (b) Fe^{3+} (c) Ni^{2+} (d) Cu^{2+}	1
5.	Which of the following is an ambident ligand? (a) oxalate ion (b) carbonate ion (c) EDTA (d) SCN^-	1

6.	The coordination number of metal in $[Cr(edta)]^-$ is (a) 2 (b) 6 (c) 4 (d) 5	1
7.	Which of the following will give nucleophilic substitution reaction most easily? (a) haloarene (b) vinyl halide (c) ethyl chloride (d) chlorobenzene	1
8.	Phenol reacts with bromine in CS_2 at low temperature to give a) m-bromophenol b) p-bromophenol c) o-and p-bromophenol d) 2,4,6-tribromophenol	1
9.	The alcohol which does not give iodoform test is a) methanol b) ethanol c) propan-2-ol d) butan-2-ol	1
10.	The IUPAC name of the alkene which on ozonolysis gives ethanal only is (a) ethene (b) propene (c) but-2-ene (d) but-1-ene	1
11.	Deficiency of which vitamin results in increased blood clotting time? (a) Vitamin A (b) Vitamin K (c) Vitamin C (d) Vitamin D	1
12.	Which of the following: when heated with a mixture of ethanamine and alcoholic potash gives ethyl isocyanide? (a)2-chloropropane (b)2,2-dichloropropane (c)trichloro methane (d) carbon tetrachloride	1
13.	Given below are two statements labeled as Assertion(A) and Reason(R) Assertion (A): Molar conductance of weak electrolyte cannot be obtained by graphical method. Reason: Molar conductance of weak electrolyte decreases with dilution. Select the most appropriate answer from the options given below: 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.	1
14.	Given below are two statements labeled as Assertion(A) and Reason(R) Assertion (A): Zn is not considered as transition metal. Reason(R): d orbital of Zn is fully filled and not used in bonding. Select the most appropriate answer from the options given below: 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.	1

15.	Given below are two statements labeled as Assertion(A) and Reason(R) Assertion (A): Phenol on electrophilic substitution give ortho para substituted products. Reason: Phenolic group is electron withdrawing in nature. Select the most appropriate answer from the options given below: d) Both A and R are true and R is the correct explanation of A e) Both A and R are true but R is not the correct explanation of A. f) A is true but R is false. g) A is false but R is true.	1
16.	Given below are two statements labeled as Assertion(A) and Reason(R) Assertion: Primary amines have highest boiling point among isomeric amines. Reason: Primary amines are less basic than secondary amines Select the most appropriate answer from the options given below: 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.	1
	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.	Define chemical equivalent and electro chemical equivalent.	2
18.	a) Define rate law expression. b) Find order of reaction for which rate law is $R= K[A][B]^{3/2}$	2
19.	a) Write IUPAC name for the compound: $[Ni(CO)_4]$ b) Why tetrahedral complexes do not show geometrical isomerism?	2
20.	a) Arrange the following in increasing order of boiling point: (i) $CH_3CH_2CH_2CH_2Cl$ (ii)$(CH_3)_3Cl$ (iii)$(CH_3)_2CHCl$ b) Convert Propene to propan-1-ol **OR** Give reasons: a) R-X reacts with KCN to give cyanides as major product. b) Carbon -halogen bond length in haloarenes is lesser than in haloalkanes.	2
21.	a) Which among the following will give aldol condensation and why? Methanal, ethanal and benzaldehyde. b) Give a chemical test to distinguish between Ethanal and methanal.	2
	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.	
22.	a) Define osmotic pressure. b) Calculate the temperature at which a solution containing 54 g of glucose, in 250g of water will freeze. (K_f for water = 1.86 Kkg/mol	3

23.	a) The Complex $[Fe(H_2O)_6]^{3+}$ is a colored compound. Justify. b) When a coordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 mols of AgCl are precipitated per mol of compound. Write structural formula and IUPAC name of the complex.	3
24.	a)Write four differences between SN_1 and SN_2 b) What happens when chlorobenzene reacts with Sodium in ethereal medium?	3
.25.	What happens when (write chemical equations) i) Propanone is treated with methyl magnesium bromide and the product is hydrolyzed. ii) Propan-2-ol is oxidized. iii)Tertiary butyl alcohol is heated with copper at 573K.	3
26.	Write chemical equations for the followings:(any two) a) Hydrolysis of sucrose. b) Reaction of glucose with HI. c) Reaction of glucose with bromine water.	3
27	Rate of a reaction doubles when temperature changes from 300K to 310K.Find activation energy of the reaction.	3
28	Define the following terms as related to proteins: d) Peptide linkage. b) Primary structure c) Denaturation.	3
	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.	Students are often fascinated extreme sports such as SCUBA diving. But scuba divers must be very conscious of Caisson disease, commonly called Bends. The condition is related more to Henry's law, which states that more gas will be dissolved in a liquid when gas is pressurized. Because of the water pressure, body tissue absorbs nitrogen gas faster as a diver descends than when ascending to the surface. However, if a diver ascends too quickly, nitrogen bubbles will be formed in body tissue rather than being exhaled. Nitrogen bubbles cause severe pain. a) State Henry's law. b) Name the condition that is related to nitrogen solubility at high pressure. OR What must be done to avoid this condition? c) Write two applications of Henry's law.	4
30.	Amines are classified according to the number of carbon atoms bonded directly to the nitrogen atom. Primary, secondary and tertiary amines have one, two and three alkyl groups on the nitrogen atom respectively. The alkyl groups affect physical and chemical properties of amines. We can distinguish among primary, secondary and tertiary amines by chemical tests.	4

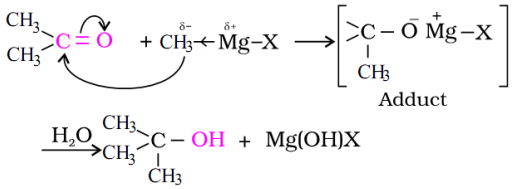
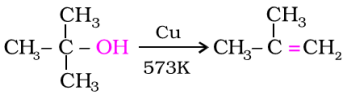
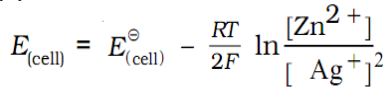
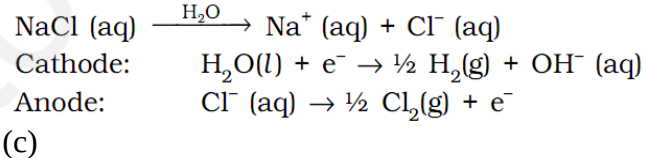
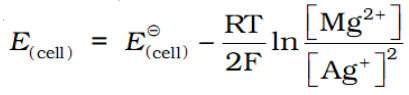
	a) Which gas is produced when primary amines react with nitrous acid? b) Write IUPAC name of $(CH3)_3N$. c) Write chemical equation for ammonolysis of alkyl halide. Why is it not advantageous to prepare pure amines? OR Give one example each for aliphatic and aromatic amines. Name the chemical test to distinguish between aliphatic and aromatic amines.	
	SECTION E The following questions are long answer type and carry 5 marks each.	
31.	(a) A cell is prepared by dipping a zinc rod in 1M zinc sulphate solution and a silver electrode in 1M silver nitrate solution. The standard electrode potential given: E^0Zn^{2+}/Zn =- 0.76 V, E^0Ag^+ /Ag =+0.80 V What is the effect of increase in concentration of Zn^{2+} on the Ecell? (b) Write the products of electrolysis of aqueous solution of NaCl with platinum electrodes. (c) Represent the cell in which the following reaction takes place $Mg(s) + 2Ag^+(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$ Calculate its E_{cell} if E^o_{cell} = 3.17 V. Write the cell configuration **OR** a) What is the role of zinc chloride in dry cell? b) /\m ° for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 S cm^2 /mol respectively. Calculate Λ^o for HAc. c) Write the chemical reactions taking place at the electrodes during discharging of lead storage battery.	5
32.	Account for the following:(any five) (i) Transition metals have high enthalpy of atomization. (ii) Actinoids exhibit greater range of oxidation states than lanthanoids (iii) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) $Mn^{3+}$is an oxidizing agent (iv)Zr and Hf have similar atomic size. (v)Transition metals show higher oxidation states in their oxides. (vi)Transition metals and their compounds show paramagnetic behavior. (vii)Lanthanoids in +2 oxidation states are good reducing agents.	5
33	a) Arrange the following compounds in increasing order of their boiling points: CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$ b) Would you expect Benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanal? Explain your answer. c) 4-Nitro benzoic acid is more acidic than4-methoxy benzoic acid. Give reason d) Explain the following reaction (i) Aldol condensation (ii) Etard reaction	5

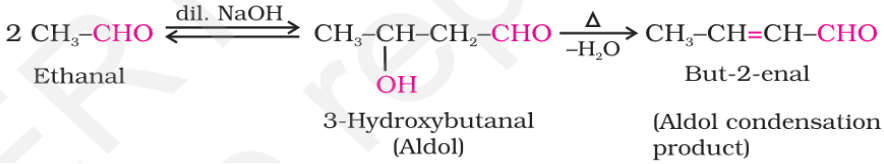
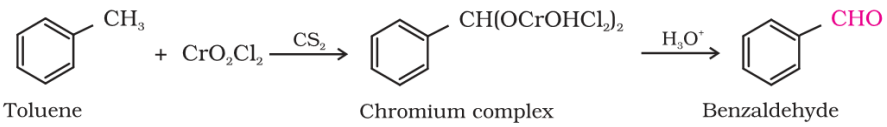
	OR a) Arrange the following compounds in increasing order of their acidity: Benzoic acid, p-nitro benzoic acid, p-methyl benzoic acid b) What happens when alkyl magnesium bromide reacts with dry ice c)Write the reactions involved in the following: (i) Hell-Volhard Zelinsky reaction. (ii) Decarboxylation reaction. (iii) Wollf-Kishner reduction.	

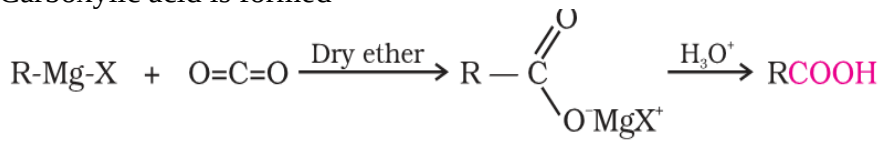
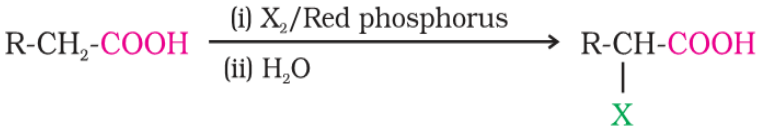
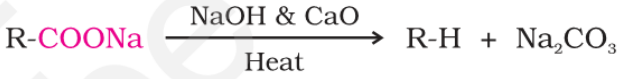
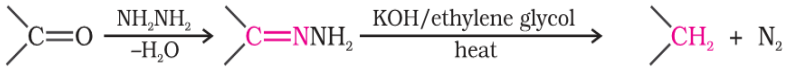
MARKING SCHEME

SECTION A

QN	Scheme of Answer	Marks
1.	d)	1
2.	d)	1
3	b)	1
4.	b)	1
5.	d)	1
6.	b)	1
7.	c)	1
8.	c)	1
9.	a)	1
10.	c)	1
11.	b)	1
12.	c)	1
13.	c)	1
14.	a)	1
15.	c)	1
16.	b)	1
	SECTION B	
17	Correct definitions	1+1
18.	a) Definition b) 2.5	1 1
19	a) Tetracarbonylnickel(0) b) Relative positions of ligands in tetrahedral complexes are same.	1 1
20.	a) Arrange the following in increasing order of boiling point: (i) $CH_3CH_2CH_2CH_2Cl$ >(ii)$CH_3CH_2CH(CH_3)$ Cl >(iii)$(CH_3)_3C.Cl$ b) $CH_3CH{=}CH_2 + HBr/\text{peroxide} \rightarrow CH_3CH_2CH_2Br \ KOHaq \rightarrow$ CH3CH2CH2OH **OR** a) Correct reason b) Correct reason	1 1 1 1
21.	a) Ethanal, it has alpha hydrogen. b) Ethanal will give iodoform test	1 1
	SECTION C	
22.	a) Correct definition. b) Tf = Kf m = 1.86x54x1000/180x250 Calculation 2.232 Freezing point 0f solution = - 2.232 0C	1 1/2 1/2 1/2 1/2
23.	a) Ti^{3+}contains one unpaired electron b) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ Pentaaquachloridochromium(III)chloride monohydrate	1 1 1

24.	a) four correct points of differences. b) $2C_6H_5Cl + 2Na \rightarrow C_6H_5\text{-}C_6H_5 + 2NaCl$	2 1
25.	i)  Adduct ii) $CH_3CHOHCH_3 + [O] \rightarrow CH_3COCH_3 + H_2O$ iii) 	1 1 1
26.	a) $C_{12}H_{22}O_{11} + H_20 \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$ b) $C_6H_{12}O_6 + HI \rightarrow CH_3\,(CH_2)_4CH_3$ c) $CHO(CHOH)_4CH_2OH \rightarrow COOH(CHOH)_4CH_2OH$	1 1 1
27	Log $K_2/K_1 = Ea[T_2\text{-}T_1/T_1T_2]/ 2.303\ R$ Putting correct values Calculations 53.6 Kj/mol1	1 1 1
28	a) correct definition b) correct definition c) correct definition	1 1 1
	SECTION :D	
29	a) Correct definition. b) The condition is called bends. OR Use air diluted with less soluble helium for breathing. c) Any two correct applications.	 1 1
30	d) Nitrogen. e) N,N dimethylmethanamine. c) $RX + NH_3 \rightarrow RNH_2 + HX$ Mixture of amines is produced. OR Correct examples Dye test	1 1 1 1 1 1
	SECTION:E	
31.	(a)  As per Nernst equation if $[Zn^{2+}]$ increased, E_{cell} will be decreased. (b)  (c) 	1 1 ½

	$= 3.17\ V - \frac{0.059V}{2} \log \frac{0.130}{(0.0001)^2}$	½
	Calculation	½
	$= 2.96\ V$	½
	$Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$	1
	OR	
	a) Zinc chloride increased conductivity of electrolyte and captures produced ammonia gas	1
	b) $\Lambda^{o}_{m(HAc)} = \Lambda^{o}_{m(HCl)} + \Lambda^{o}_{m(NaAc)} - \Lambda^{o}_{m(NaCl)}$	½
	$= (425.9 + 91.0 - 126.4)$	½
	Calculation	½
	$= 390.5\ S\ cm^2\ mol^{-1}$	½
	c) Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$ Cathode: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$	2
32.	(i) strong metallic bonding.	1
	(ii) because of the very small energy gap between 5f, 6d and 7s orbitals.	1
	(iii) Cr^{3+} is more stable than Cr^{+2} ion Mn^{2+} is more stable than Mn^{3+}	1
	(iv) due to lanthanoid contraction	1
	(v) oxygen is strong electronegative element and can form multiple bonds.	1
	(vi)presence of unpaired electrons.	1
	(vii) They get oxidized to +3 oxidation state, which is their main oxidation state.	1
33.	a) $CH_3CH_2CH_3 > CH_3OCH_3 > CH_3CHO > CH_3CH_2OH$	1
	b) Propanal is more reactive towards nucleophilic reaction because carbon atom in propanal is more electrophilic than benzaldehyde. Benzaldehyde undergoes resonance.	1
	c) Because nitro group is electron withdrawing which stabilizes carboxylate anion and ease the releasing of proton.	1
	d) (i)  	1
	(ii)  	1
	OR	

33.	a) p-methylbenzoicacid> benzoicacid > p-nitrobenzoicacid	1
	b) Carboxylic acid is formed	1
		
	c) (i)	1
		
	(ii)	1
		
	(iii)	1
		

BLUE PRINT

Unit No.	Name of Unit	Sec-A		Sec- B	Sec C	Sec- D	Sec- E	Total
		1 Mark		2 M	3 M	4 M	5 M	
		MCQ	A-R	VSA	SA	Case Based	LA	
II	Solutions				3 (1)	4 (1)		**7 (2)**
III	Electrochemistry	1 (1)	1(1)	2 (1)			5 (1)	**9 (4)**
IV	Chemical Kinetics	2 (2)		2 (1)	3(1)			**7 (4)**
VII	d -and f -Block Elements	1 (1)	1 (1)				5 (1)	**7 (3)**
IX	Coordination Compounds	2 (2)		2 (1)	3 (1)			**7 (4)**
X	Haloalkanes and Haloarenes	1 (1)		2 (1)	3 (1)			**6 (3)**
XI	Alcohols, Phenols and ethers	2 (2)	1 (1)		3 (1)			**6 (4)**
XII	Aldehydes, Ketones and carboxylic acids	1(1)		2(1)			5 (1)	**8 (3)**
XII	Amines	1 (1)	1 (1)			4 (1)		**6 (3)**
XIV	Biomolecules	1(1)			6 (2)			**7 (3)**
	Total	**12 (12)**	**4 (4)**	**10 (5)**	**21 (7)**	**8 (2)**	**15 (3)**	**70 (33)**

SET-19

BOARD MODEL PAPER
SESSION: 2022-23
SUBJECT: CHEMISTRY THEORY
CLASS-XII

MM: 70 **Time: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 very 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 calculator is not allowed.

SECTION A

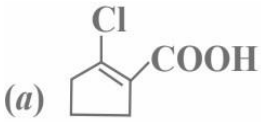
The following questions are multiple-choice questions with one correct answer. Each question carries 1mark. There is no internal choice in this section.

1	For non-electrolyte solute the value of Van't Hoff factor is (a) 0 (b) 1 (c) >1 (d) <1
2	Charge carried by 1 mole of electrons is (a) 6.023×10^{23} coulomb (b) 9.65×10^{4} coulomb (c) 1.6×10^{-19} coulomb (d) 6.28×10^{19} coulomb
3	The difference between the electrode potentials of two electrodes when no current is drawnthrough the cell is called (a) Cell potential (b) Cell emf (c) Potential difference (d) Cell voltage
4	In the reaction, A + 2B □ 6C + 2D, if the initial rate – d [A]/dt at t = 0 is 2.6×10^{-2} M sec^{-1}, whatwill be the value of – d [B]/dt at t = 0? (a) 8.5×10^{-2} M sec^{-1} (b)2.5×10^{-2} M sec^{-1} (c) 5.2×10^{-2} M sec^{-1} (d)7.5×10^{-2} M sec^{-1}
5	Which of the following lanthanoids show +2 oxidation state besides the characteristic oxidationstate +3 of lanthanoids? (a) Ce (b) Eu (c) Yb (d) Ho
6	The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is (a) 2.87 B.M. (b) 3.87 B.M. (c) 3.47 B.M (d) 3.57 B.M
7	The compounds $[Co(SO_4)(NH_3)_5]Br$ and $[Co(SO_4)(NH_3)_5]Cl$ represents (a) Linkage isomerism (b) No isomerism (c) Ionisation isomerism (d) Coordination isomerism
8	The formula of the complex tris(ethylenediamine)cobalt(III) sulphate is(a)$[Co(en)_3]SO_4$ (b)$[Co(en)_3\ SO_4]$ (c)$[Co(en)_3]_2(SO_4)_3$ (d)$[Co(en)_3](SO_4)_3$

9	Which reagent will you use for the following reaction? $CH_3CH_2CH_2CH_3 \rightarrow CH_3CH_2CH_2CH_2Cl + CH_3CH_2CHClCH_3$ (a) Cl_2/UV light (b) $NaCl + H_2SO_4$ (c) Cl_2 gas in presence of Fe in dark (d) Cl_2 gas in dark
10	Phenol is less acidic than (a) Ethanol (b) o-nitrophenol (c) o-methylphenol (d) o-methoxyphenol
11	Which out of the following reactions need α-H atom to get started? (a) Etard reaction (b) Cannizaro's reaction (c) Aldol condensation (d) HVZ reaction
12	Hoffmann Bromamide Degradation reaction is shown by (a) $ArNH_2$ (b) $ArCONH_2$ (c) $ArNO_2$ (d) $ArCH_2NH_2$
	In the Following questions a statement of Assertion(A) is followed by a statement of Reason(R). Selectthe most appropriate answer from the options given below: **(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):** Aromatic 1° amine can be prepared by Gabriel pthalamide synthesis. **Reason (R):** Primary Alkylhalide undergoes nucleophilic substitutionreaction with anion formedby pthalamide.
14	**Assertion (A):** Nitration of aniline can be conventionally done by protecting the amino group byacetylation. **Reason (R):**Acetylation increases the electron density in benzene ring.
15	**Assertion (A):**Sucrose is a non-reducing sugar. **Reason (R):**In sucrose, the aldehydic group of glucose and ketonic group of fructose are notfree.
16	**Assertion (A):** D-(+)-Glucose is dextrorotatory in nature. **Reason (R):** D-(+) Glucose rotates the plane polarised light in clockwise direction.
	SECTION B This section contains 5 questions with internal choice in onequestion. The following questions are veryshort answer type and carry 2 marks each.
17	Calculate the emf of the cell in which the following reaction takes place:$Ni(s) + 2Ag^+ (0.002\ M) \rightarrow Ni^{2+} (0.160\ M) + 2Ag(s)$ [Given that E^o cell = 1.05 V, log 2 = 0.301]
18	Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging.
19	A metal ion M^+ having d^4 valence electronic configuration combines with three bidentate ligands to form a complex compound. Assuming $\Delta_0 > P$: (i) Name the type orbital splitting during this complex formation. (ii) Write the electronic configuration of the valence electrons of the metal M^+ ion in terms of t_{2g} and e_g.
20	Arrange the following sets of compounds in order of their increasing boiling points: (a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol. (b) Pentan-1-ol, n-butane, pentanal, ethoxyethane. **OR** Explain the mechanism of the acid catalysed hydration of ethene
21	What happens when D-glucose is treated with the following reagents? (i) HI (ii) Bromine water

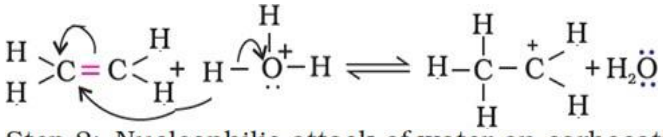
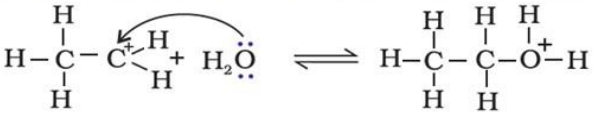
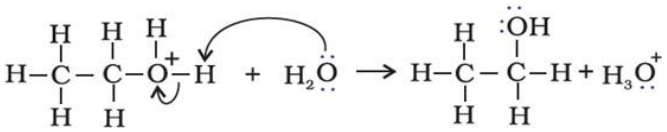
	SECTION C This section contains 7 questions with internal choices in one question. The following questions are shortanswer types and carry 3 marks each
22	The chemistry of corrosion of iron is essentially an electrochemical phenomenon. Explainthe reactions occurring during the corrosion of iron in the atmosphere.
23	The limiting molar conductivity of sodium acetate, sodium chloride and hydrochloric acid are 83, 127 and 426 mho $cm^2\ mol^{-1}$ at 250 ^oC respectively. Calculate the limiting molar conductivity of acetic acid solution.
24	How will you convert the following in not more than two steps: (i) Benzoic acid to benzaldehyde (ii) Acetophenone to benzoic acid (iii) Ethanoic acid to 2-hydroxyethanoic acid
25	$CoSO_4Cl.5NH_3$ exists in two isomeric forms 'A' and 'B'. Isomer 'A' reacts with $AgNO_3$ to givewhite precipitate, but does not react with $BaCl_2$. Isomer 'B'gives white precipitate with $BaCl_2$ but does not react with $AgNO_3$. Answer the following questions. (i) Identify 'A' and 'B' and write their structural formulas. (ii) Name the type of isomerism involved. (iii) Give the IUPAC name of 'A' and 'B'.
26	Give reasons for the following: - (a) Alcohols are more soluble in water than the hydrocarbon of comparable molecular masses. (b)Phenoxide ion is more stable than phenol. (c) Ortho nitro phenol is more acidic than Ortho-methoxyphenol. **OR** Write Short notes on the following reactions (a) Williamson Synthesis (b) Reimer Tiemann (c) Kolbe' Reaction
27	Arrange the following: (i) CH_3NH_2, $(CH_3)_2NH$, NH_3, $(CH_3)_3N$ [basic strength in gaseous phase] (ii) $C_2H_5NH_2$, $C_6H_5NH_2$, NH_3, $C_6H_5CH_2NH_2$ and $(C_2H_5)_2NH$ [basic strength] (iii) $C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2 [basic strength]
28	Give answer for the following: (i) Give one structural difference between amylose and amylopectin (ii) Name the protein and its shape present in the oxygen carrier in the human body. (iii) What type of linkage is present in proteins?
	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	Read the passage given below and answer the following questions: The solubility of gases increases with increase of pressure. William Henry made a systematic investigation of the solubility of a gas in a liquid. According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at constant temperature is directly proportional to the pressure of the gas in equilibrium with the solution". Dalton during the same period also concluded independently that the solubility of a gas in a liquid solution depends upon the partial pressure of the gas. If we use the mole fraction of gas in the solution as a measure of its solubility, then Henry's law can be modified as "the partial pressure of the gas in the vapour phase is directly proportional to the mole fraction of the gas in the solution': (i) Why the aquatic animals feel more comfortable in cold water. (ii) How solubility of gas in liquid varies with increasing temperature.(iii)Write any two applications of henry law. **O** **R** (iii) State Henry's law for gas in liquid solution. Write the mathematical expression of thislaw.
30	Read the passage given below and answer the following questions: Aldehydes and ketones having acetyl group are oxidised by sodium hypohalate (NaOX) or halogen and alkali (X_2 + OH-) to corresponding sodium salt having one carbon atoms less than the carbonyl compound and give a haloform. Sodium hypoiodite (NaOI) when treated with compounds containing CH_3CO - group gives yellow precipitate of iodoform. Haloform reaction does not affect a carbon-carbon double bond present in the compound. (i) Why the methanal is more reactive towards nucleophilic substitution reaction than ethanal. (ii) Write the structure of pentane -2- one. **OR** (i) Write the common name of 1,1,1trichloro ethanal. (ii) How can you distinguish between Acetophenone and benzophenone.
31	**Attempt any five of the following-** (a) Why enthalpy of atomisation of transition metals are quite high. (b) There is a close similarity in physical and chemical properties of the 4d and 5d series of the transition elements, much more than expected on the basis of usual family relationship. Explain. (c) Why the members in the actinoid series exhibit larger number of oxidation states than the corresponding members in the lanthanoid series. (d) Cu^{2+} is stable in aqueous solution inspite of having $3d^9$ configuration. Why? (e) The E° values of Mn and Zn is more negative. Give reason. (f) The transition metals are generally paramagnetic in nature why? (g) Scandium is a transition element but Zinc is not. Why?

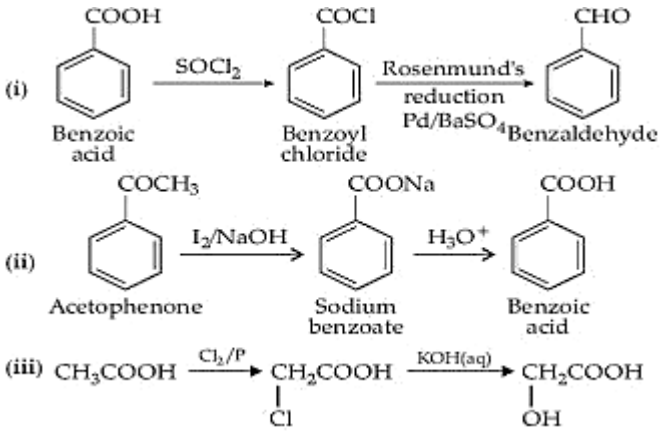
32	(a) The rate constant for a first order reaction is 60 s^{-1}. How much time will it take to reducethe initial concentration of the reactant to its 1/16th value? (b) Calculate the energy of activation of a reaction for which rate constant becomes doubles by Increase of 10K temperature from 298K **OR** (a)(i) A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is theorder of the reaction? (ii) A first order reaction is 50% completed in 1.26×10^{14} s. How much time would ittake for100% completion? (iii) The activation energy of a reaction is zero. Will the rate constant depend upon temperature? Explain. (b) A reaction is first order in A and second order in B. Write the differential rate equation and calculate how the rate is affected when (i) concentration of B is tripled, (ii) concentration of both A and B is doubled.
33	(i) Among all the isomers of molecular formula C_4H_9Br, identify- (a) the one isomer which is optically active. (b) the one isomer which is highly reactive towards S_N2. (c) the two isomers which give the same product on dehydrohalogenation with alcoholic KOH. (ii) Give IUPAC the name of the following organic compounds: (a)  (b) $(CH_3)_3CCH_2Br$ **OR** What happens when- (i) n-butyl chloride is treated with alcoholic KOH, (ii) bromobenzene is treated with Mg in the presence of dry ether, (iii) chlorobenzene is subjected to hydrolysis, (iv) ethyl chloride is treated with aqueous KOH, (v) methyl bromide is treated with sodium in the presence of dry ether.

MARKING SCHEME: SAMPLE PAPER-1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
b	b	b	c	b	b	b	c	a	b	c	b	d	c	a	a

Q. No	Value Point/ Expected Answer	Marks
17	$E_{(cell)} = E^{o}_{(cell)} - \frac{0.059}{2} log \frac{[Ni^{2+}]}{[Ag^{+}]2} = 0.91V$	2
18	During recharging, electrical energy is supplied to the cell from an external source. Thereactions are reverse of those that takes place during discharge. At cathode: $PbSO_4$ (s) $+2e^- \rightarrow Pb(s) + SO^{2-}(aq)$ At anode: $PbSO_4$ (s) $+ 2H_2O \rightarrow PbO_2$ (s) $+ 4H^+(aq) + SO^{2-}(aq) + 2e^-$ Overall reaction: $PbSO_4$ (s) $+ 2H_2$ O(l) $\rightarrow Pb(s) + PbO_2$ (s) $+ 2H_2SO_4$ (aq)	2
19	(i) Octahedral splitting will takes place. (ii) As $\Delta_0 > P$ pairing will occur in the t_{2g} orbitals and e_g orbitals will remain vacant. $t_{2g}^4 eg^0$	1 1
20	(a) Methanol, ethanol, propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol.(b)n-Butane, ethoxyethane, pentanal and pentan-1-ol. OR Step 1: Protonation of ethene to form carbocation by electrophilic attack of H_3O^+ *or* H^+.  Step 2: Nucleophilic attack of water on carbocation.  Step 3: Deprotonation to form an alcohol. 	1 1 2
21	(i) n-Hexane, (ii)Gluconic acid	1+1

22	**At anode:** $Fe \longrightarrow Fe^{2+} + 2e^-$; $E^{o}_{Fe^{2+}/Fe} = -0.44$ V **At cathode:** $2H^+ + \frac{1}{2}O_2 + 2e^- \longrightarrow H_2O$; $E^{o}_{H^+/O_2/H_2O} = 1.23$ V **Overall reaction:** $Fe + 2H^+ + \frac{1}{2}O_2 \longrightarrow Fe^{2+} + H_2O$; $E^{o}_{cell} = 1.67$ V The Fe^{2+} ions are further oxidised by atmospheric oxygen to Fe^{3+} ions, which comes out in the form of hydrated ferric oxide (rust). $2Fe^{2+} + \frac{1}{2}O_2 + 2H_2O \longrightarrow Fe_2O_3 + 4H^+$ $Fe_2O_3 + xH_2O \longrightarrow Fe_2O_3.xH_2O$ (Rust)	3

23	Given:$\Lambda\ \left(CH_3COONa\right) = 83\ mho\ cm_2\ mol^{-1}$ $\Lambda_m{}^o{}_{(NaCl)} = 127\ mho\ cm^2\ mol^{-1}$ $\Lambda_m{}^o{}_{(HCl)} = 426\ mho\ cm^2\ mol^{-1}$ $\Lambda_m{}^o{}_{(CH\ COOH)}$ =? Using Kohlrausch law of independent migration of ions $\Lambda_m{}^o{}_{(CH\ COOH)} = \Lambda_m{}^o{}_{(CH\ COONa)} + \Lambda_m{}^o{}_{(HCl)} - \Lambda_m{}^o{}_{(NaCl)}$ or $\Lambda_m{}^o{}_{(CH\ COOH)} = 83 + 426 - 127 = 382\ mho\ cm_2\ mol^{-1}$	3
24		
25	(i) **A** - $[Co(NH_3)_5SO_4]Cl$ **B** - $[Co(NH_3)_5Cl]SO_4$	1
	(ii) Ionisation isomerism	1
	(iii) (A), Pentaamminesulphatocobalt (III) chloride	1
	(B), Pentaamminechloridocobalt (III) sulphate.	
26	(a) Alcohols have hydrogen bonding whereas hydrocarbons have weak vander waal's force ofattraction. (b) due to +M or +R effect in phenoxide ion. (c) Ortho nitrophenol is more acidic due to electron withdrawing effect of nitro group whichfacilitates release of proton. **OR** (a) R-X + R-Ona → ROR + NaX (in presence of dry ether) (b) $C_6H_50H + CHCl_3 + KOH \rightarrow$ Salicyldehyde + KCl + H_2O (c) $C_6H_5ONa + CO_2 \rightarrow$ Salicylic Acid	1 1 1 1 1 1
27	(i) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$ (ii) $C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$ (iii) $C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < (C_2H_5)_2NH$	1 1 1
28	(i) Amylose is a long unbranched chain polymer of α-D(+) glucose. Amylopectin is a branched chain polymer of α-D(+) glucose.	1
	(ii) Globular protein (haemoglobin) and its shape are spherical.	1
	(iii) Peptide linkage	1

29	(i)The amount of dissolved oxygen in water decreases with rise in the water's temperature. Cold water has more dissolved oxygen per unit area than warm water. This the reason why aquatic animals are more comfortable in cold water than warm water. (ii) Solubility of gas in liquid decreases.(iii)Any two applications **OR** According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at constant temperature is directly proportional to the pressure of the gas in equilibrium with thesolution". $P=K_H$. x	1 1 2
30	(i) due to less steric hindrance in methanal. (ii)Correct structure. **OR** (i) Chloral (ii) iodoform test and correct equation.	1 1 2
31	(a) This is because transition metals have strong metallic bonds as they have large number ofunpaired electrons. (b) This is because 5d and 4d-series elements have virtually the same atomic and ionic radiidue to lanthanoid contraction. (c) due to the fact that the 5f, 6d and 7s levels are of comparable energies. (d) The high energy to transform Cu(s) to Cu^{2+} (aq) is balanced by its hydration enthalpy. (e) The stability of the half-filled d sub-shell in Mn^{2+} and the completely filled d^{10} configuration in Zn^{2+} are related to their more negative E° V values. (f) due to incomplete d orbitals and presence of unpaired electron. (g) Because of fully filled d orbitals in zinc.	1x5 =5
32	(a) t = 2.303/k log $[A_0]/[A]$ = 2.303/ 60 log 1/1/16 = 0.046 s (b) log $[k_2/k_1]$= $Ea/2.303R[T_2-T_1/T_1 \times T_2]$ Substituting the correct value and ans= 52.9 Kj/mol **OR** (a) (i) First order (ii) Infinite, because no first order reaction is 100% completed. (iii) $k= Ae^{-Ea/RT}$, if Ea=0 then k =A, so the rate constant does not depend on temperature. (b)Rate(R)=$k[A][B]^2$ (i)Rate(R1) =$k[A][B]^2$ (R1) =9R, so the rate increases 9 times. (ii) R2= $k[A][B]^2$ R2=8R,rate increases 8 times	2 3 1x3

33	(*i*) (*a*) $CH_3—CH_2—\underset{\displaystyle Br}{\underset{\vert}{CH}}—CH_3$ (2 - Bromobutane) (*b*) $CH_3—CH_2—CH_2—CH_2—Br$ (1 - Bromobutane)	1 1 1
	(*c*) $CH_3—\underset{\displaystyle CH_3}{\underset{\vert}{CH}}—CH_2—Br$ (1 - Bromo - 2 - methyl propane) and $CH_3—\underset{\displaystyle Br}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}—CH_3$ (2 - Bromo - 2 - methyl propane)	2
	(*ii*) (*a*) 2-chloro cyclopent-1-ene-1-carboxylic acid (*b*) 1-bromo-2, 2-dimethyl propane	
	OR (*i*) $CH_3CH_2CH_2CH_2Cl + KOH(alc.) \xrightarrow{\Delta} CH_3CH_2CH=CH_2 + KCl + H_2O$ (*n* - Butyl chloride; Dehydrohalogenation; But - 1 - ene) (*ii*) Bromobenzene + Mg $\xrightarrow{\text{Dry ether}}$ Phenylmagnesium bromide (*iii*) Chlorobenzene + NaOH(*aq*) $\xrightarrow[300\text{ atm, }H^+]{\Delta}$ Phenol (*iv*) $CH_3CH_2Cl + KOH\,(aq) \xrightarrow[\Delta]{\text{Hydrolysis}} CH_3CH_2—OH + KCl + H_2O$ (Ethyl chloride; Ethyl alcohol) (*v*) $CH_3Br + 2Na + BrCH_3 \xrightarrow[\text{(Wurtz reaction)}]{\text{Dry ether}} CH_3CH_3 + 2NaBr$ (Methyl bromide; Ethane)	1x5

BLUE-PRINT								
S.No	Chapter	MCQ	A/R	VSA I	SA I	Case Based	LA	Total
		1 Marks	1 Marks	2 Marks	3 Marks	4 Marks	5 Marks	
1	Solutions	1(1)		2(1)		4(1)		7(3)
2	Electrochemistry	1(1)		2(1)	6(2)			9(4)
3	Chemical Kinetics	2(2)					5(1)	7(3)
4	d -and f -Block Elements	2(2)					5(1)	7(3)
5	Coordination Compounds	2(2)		2(1)	3(1)			7(4)
6	Haloalkanes andHaloarenes	1(1)					5(1)	6(2)
7	Alcohols, Phenols and Ethers	1(1)		2(1)	3(1)			6(3)
8	Aldehydes, Ketones andCarboxylic Acids	1(1)			3(1)	4(1)		8(3)
9	Amines	1(1)	2(2)		3(1)			6(4)
10	Biomolecules		2(2)	2(1)	3(1)			7(4)
	Total	12(12)	4(4)	10(5)	21(7)	8(2)	15(3)	70(33)