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.

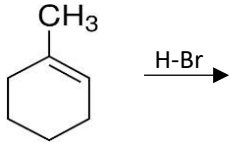
(ii) Nucleoside and Nucleotide

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.

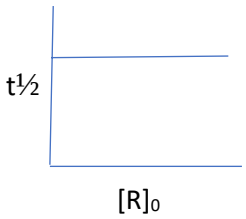
(ii) Treating phenol with chloroform in the presence of aq. NaOH

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

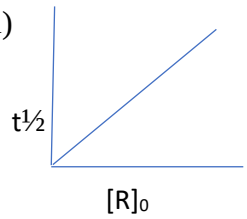
Q28. (a) A first order reaction is 75% completed in 40 min. Calculate $t_{½}$.

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

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.

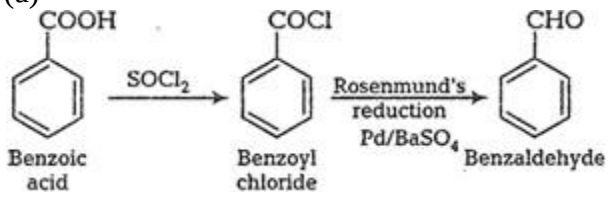
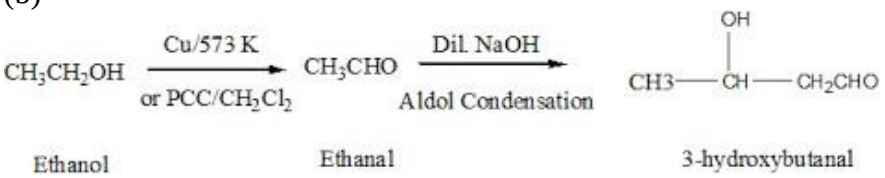
OR

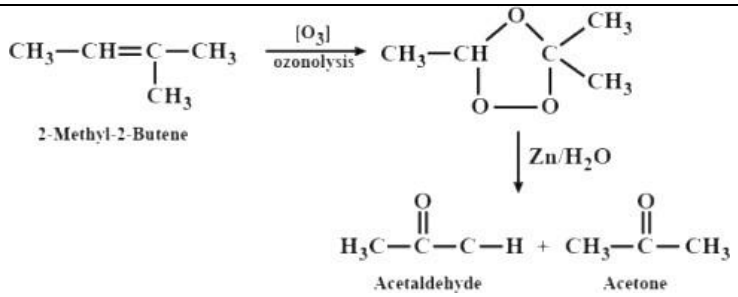
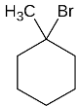
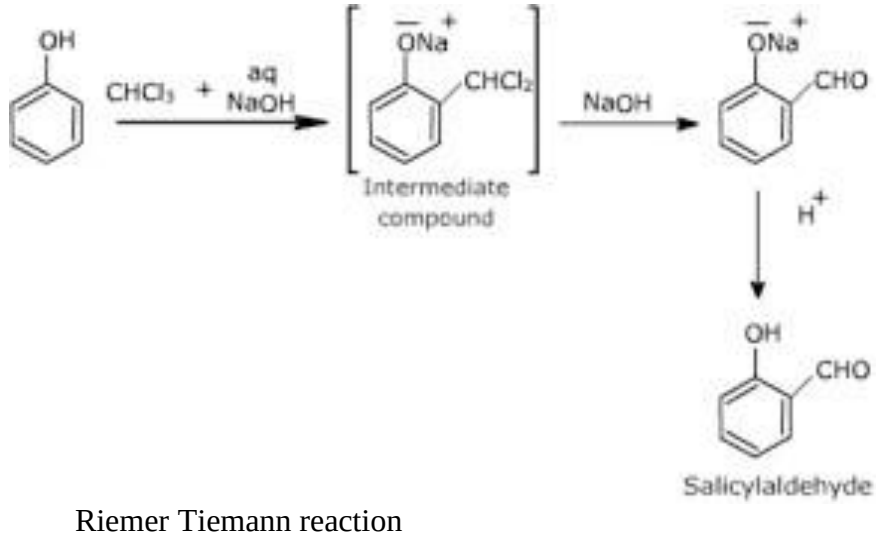
(a) On mixing liquid A and liquid B volume of resulting solution decreases. What type of deviation from Raoult's law is shown by the mixture.

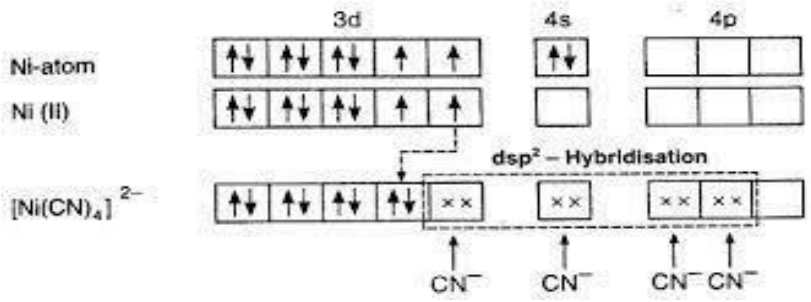
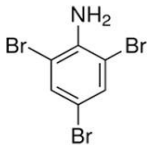
(b) Which colligative property is considered best for determining molar mass of proteins.

(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	$\log K = \log A - Ea/2.303RT$ $Ea/2.303RT = 2 \times 10^4$ $Ea = 3.3294 \times 10^5$ **OR** Rate = $-1/2\ d[N_2O_5]/dt$ Rate = $1/2 \times 1.4 \times 10^{-3}$ Rate = $7 \times 10^{-4}\ molL^{-1}s^{-1}$	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	$\Lambda_m = \frac{1000 \times K}{M} S\ cm^2\ mol^{-1}$ $\Lambda_m = \frac{1000 \times 5.25 \times 10^{-5}}{2.5 \times 10^{-4}} S\ cm^2 mol^{-1}$ $= 210\ S\ cm^2 mol^{-1}$ $\Lambda^0_m\ HCOOH = \lambda^o HCOO^- + \lambda^o H^+$ $= (50.5 + 349.5)\ S\ cm^2 mol^{-1}$ $= 400\ S\ cm^2 mol^{-1}$ $\alpha = \Lambda_m / \Lambda^\circ_m$ =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) $R\text{-}OH + SOCl_2 \rightarrow R\text{-}Cl + SO_2(g) + HCl(g)$, 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 $(\wedge_m^o)$ 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) $\triangle Tb = 100.20^0C - 100\ ^0C = 0.20\ ^0C$ $\triangle Tb = K_b \cdot m$ $m = \triangle Tb / K_b$ $m = 0.20\ K / 0.512\ Kkg\ mol^{-1} = 0.39\ mol\ kg\text{-}1$ $\triangle T_f = K_f.m$ $\triangle T_f = 1.86\ K\ kg\ mol^{-1} \times 0.39\ mol\ kg^{-1}$ $= 0.725\ K$ $T_f = T^0_f - \triangle T_f$ $= 273.15K - 0.725\ K$ $= 272.425\ K$	1 1 1 1+1 1 1 ½ ½ ½ ½ ½ ½ ½

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)