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Tirupathur District – halfyearly Examination – Dec - 2024
12th Std – Chemistry – Answer Key

Part – I 15 x 1 = 15

Q. No	Answer	Q. No	Answer
1	a) 5.92BM	9	a) Sn / HCl
2	b) FeO	10	d) H_3N^+ - CH(R) – COO^-
3	a) Solubility	11	c) IV II III I
4	c) 1.6×10^{-11}M	12	c) basic
5	b) 3F	13	d) Cancer treatment
6	d) Tyndall effect	14	d) potassiumtrioxalatoaluminium(III)
7	a) if both assertion and reason are true and reason is the correct explanation of assertion	15	a) Zero
8	b) Cannizaro reaction		

Part – II

Answer any 6 questions and question No. 24 is compulsory. 6 x 2 = 12

16	**What are the various steps involved in extraction of pure metals from their ores?** i) Concentration of ores ii) Extraction of crude metal iii) Refining of crude metal	2	2
17	Aluminium (III) chloride is more stable whereas thallium (III) chloride is highly unstable. Why? Aluminium (III) chloride is more stable whereas thallium (III) chloride is highly unstable and disproportionates to thallium(I) chloride and chlorine gas. This shows that in thallium the stable lower oxidation state corresponds to the loss of np electrons only and not ns electrons. Thus, in heavier post-transition metals, the outer s electrons (ns) have a tendency to remain inert and show reluctance to take part in the bonding, which is known as inert pair effect.	2	2
18	**Explain why $[Ti(H_2O)_6]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ is colourless?** (see table below)	2	2

	$[Ti(H_2O)_6]^{3+}$	$[Sc(H_2O)_6]^{3+}$
Central metal ion	Ti^{3+}	Sc^{3+}
outer electronic configuration	$3d^1$	$3d^0$
number of unpaired electrons	1	0
	Ti^{3+} has one electron. d-d electron transition occurs. so, it is coloured	no unpaired electron. d-d electron transition does not occur. so, it is colourless

19	**Which is more stable Fe^{3+} or Fe^{2+}? Why? (May-22, Mar-24)** The electronic configuration of Fe^{2+} ([Ar] $3d^6$ $4s^0$) is partially filled whereas the electronic configuration of Fe^{3+} ([Ar] $3d^5$ $4s^0$) is half filled. So, Fe^{3+} is more stable. **(or)** only electronic configuration	2 1	2

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20	**What is zwitter ion.** In aqueous solution the proton from carboxyl group can be transferred to the amino group of an amino acid leaving these groups with opposite charges. Despite having both positive and negative charges this molecule is neutral and has amphoteric behaviour. These ions are called zwitter ions. **(or) Structure only**	2 1	2
21	**Write a note on catalytic poison (Mar-23)** Certain substances when added to a catalysed reaction either decreases or completely destroys the activity of a catalyst and they are often known as catalytic poisons. **(or)** **Eg:** $N_2 + 3H_2 \xrightarrow[H_2S]{Fe} 2NH_3$ catalytic poison	2	2
22	**Schotten – Baumann reaction** $C_6H_5-NH_2 + C_6H_5-\overset{O}{\overset{\Vert}{C}}-Cl \xrightarrow{Pyridine} C_6H_5-NH-\overset{O}{\overset{\Vert}{C}}-C_6H_5 + HCl$ Aniline, Benzoylchloride, N - phenyl benzamide **(or)** any correct equation **(or)** Explanation only	2 2 1	2
23	**Ethylamine is soluble in water whereas aniline is not. Why?** Ethylamine forms hydrogen bond with water. Hence it is soluble in water. Aniline does not form hydrogen bond with water due to the presence of a large hydrophobic C_6H_5 - group. Hence it is insoluble in water.	2	2
24	**Calculate pH of 10^{-7} M HCl.** $[H_3O^+] = 10^{-7}$ (from HCl) $+10^{-7}$ (from water) $= 10^{-7}(1+1) = 2\times10^{-7}$ $pH = -\log_{10}[H_3O^+]$ .... $= -\log_{10}(2\times10^{-7}) = -[\log 2 + \log 10^{-7}]$ .... $= -\log 2 - (-7).\log_{10} 10$ $= 7 - \log 2$ $= 7 - 0.3010 = 6.6990$ $= 6.70$	1 ½ ½	2

Part – III

Answer any 6 questions and question No. 33 is compulsory. **6 x 3 = 18**

25	**What are interhalogen compounds? Give examples. (Aug-21, Mar,Jun-22)** Each halogen combines with other halogens to form a series of compounds called interhalogen compounds. **Properties of of inter halogen compounds: (any two)** 1. The central atom will be the larger one. 2. It can be formed only between two halogens. 3. Fluorine can't act as central metal atom due to smaller size. 4. Due to high electronegativity and smaller size chlorine helps the central atom to attain high coordination number. 5. They can undergo auto ionisation. 6. They are strong oxidizing agents.	1 2	3

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26	**How will you identify borate radical? (Ethyl Borate test) (Mar-23)** $H_3BO_3 + 3C_2H_5OH \xrightarrow{Con.\ H_2SO_4} B(OC_2H_5)_3 + 3H_2O$ The vapour of this Ester burns with green edged flame. **(or)** unbalanced equation **(or)** if Con. H_2SO_4 is not mentioned **(or)** Explanation only	3 2 1	3
27	**Explain why d block elements form complexes?** • Transition metal ions are small and highly charged • They have vacant low energy d-orbitals to accept an electron pair donated by other groups.	3	3
28	**Write Arrhenius equation and explain the terms involved in it.** $K = Ae^{-Ea/RT}$ k = Rate constant, A = Frequency factor, E_a = Activation energy, R = Gas constant, T = Absolute temperature in K.	1 2	3
29	**What is Kohlrausch Law. What are the uses of Kohlrausch's Law?** At infinite dilution, the limiting molar conductivity of an electrolyte is equal to the sum of the limiting molar conductivities of its constituent ions. **Uses: (any two)** 1. Calculation of molar conductance at infinite dilution of a weak electrolyte. 2. Calculation of degree of dissociation of weak electrolytes 3. Calculation of solubility of sparingly soluble salts **(or)** explanation of any uses	2 1 1	3
30	**Define Helmholtz electrical double layer?** The surface of colloidal particle adsorbs one type of ion due to preferential adsorption. This layer attracts the oppositely charged ions in the medium and hence at the boundary separating the two electrical double layers are setup. This is called as Helmholtz electrical double layer. **(or)** Diagram only	3 1	3
31	**What is Baeyer's reagent? How it is useful to prepare glycol?** Cold alkaline solution of potassium permanganate is called as Baeyer's reagent $\underset{\text{ethene}}{CH_2=CH_2} + H_2O \xrightarrow[{[O]}]{\text{Cold alkaline } KMnO_4} \underset{\text{ethane-1,2-diol}}{CH_2(OH)-CH_2(OH)}$ **(or)** Explanation only	1 2 1	3
32	**Stephen's reaction** $CH_3CN \xrightarrow[(H)]{SnCl_2/HCl} CH_3CH{=}NH \xrightarrow{H_3O^+} CH_3CHO + NH_3$ **(or)** Explanation only	3 1	3
33	**A hydride of 2nd period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). Identify A, B and C. (Sep-20 Compulsory)** $\underset{(A)}{2LiH} + \underset{(B)}{B_2H_6} \xrightarrow{Ether} \underset{(C)}{2LiBH_4}$ **(or)** A = Lithium hydride **(or)** LiH B = Diborane **(or)** B_2H_6 C = Lithium borohydride **(or)** $LiBH_4$	3	3

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Part – **IV**

Answer all the questions. **5 x 5 = 25**

Q.No	Answer	Marks	Total
34	**a) i) Define a method for refining Nickel by Mond process? (2)** $Ni_{(S)} + 4CO_{(g)} \xrightarrow{350K} Ni(CO)_4{}_{(g)} \xrightarrow{460K} Ni_{(S)} + 4CO_{(g)}$ **(or)** if temperature not mentioned **(or)** Explanation only	2 1	5
	ii) Explain zone refining process? (3) • **Principle:** Fractional crystallization • **Eg:** Germanium, Silicon, Gallium • When an impure metal is melted and allowed to solidify, the impurities will prefer to be in the molten region. • Impure metal is taken in the form of rod • **Process:** one end of the rod is heated using a mobile induction heater. when the heater is moved to the other end, pure metal crystallizes while the impurities will move on to the adjacent molten zone. The process is repeated several times by moving the heater in the same direction again and again to achieve the desired purity level.	1 1 1	
	(or) b) i) Write the preparation of Alum? (2) $K_2SO_4.Al_2(SO_4)_3.4Al(OH)_3 + 6H_2SO_4 \longrightarrow K_2SO_4 + 3Al_2(SO4)_3 + 12H_2O$ $K_2SO_4 + Al_2(SO_4)_3 + 24H_2O \longrightarrow K_2SO_4.Al_2(SO_4)_3.24H_2O$ **(or)** Explanation only	1 1 1	
	ii) What are the differences between Graphite & Diamond (3) (any three) (see table below)	3	

	Graphite	Diamond
1	It is soft	It is hard
2	It Conducts Electricity	It will not conduct electricity
3	sp^2 Hybridisation	sp^3 Hybridisation
4	Flat hexagonal sheets of carbon atoms	Tetrahedral arrangement
5	Successive carbon sheets held together by weak Vander Waals forces	Covalent bonds
6	Used as Lubricant	Used for cutting glasses and rock drilling
7	Using carbons 4 valence electrons, $3e^-$ forms 3σ bonds, $1e^-$ forms 1π bond. This π e^- delocalised over entire sheet and responsible for its conductivity.	There is no free electron for conductivity

Q.No	Answer	Marks	Total
35	**a) i) Compare lanthanides and actinides. (2) (any two)** (see table below)	2	5

	Lanthanoids	Actinoids
1.	Differentiating electrons enters in 4f orbital.	Differentiating electrons enters in 5f orbital.
2.	Binding energy of 4f orbitals are higher.	Binding energy of 5f orbitals are lower.
3.	They show less tendency to form Complexes.	They show greater tendency to form complexes.
4.	Most of the lanthanoids are colourless	Most of the actinoids are coloured. For Eg. U^{3+} (Red), U^{4+}(Green), UO_2^{2+}(Yellow)

5.	They do not form oxocations	They do form oxocations such as UO_2^{2+}, NpO_2^{2+}
6.	Besides +3 oxidation states lanthanoids show +2 and +4 oxidation states in few cases.	Besides +3 oxidation states actinoids show higher oxidation states such as +4, +5, +6 and +7.

ii) Write the postulates of werner's theory. (3)

1. Most of the element's exhibit, two types of valences.
   - Primary valence
   - Secondary valence

	Primary valence	Secondary valence
2	It denotes oxidation state of the metal atom.	It denotes the coordination number.
3	It is positive in most of the cases and zero in certain cases. They are always satisfied by negative ions.	It is satisfied by negative ions, neutral molecules, positive ions or the combination of these.
4	It is non directional	It is directional

5. According to Werner, there are two spheres of attraction around a metal atom/ion in a complex. The inner sphere is known as coordination sphere. The outer sphere is called ionisation sphere.

6. The geometry of the complex is determined by the spacial arrangement of the groups which satisfy the secondary valence. If the secondary valency is,

Six - octahedral geometry.

Four -either tetrahedral or square planar geometry.

Limitation: it does not explain their colour and the magnetic properties.

3 x 1

(or) b) i) Calculate the percentage efficiency of packing in case of body centered cubic crystal? (3)

Packing efficiency = $\frac{\text{total volume occupied by spheres in a unit cell}}{\text{volume of the unit cell}}$ x 100

Volume of cube = a x a x a = a^3 ½

In ΔABC,

$AC^2 = AB^2 + BC^2$

AC = $\sqrt{AB^2 + BC^2} = \sqrt{a^2 + a^2} = \sqrt{2}a$ ½

In ΔAGC,

$AG^2 = AC^2 + CG^2$

AG = $\sqrt{AC^2 + CG^2} = \sqrt{(\sqrt{2}a)^2 + a^2} = \sqrt{3}a$ ½

from figure, AG = 4r

$\sqrt{3}a = 4r$ ½

$r = \frac{\sqrt{3}}{4}a$

Volume of the sphere with radius 'r' = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{\sqrt{3}}{4}a\right)^3 = \frac{\sqrt{3}}{16}\pi a^3$ ½

The number of spheres belongs to a unit cell in bcc arrangement is 2.

Packing efficiency = $\frac{2\times\frac{\sqrt{3}}{16}\pi a^3}{a^3}$ X 100 = $\frac{\sqrt{3}\,\pi}{8}$ X 100 = 68% ½

	ii) The rate constant for a first order reaction is 1.54×10^{-3} S^{-1}. calculate its half life time. (2) Half-life = $\frac{0.693}{k} = \frac{0.693}{1.54 \times 10^{-3}}$ = 0.45 x 1000 = 450 s	1 1	
36	**a) i) Write the expression for the solubility product of $Ca_3(PO_4)_2$. (2)** $Ca_3(PO_4)_{2\,(s)} \leftrightharpoons 3Ca^{2+}_{(aq)} + 2PO_4^{3-}{}_{(aq)}$ 3S 2S $K_{sp} = [Ca^{2+}]^3\,[PO_4^{3-}]^2$ **(or)** $K_{sp} = (3S)^3\,(2S)^2$ $= 27\,S^3 \times 4\,S^2 = 108\,S^5$	1 1	5
	ii) Derive integrated rate law for a first order reaction? (3) A ⟶ Product Rate = $k[A]^1$ $\frac{-d[A]}{dt} = k[A]^1$ **(or)** $\frac{-d[A]}{[A]} = k\,dt$ integrating between the limits of concentration $[A_0]$ to [A] and time t = 0 to t = 1. $\int_{[A_0]}^{[A]} \frac{-d[A]}{[A]} = K \int_0^t dt$ **(or)** $(-ln\,[A])_{[A_0]}^{[A]} = k\,(t)_0^t$ $-ln[A] - (-ln[A_0]) = k(t-0)$ $-\,ln[A] + ln[A_0] = kt$ $ln\left(\frac{[A_0]}{[A]}\right) = kt$ $2.303 \log \frac{[A_0]}{[A]} = kt$ **(or)** $k = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$	1 1 1	
	(or) b) i) Derive an expression for Nernst equation (3) $xA + yB \rightleftharpoons lC + mD$ $Q = \frac{[C]^l\,[D]^m}{[A]^x[B]^y}$ $\Delta G = \Delta G° + RTlnQ$ $\Delta G = -nFE,\ \Delta G° = -nFE°$ $-nFE = -nFE° + RTln \frac{[C]^l\,[D]^m}{[A]^x[B]^y}$ **(or)**	1 1	

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÷ - nF

$$E = E^\circ - \frac{RT}{nF} \ln \frac{[C]^l [D]^m}{[A]^x [B]^y}$$

$$E = E^\circ - \frac{2.303RT}{nF} \log \frac{[C]^l [D]^m}{[A]^x [B]^y}$$

$$E = E^\circ - \frac{0.0591}{n} \log \frac{[C]^l [D]^m}{[A]^x [B]^y}$$

R = 8.314 J K^{-1} mol^{-1}
T = 298 K
1 F = 96500 C mol^{-1} — 1

ii) State Faraday's Laws of electrolysis? (2)

When the same quantity of charge is passed through the solutions of different electrolytes, the amount of substances liberated at the respective electrodes are directly proportional to their electrochemical equivalents. — 2

(or) **m ∝ Z** — 1

37

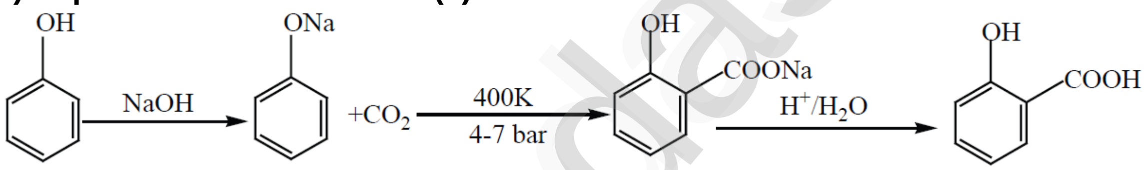
a) i) Explain intermediate compound formation theory of catalysis with an example? (3)

This theory explains homogeneous catalysed reactions. A catalyst may combine with one or more reactant to form an intermediate which reacts with other reactant or decompose to give products and the catalyst is regenerated. — 1

$A + B \longrightarrow AB$	Eg: $H_2 + \frac{1}{2} O_2 \longrightarrow H_2O$
$A + C \longrightarrow AC$ (Intermediate)	$2Cu + \frac{1}{2} O_2 \longrightarrow Cu_2O$ (Intermediate)
$AC + B \longrightarrow AB + C$ (Catalyst)	$Cu_2O + H_2 \longrightarrow H_2O + 2Cu$ (Catalyst)

1+1

ii) Explain Kolbe's reaction? (2)

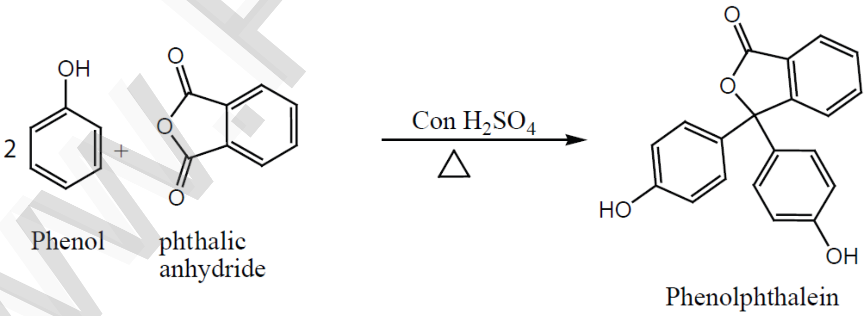


phenol sodium phenoxide sodium salicylate Salicycic acid — 2

(or) Explanation only — 1

(or) b) i) How do you convert the following

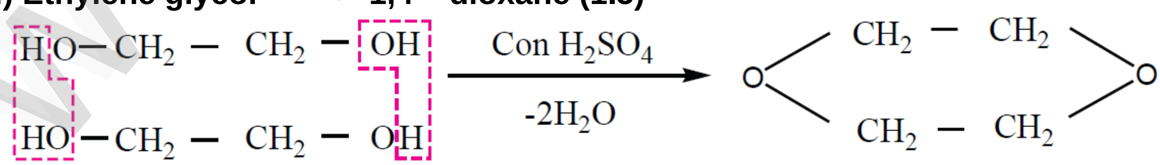
i) Phenol ⟶ Phenolpthalein (1.5)



1½

(or) Explanation only — 1

ii) Ethylene glycol ⟶ 1,4 – dioxane (1.5)



ethane - 1,2 - diol 1,4 - dioxane — 1½

(or) Explanation only — 1

5

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	ii) Write Rosenmund reduction? (2) $CH_3-\overset{O}{\overset{\Vert}{C}}-Cl + H_2 \xrightarrow{Pd/\ BaSO_4} CH_3-\overset{O}{\overset{\Vert}{C}}-H + HCl$ Acetyl chloride Acetaldehyde In this reaction, barium sulphate act as a catalytic poison to palladium catalyst, so that aldehyde cannot be further reduced to alcohol. **(or)** Explanation only	1 1 1	
38	**a) i) Compound A with molecular formula C_7H_6O reduces tollen's reagent. A on reaction with 50% NaOH gives compound B with molecular formula C_7H_8O and molecular formula $C_7H_5O_2Na$. compound C react with dil.HCl gives compound D with molecular formula $C_7H_6O_2$. Compound D on heating with sodalime gives compound E. Identify A, B, C, D and E. write the reaction involved. (3)** A= C_6H_5CHO $C_6H_5CHO + C_6H_5CHO \xrightarrow{50\%\ NaOH} C_6H_5CH_2OH + C_6H_5COONa$ Benzaldehyde (A) Benzyl alcohol (B) Sodium Benzoate (C) $C_6H_5COONa + HCl \longrightarrow C_6H_5COOH + NaCl$ Sodium Benzoate (C) Benzoic acid (D) $C_6H_5COOH + NaOH \xrightarrow[\Delta]{CaO} C_6H_6 + CaCO_3$ Benzoic acid (D) Benzene (E) **(or)** if A, B, C, D, E not mentioned	1 1 1 1½	5
	ii) Identify the compounds A and B in the following reaction. (2) $C_6H_5NO_2 + 6(H) \xrightarrow{Sn\ /\ HCl} C_6H_5NH_2 \xrightarrow[273K]{HNO_2} C_6H_5N_2^+Cl^-$ **(or)** A B A = Aniline (or) $C_6H_5NH_2$ B = Benzene diazonium chloride (or) $C_6H_5N_2^+Cl^-$	2 2	
	(or) b) i) Determine the structure of glucose. (3) 1. Elemental analysis and molecular weight determination show that the molecular formula of glucose is C6H12O6. 2. On reduction with HI / P gives a mixture of n-hexane indicating that the six carbon atoms are bonded linearly. 3. Glucose forms penta acetate with acetic anhydride suggesting the presence of five alcohol groups. 4. Glucose reacts with NH2OH to form oxime and with HCN to form cyanohydrin. These reactions indicate the presence of carbonyl group in glucose. 5. Glucose reduces Tollen's reagent and Fehling's solution confirm the presence of an aldehyde group 6. Glucose gets oxidized to gluconic acid with bromine water suggesting that the carbonyl group is an aldehyde group and it occupies one end of the carbon chain. 7. When oxidised with conc. nitric acid gives glucaric acid (saccharic acid) suggesting the other end is occupied by a primary alcohol group.	4 x ½	

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	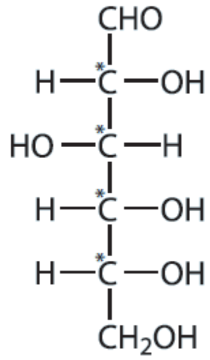	1	

ii) Give any three differences between DNA and RNA. (2) (any two) — 2

	DNA	RNA
1	It is mainly present in nucleus, mitochondria and chloroplast	It is mainly present in cytoplasm, nucleolus and ribosomes
2	It contains deoxyribose sugar	It contains ribose sugar
3	Its life time is high	It is Short lived
4	It is stable and not hydrolysed easily by alkalis	It is unstable and hydrolyzed easily by alkalis
5	Double stranded molecules	Single stranded molecules
6	Base pair A = T. G ≡ C	Base pair A = U. C ≡ G
7	It can replicate itself	It cannot replicate itself. It is formed from DNA.