II PUC – CHEMISTRY (34)

MODEL QUESTION PAPER - 1

Time: 3hours 15 minutes   Maximum marks: 70

Instructions:

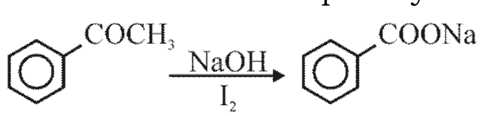
1. *The question paper has four parts: A, B, C and D. All parts are compulsory.*
2. *Write balanced chemical equations and draw labeled diagrams wherever required.*
3. *Use log tables and the simple calculator if necessary.*

   (Use of scientific calculators is not allowed)

PART-A

I. Answer ALL of the following. (Each question carries 1 mark)   10x1=10

(Answer each question in one word or in one sentence)

1. Name a colligative property.
2. What does the Van't Hoff factor ' i ' for a solute in a solvent account for?
3. What is a secondary cell?
4. By how many times does the $t_{1/2}$ of zero order reaction increase if the initial concentration of the reactant is doubled?
5. Name the catalyst that catalyzes the decomposition of $KClO_3$ into KCl and O_2.
6. Give the composition of 'copper matte'.
7. What is the structure of XeF_2?
8. A racemic mixture is optically inactive. Why?
9. 

   + X. Give the IUPAC name of X.
10. What does the primary structure specify about the structure of a protein.

PART-B

II. Answer any FIVE of the following. (each question carries 2 marks)   5x2=10

11. Give two differences between Schottky and Frenkel defects in ionic solids.
12. Name the gases liberated at anode and cathode respectively when an aqueous solution of sodium chloride is electrolysed.
13. Given $2NO_{(g)} + O_{2\,(g)} \longrightarrow 2NO_{2(g)}$; rate = $k[NO]^2\,[O_2]^1$. By how many times does the rate of the reaction change when the volume of the reaction vessel is reduced to $1/3^{rd}$ of its original volume? Will there be any change in the order of the reaction?
14. Give reasons: i) actinoids show variable oxidation states
    ii) Zr and Hf have almost identical radii
15. What is Lucas reagent? Between primary and tertiary alcohols, which one of these will react faster with Lucas reagent?
16. A carboxylic acid is treated with alcohol in presence of conc. H_2SO_4. Name the reaction. Give its general equation.
17. What are food preservatives? Give an example.
18. Name any two types of synthetic detergents.

PART-C

III. Answer any FIVE of the following. (each question carries 3 marks) 5x3=15

19. Describe the three steps involved in the leaching of bauxite to get pure alumina (equations not expected). 3

20. White phosphorus is heated with excess of dry chlorine to get X. X on hydrolysis finally forms an oxyacid of phosphorous Y. What are X and Y? What is the basicity of acid Y? 3

21. Describe the preparation of ozonised oxygen with an equation. Name the oxidized product obtained when ozone reacts with lead sulphide. 3

22. Complete the following equations:

    i) $2F_2 + 2H_2O \longrightarrow$

    ii) $H_2S + Cl_2 \longrightarrow$

    iii) $8NH_3$ (excess) + $3Cl_2 \longrightarrow$ 3

23. Name the metal of the 1st row transition series that

    i) has highest value for M^{2+} / M standard electrode potential

    ii) has zero spin only magnetic moment in its +2 oxidation state.

    iii) exhibit maximum number of oxidation states. 3

24. Write ionic equations for the reaction of dichromate ions with

    i) hydroxyl ions ii) Fe^{+2} ions in acidic medium

    In which one of the two reactions will the oxidation number of chromium remains same? 3

25. Using VBT account for the geometry and magnetic property of $[Ni(CN)_4]^{2-}$. Given atomic number of Ni =28. 3

26. Give the IUPAC name of $[Co\ Cl_2\ (NH_3)_4]Cl$. Draw cis and trans isomers of $[Co\ Cl_2\ (NH_3)_4]^+$ ion.

PART-D

IV. Answer any THREE of the following. (each question carries 5 marks) 3x5=15

27. What is packing efficiency in a crystal? Draw the unit cell of a simple cubic lattice and calculate the packing efficiency in a simple cubic lattice. 5

28. a) Vapour pressure of liquids A and B at 298 K is 300 mm of Hg and 450 mm of Hg respectively. If the total vapour pressure of a mixture of A and B is 405 mm of Hg, calculate the mole fraction of A in the mixture.

    b) What happens to the solubility of a gas in a liquid with increase in temperature? Give reason. 3+2

29. a) Calculate the equilibrium constant of the reaction at 298 K.

    $Mg_{(s)} + 2Ag^+_{(aq)} \longrightarrow Mg^{+2}_{(aq)} + 2Ag_{(s)}$; $E^0_{cell} = +3.16$ V

    b) How is molar conductivity related to the conductivity of a solution? Which one of these has higher molar conductivity:0.1 M KCl or 0.01 M KCl? 3+2

30. a) The rate of a reaction increases by 4 times when the temperature of the reaction is raised from 340 K to 360 K. Calculate the energy of activation of the reaction. Given R = 8.314 J/K/mol.

    b) Draw a graph of potential energy versus reaction coordinate to show the effect of catalyst on activation energy. 3+2

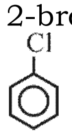
31. a) What is coagulation of a sol? Name two methods by which a lyophobic sol can be coagulated.

b) What is the change in enthalpy and entropy during adsorption of gas in a solid? 3+2

V. Answer any FOUR of the following. (Each question carries 5 marks) 4x5=20

32. a) Mention the **major** product formed in the following reactions:

i) 2-bromopentane $\xrightarrow{\text{alc.KOH},\Delta}$

ii)  + $CH_3–CO–Cl \xrightarrow{\text{anhyd. } AlCl_3}$

iii) $C_2H_5Br + AgCN \xrightarrow{\Delta}$ 3+2

b) Write the equations for the steps in S_N1 mechanism of the conversion of *tert*-butyl bromide into *tert*-butyl alcohol.

33. a) Give equations for:

i) Kolbe's reaction ii) Williamson's ether synthesis

b) An organic compound (P) with the formula C_3H_6O reacts with CH_3MgX followed by hydrolysis forms an alcohol (Q), which does not undergo dehydrogenation? Name the compounds P and Q. 3+2

34. a) Write equations for:

i) Gattermann-Koch reaction to convert benzene into benzaldehyde.

ii) the formation of oxime from carbonyl compounds

iii) the reaction between carboxylic acid and PCl_5.

b) Give reasons:

i) α-hydrogen atoms of aldehydes and ketones are acidic.

ii) An electron donating group decreases the acid strength of carboxylic acid. 3+2

35. a) i) $C_6H_5CONH_2 \xrightarrow{Br_2/NaOH} X$. ii) $X \xrightarrow[0°C]{NaNO_2,HCl} Y$. What are X and Y? Name the reaction occurring in step (i).

b) Arrange the following in the increasing order of their basic strengths in the aqueous medium: $(CH_3)_3N$, NH_3, CH_3NH_2, $(CH_3)_2NH$. Give one reason for the trend observed. 3+2

36. a) Mention two differences in the structure of starch and cellulose. Write the Haworth's structure of the monomer in cellulose.

b) Give an example each for i) acidic α-amino acid ii) fibrous protein. 3+2

37. a) How are condensation polymers formed? Give an example with an equation.

b) With respect to natural rubber:

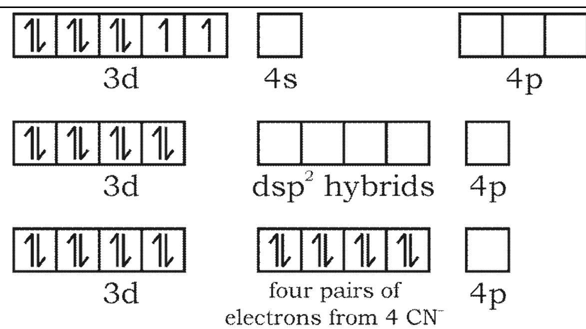
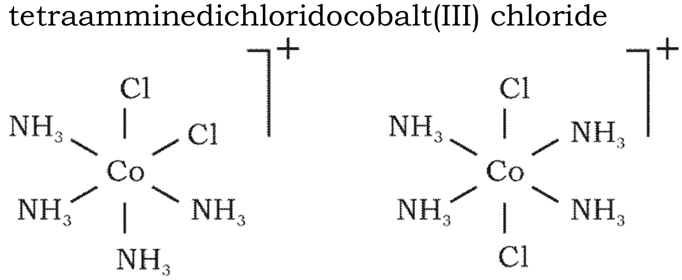
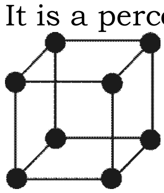
i) name its monomer

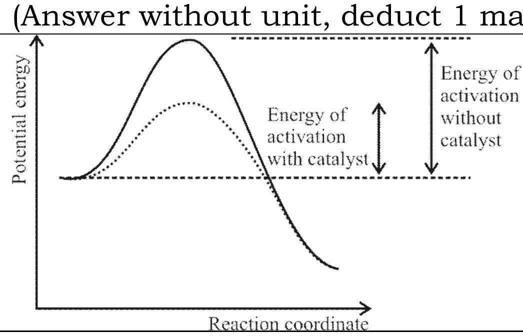
ii) name the element used for vulcanization. 3+2

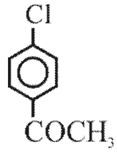
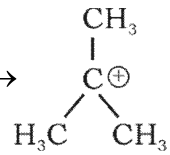
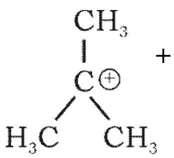
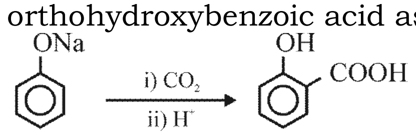
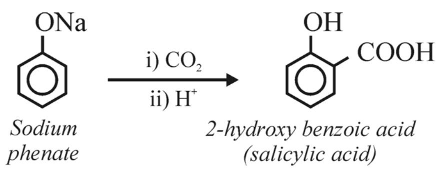
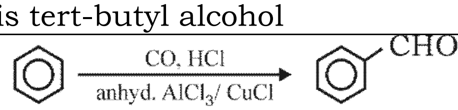
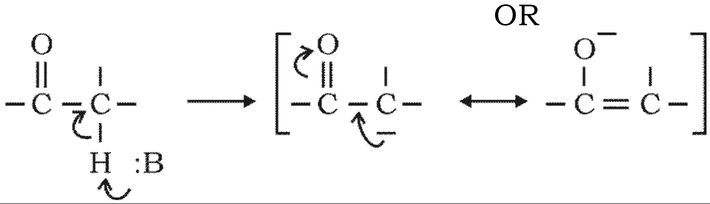
Scheme of valuation for model question paper-1

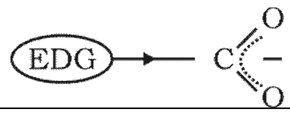
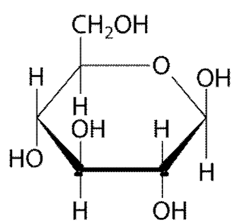
Note: Any other correct alternate answer can be honoured wherever applicable.

Q.N	Value Points	Marks
I.	**PART-A**	
1	Any one out of the four	1
2	Extent of association **OR** dissociation of a solute	1
3	A cell that can be recharged again	1
4	$t_{½}$ gets doubled **OR** becomes 2 times the original	1
5	Manganese dioxide or MnO_2	1
6	$Cu_2S + FeS$	1
7	Linear	1
8	Rotation by an enantiomer is cancelled by the other	1
9	triiodomethane	1
10	Sequence of α-amino acids in a polypeptide chain	1
II.	**PART-B**	
11	**Schottky defect**: i. Density decreases ii. Observed when cations and anions have similar size. iii. Equal number of cations and anions are missing from lattice points **Frenkel defect**: i. No change in density. ii. Observed when cations and anions differ in their size. iii. The smaller ion gets dislocated from its lattice point Any two	2
12	Anode – Chlorine ; Cathode – Hydrogen (1+1)	2
13	27 times No change in the order	1 1
14	i) Due to comparable energies of 5f, 6d and 7s levels. ii) It is due to Lanthanoid contraction.	1 1
15	Conc. $HCl + ZnCl_2$ tertiary alcohol	1 1
16	Esterification $R–COOH + R^1OH \longrightarrow RCOOR^1 + H_2O$	1 1
17	They prevent spoilage of food. Table salt or sugar or sodium benzoate (any one)	1 1
18	Anionic, cationic, non-ionic (any two) (1+1)	2
III.	**PART-C**	
19	i) Bauxite is concentrated by digesting the powdered ore in a concentrated solution of sodium hydroxide at 473-573 K and 35 bar pressure. Al_2O_3 is leached as sodium aluminate. ii) Aluminate solution is neutralised by passing CO_2. Hydrated Al_2O_3 is precipitated by seeding.	1 1 1

	iii) Hydrated Al_2O_3 is filtered, dried and heated to get pure Al_2O_3.	
20	X is PCl_5 Y is H_3PO_4 Basicity of Y is 3.	1 1 1
21	A slow dry stream of oxygen is passed through a silent electrical discharge. Some oxygen gets converted into ozone. $3O_2 \longrightarrow 2O_3$ Lead sulphate	1 1 1
22	i) $\longrightarrow 4HF + O_2$ ii) $\longrightarrow 2HCl + S$ iii) $\longrightarrow 6NH_4Cl + N_2$	1 1 1
23	i) Copper ii) Zinc iii) Manganese	1 1 1
24	i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$ ii) $Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \longrightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$ In reaction (i)	1 1 1
25	E.C. Ni^{2+} : [Ar] $3d^8$ or dsp^2 hybridised orbitals of Ni^{2+} $[Ni(CN)_4]^{2-}$  Geometry: square planar	1 1 1
26	tetraamminedichloridocobalt(III) chloride  cis trans	1 2
IV.	**PART-D**	
27	It is a percentage of total space filled by the particles in a crystal.  Edge length or side of a cube = a, radius of a particle = r Particles touch each other along the edge $\therefore$ a = 2r, volume of the cell = $a^3 = 8r^3$	1 1 1

	Simple cubic unit cell contains only 1 atom Volume occupied = $\frac{4}{3}\pi r^3$ Packing efficiency = $\frac{\text{volume of one atom}}{\text{volume of the unit cell}} \times 100\%$ $= \frac{4/3\pi r^3}{8r^3} \times 100 = 52.4\%$	1 1
28a.	Let mole fraction of A be x_A ; mole fraction B ; $x_B = (1 - x_A)$ From Raoult's law $p_A^0 x_A + p_B^0 x_B = P_{total}$ OR $p_A^0 x_A + p_B^0 (1 - x_A) = P_{total}$ $300\, x_A + 450\, (1 - x_A) = 405$ $x_A = 0.3$	 1 1 1
b.	It decreases. Dissolution of a gas in a liquid is an **exothermic process**.	1 1
29a.	$E^0_{cell} = \frac{0.059}{n} \log K_C$ $3.16 = \frac{0.059}{2} \log K_C$ $K_C = 1.314 \times 10^{107}$	1 1 1
b.	$\Lambda_m = \frac{\kappa}{C}$ 0.01 M KCl	1 1
30a.	$\log \frac{k_2}{k_1} = \frac{Ea}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$ $\log 4 = \frac{Ea}{2.303 \times 8.314}\left[\frac{360 - 340}{360 \times 340}\right]$ $E_a = 70554$ J or 70.554 kJ (Answer without unit, deduct 1 mark)	1 1 1
b.		2
31a.	The process of settling of colloidal particles is called coagulation of the sol. By electrophoresis **OR** by boiling **OR** by adding an electrolyte **OR** by mixing two oppositely charged sols. (Any two)	1 2
b.	Enthalpy decreases OR ΔH is negative. Entropy decreases OR ΔS is negative.	1 1
V.		
32a.	i) $CH_3 - CH = CH{-}CH_2{-}CH_3$ or pent–2–ene	1

	ii)  or 4–chloroacetophenone iii) C_2H_5NC or ethylisocyanide or ethylisonitrile or ethylcarbylamine	1 1
b.	Step-1: $(CH_3)_3CBr \longrightarrow$  $+ Br^-$ Step-2:  $+ {}^-OH \longrightarrow (CH_3)_3C\,OH$	1 1
33a.	i) Kolbe's reaction: Sodium phenate undergoes electrophile substitution reaction with CO_2 a weak electrolyte, finally to form orthohydroxybenzoic acid as main product.  **OR**  ii) Alkyl halide reacts with sodium alkoxide to form ether $R–X + Na–O–R \longrightarrow R–O–R + NaX$ **OR** $\underset{\text{Alkyl halide}}{R–X} + \underset{\text{Sodium alkoxide}}{Na–O–R} \longrightarrow \underset{\text{ether}}{R–O–R} + NaX$	1 1 2 1 1 2
b.	P is acetone Q is tert-butyl alcohol	1 1
34a.	i)  ii) $>C=O + H_2NOH \longrightarrow >C=N-OH + H_2O$ iii) $R–COOH + PCl_5 \longrightarrow R–COCl + POCl_3 + HCl$	1 1 1
b.	i) It is due to strong electron withdrawing effect of carbonyl group and resonance stabilisation of conjugate base. OR  	1

<table>
<tr><td></td><td>ii) An electron donating group destabilises the carboxylate anion or the conjugate base.
OR
</td><td>1</td></tr>
<tr><td>35a.</td><td>X is $C_6H_5NH_2$
Y is $C_6H_5N_2Cl$.
Hoffmann’s bromamide degradation reaction</td><td>1
1
1</td></tr>
<tr><td>b.</td><td>$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$
Inductive effect or solvation effect or steric hindrance</td><td>1
1</td></tr>
<tr><td>36a.</td><td><table>
<tr><th>Starch</th><th>Cellulose</th></tr>
<tr><td>1. Made up of α–D(+) glucose units
2. Has α–glycosidic linkage.
3. Has C_1–C_4 and C_1–C_6 linkages.
4. Has linear and branched polymeric chains.</td><td>1. Made up of β–D(+) glucose units
2. Has β–glycosidic linkage.
3. Has only C_1–C_4 linkages.
4. It is a linear polymer.</td></tr>
</table>
Any two
</td><td>2

1</td></tr>
<tr><td>b.</td><td>i) Aspartic acid **OR** glutamic acid.
ii) Keratin **OR** myosin</td><td>1
1</td></tr>
<tr><td>37a.</td><td>Condensation polymers are formed by repeated condensation reaction between two different bifunctional monomeric units.
E.g.: Nylon 6, 6
$nH_2N(CH_2)_6NH_2 + nHOOC(CH_2)_4COOH \longrightarrow$
$\left[NH(CH_2)_6NHCO(CH_2)_4CO \right]_n + (n-1)H_2O$
Any other suitable example with equation.</td><td>1
1
1</td></tr>
<tr><td>b.</td><td>i) Isoprene **OR** 2-methyl – 1, 3 –butadiene
ii) Sulphur</td><td>1
1</td></tr>
</table>