II PUC CHEMISTRY SYLLABUS BLOW-UP

UNIT-I Solid State 8 hrs

General characteristics of solids: amorphous and crystalline solids – examples, differences. Classification of crystalline solids – based on binding forces: molecular solids – (non-polar, polar, H-bonded), ionic solids, metallic solids, covalent or network solids – examples for all.

Definitions – lattice point, crystal lattice, unit cell, coordination number. Parameters of a unit cell, names of seven crystal systems , calculation of number of atoms in a cubic unit cell – simple cubic, bcc, fcc. Close packing in two dimensional and three dimensional lattices - brief information, voids - types of voids, tetrahedral and octahedral and their relative numbers, calculation of the formula of the compounds based on the number of voids filled. Packing in solids - calculation of packing efficiency- fcc/ccp, bcc, simple cubic. Formula to calculate the density of the unit cell to be assumed- use the formula to calculate a, d , z , M , N_A. Numerical problems.

Point defects-types, a brief account of Frenkel and Schottky defects, metal excess defect and metal deficiency defect with examples.

Electrical properties: classification into conductors, insulators and semiconductors - their comparison based on band theory of metals, n- type and p-type semiconductors – differences and examples. Magnetic properties of substances – paramagnetism, diamagnetism and ferromagnetism, examples.

UNIT-II Solutions 9 hrs

Types of Solutions – binary – gaseous, liquid and solids, expressing the concentration of a solution of a solid in a liquid – mole fraction, molarity and molality. Solubility, solubility of a gas in a liquid – Henry's law, graph of partial pressure of a gas *v*s its mole fraction in solution, effect of pressure, temperature, applications of Henry's law.

Solution of liquid in liquid – Raoult's law- statement, mathematical expression, numerical problems, ideal solution – characteristics, graph, non - ideal solution –types - their characteristics and differences, examples, azeotropes – types, examples.

Solution of a solid in a liquid – Raoult's law – colligative properties – relative lowering of vapour pressure, elevation in boiling point, depression in freezing point, graphs for elevation in boiling point and depression in freezing point, SI units for K_b, K_f , osmosis – osmotic pressure, isotonic, hypertonic, hypotonic solutions, reverse osmosis – application in desalination of water. Numerical problems on determination of molar mass using colligative properties.

Abnormal molar mass, van't Hoff factor *i*, value of *i* for non-electrolytes and solutes that associate or dissociate in dilute solution.

UNIT-III Electrochemistry 9 hrs

Redox reaction – As fundamental reaction in electrochemical cells, electronic and electrolytic conductors – differences, strong and weak electrolytes, examples-Ionic conductance- factors affecting ionic conductance, conductivity and molar conductivity of electrolytic solutions- definitions, mathematical expressions, relationship between them, SI units, numerical problems. Variation of conductivity and molar conductivity with concentration, graph for variation of Λ_m *vs* $\sqrt{c}$ for strong and weak electrolytes using equation $\Lambda_m = \Lambda_m^0 - A\sqrt{c}$ (measurement of conductivity from Wheatstone network not included), limiting molar conductivities, Kohlrausch law and applications, numerical problems on calculation of Λ_m^0 for weak electrolytes. Electrolysis –Faraday's laws of electrolysis (elementary idea) , concept of nF required to discharge one mole of M^{n+} ions, numerical problems on I law.

Galvanic cells **:** Electrode potential , half cell concept, standard electrode potential, galvanic cell, Daniell cell, cell potential, EMF (emf), $E^0 = E_R^0 - E_L^0$. Measurement of electrode potential – SHE - diagram, half cell representation, half cell reaction, E^0 taken as ± 0.0 V (at all temperatures). Measurement of E^0 of Zn and Cu using SHE (experimental details not expected) numerical problems on $E^0 = E_R^0 - E_L^0$, importance of standard electrode potentials- to decide and compare the strengths of oxidizing and reducing agents . Nernst equation (derivation not required) **:** Nernst equation at 298 K for single electrode potential and cell potential, numerical problems to calculate half cell and cell potentials (only for metal electrodes). Relationship between equilibrium constant and E_{cell}^0 (derivation not required), numerical problems. Relationship between standard Gibbs energy and E_{cell}^0 ,numerical problems.

Factors affecting the products of electrolysis, examples – molten and aqueous solution of NaCl only.

Batteries**:** types-difference, examples, Leclanche cell (dry cell) and Lead acid battery–anode, cathode, electrolyte, reactions at anode and cathode (diagram not required), Fuel cell – definition – examples, H_2-O_2 fuel cell – schematic diagram, anode, cathode, electrolyte, reactions at anode and cathode.

Corrosion – rusting of iron- anodic, cathodic reactions, composition of rust, methods of prevention.

UNIT-IV Chemical Kinetics 9 Hrs

Rate of a reaction – average and instantaneous ,with graphs, SI unit, rate of a reaction expressed as rate of change in molar concentration of reactants and products using balanced equation, factors affecting rate of a reaction, dependence of rate on concentration – rate expression (rate law),specific rate constant, order, units for rate constant of zero, first and, second order reactions. Molecularity – uni, bi and termolecular reactions – examples.

Derivation of integrated rate equation for the rate constant of zero and first order reactions, graphs for zero and first order reactions-analysis, half life – derivation of relationship between $t_{1/2}$ and k for zero and first order reactions. Numerical problems on first order and half life, Pseudo first order reaction- examples.

Temperature dependence: Arrhenius equation – activation energy, energy distribution curve showing temperature dependence of the rate of the reaction, problems based on

log $\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$, graph of $\ln k$ *vs* $\frac{1}{T}$ with intercept and slope. Effect of catalyst, explanation with graph. An elementary idea of collision theory, criteria for effective collision – threshold energy and orientation factor.

UNIT-V Surface chemistry 6 hrs

Adsorption: adsorbate, adsorbent, examples, distinction between adsorption and absorption. ΔH, ΔS and ΔG for adsorption of gas on a solid. Physisorption and chemisorption-characteristics and differences. Factors affecting adsorption of a gas on a solid. Applications (to be mentioned).

Catalysis: homogeneous and heterogeneous catalysis, examples, activity and selectivity of a catalyst ,examples, shape selective catalysis, examples. Enzyme catalysis: examples, characteristics (to be mentioned), mechanism.

Colloids: colloidal state-distinction of true solution, colloids, and suspension based on particle size.

Classification of colloids-types of colloidal systems- examples, lyophilic and lyophobic—differences and examples, macromolecular, multimolecular and associated colloids, examples, formation of micelle, cleansing action of soaps. Preparation of colloids-chemical methods-sulphur and ferric hydroxide sols, Bredig's arc method for metal sols, peptisation. Purification–dialysis, electro-dialysis, ultrafiltration (in brief).

Properties of colloids: Tyndall effect, Brownian movement, charge on colloidal particles, examples, electrophoresis, coagulation – methods of coagulation of lyophobic sols, Hardy-Schulze rule-examples, coagulating value. Protective colloid - example. Applications: In industries, medicines, purification of drinking water.

Emulsions : types , examples.

UNIT–VI General Principles and Processes of Isolation of Elements 5 hrs

Principles and methods of extraction: concentration of ores – hydraulic washing, magnetic separation, froth floatation, leaching -of alumina from bauxite, roasting and calcination – examples. Occurrence (ores) of Al, Cu, Zn and Fe. Principles of extraction of aluminium, copper, zinc, iron: highlight the principle of extraction of iron from its oxide using Ellingham diagram.

Extraction of iron from its oxides - blast furnace – diagram, reactions, equations as:

$C + O_2 \longrightarrow CO_2$ $CO_2 + C \longrightarrow 2CO,$

$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2,$ $FeO + CO \longrightarrow Fe + CO_2$

$CaCO_3 \longrightarrow CaO + CO_2,$ $CaO + SiO_2 \longrightarrow CaSiO_3.$

Extraction of copper from sulphide ore containing iron impurity, extraction of zinc from zinc oxide, extraction of aluminium from purified alumina, oxidation-reduction - extraction of gold.

Refining: principles and examples each for distillation, liquation, electrolytic method, zone refining, vapour phase refining- details for Mond's and Van Arkel processes.

UNIT – VII p-Block Elements 11 hrs

Group 15 elements - General introduction, occurrence, electronic configuration, oxidation states, anomalous behavior of nitrogen with reasons, trends in physical and chemical properties - reactivity towards hydrogen and oxygen.

Dinitrogen: preparation- from $(NH_4)_2Cr_2O_7$, laboratory method from NH_4Cl, properties and uses. Compounds of nitrogen: ammonia – manufacture by Haber's process, properties – basic character, reaction with $ZnSO_4$ and Cu^{2+} ion. Nitric acid – manufacture by Ostwald's process , laboratory method – from $NaNO_3$, properties – oxidizing properties – dilute HNO_3 with Zn and Cu, concentrated HNO_3 with Cu, Zn, I_2 and carbon , passivity with Al and Cr with reason, Brown ring test. Oxides of nitrogen – structures for NO, NO_2 and N_2O_5 only.

Phosphorus: allotropic forms – white and red (brief account), phosphine – laboratory preparation, properties – basic nature, PCl_3 and PCl_5 – preparation from dry chlorine, properties- action on water (hydrolysis). Oxoacids: hypophosphorous acid, orthophosphorous acid, orthophosphoric acid –formula, structure, reducing property, basicity.

Group 16 elements - General introduction, occurrence, electronic configuration, oxidation states, anomalous behaviour of oxygen with reasons, trends in physical and chemical properties, reactivity with hydrogen and halogen.

Dioxygen - preparation from $KClO_3$, properties- reaction with Al, CH_4, C, uses. Oxides – simple oxides – classification – acidic, basic and amphoteric, examples.

Ozone: preparation, properties, oxidising properties - with PbS and NO.

Sulphur: **a**llotropic forms - brief account of rhombic and monoclinic.

Compounds of sulphur : SO_2 - laboratory preparation from SO_3^{2-}, properties – reaction with NaOH, Cl_2, reducing property – with Fe^{3+} and MnO_4^-, uses, sulphuric acid: manufacture by contact process – flow chart and equations, properties- acidic, dehydrating and oxidizing, reaction with metal halides (halide = F,C*l*), uses.

Oxoacids of sulphur: sulphurous acid, sulphuric acid, peroxodisulphuric acid and pyrosulphuric acid – formula, structure.

Group 17 elements: General introduction, occurrence, electronic configuration, oxidation states, trends in physical and chemical properties, anomalous behaviour of fluorine with reasons, reactivity towards hydrogen and oxygen.

Chlorine: preparation– from HCl with $KMnO_4$, properties – reaction with Al, S_8, H_2S, NH_3, NaOH, $Ca(OH)_2$, oxidising property – with $FeSO_4$, Na_2SO_3, bleaching property, uses. Hydrogen chloride: laboratory preparation, properties – acidic nature, reaction with NH_3, aqua regia, uses.

Oxoacids of halogen: names, formulae and structures of oxoacids of chlorine only.

Interhalogen compounds: Preparation of ClF_3, ICl, BrF_5, properties- reactivity compared with halogens, hydrolysis – general equation.

Group 18 elements: General introduction, occurrence, electronic configuration, trends in physical and chemical properties – reason for their inertness, formation and formula of Bartlett compound, preparation of XeF_6 and XeO_3, XeO_2F_2(by hydrolysis of XeF_6), uses of noble gases.

UNIT VIII d and f Block Elements 9 hrs

General introduction, electronic configuration, characteristics of transition metals (d-block) - variation in atomic and ionic size.

Electronic configuration of 3d series elements, general trends in properties of the first row transition metals (3d series) – metallic character, ionization enthalpies, oxidation states, magnetic properties, colour, catalytic properties, formation of interstitial compounds, alloy formation.

Potassium dichromate: preparation from chromite ore ($FeCr_2O_4$). Properties – oxidizing property – with I^-, H_2S, Sn^{2+}, Fe^{2+}, interconversion of chromates and dichromates in aqueous solution depending on pH.

Potassium permanganate: Preparation from MnO_2 by fusion with KOH and acidification. Properties-action of heat, oxidising property- oxidation of I^-, Fe^{2+}, $C_2O_4^{2-}$, H_2S in acidic medium, $S_2O_3^{2-}$, I^-, in neutral / alkaline medium.

f-block elements: Lanthanoids-electronic configuration, atomic size- lanthanoid contraction and its consequences ,oxidation states, chemical reactivity –general characteristics.

Actinoids: electronic configuration, ionic size – actinoid contraction – compared to lanthanoid contraction, oxidation states– general characteristics compared with lanthanoids.

UNIT-IX Coordination Compounds 7 hrs

General introduction to salts, difference between double salt and coordination (complex salt) compound with respect to their ionization in water, with an example.

Coordination entity, central metal ion, coordination number, coordination sphere, oxidation state of central metal ion, homoleptic and heteroleptic complexes , examples. Ligands -types- unidentate, didentate, polydentate, ambidentate, examples.

Nomenclature of coordination compounds – mononuclear compounds.

Werner's theory – postulates, limitations. VBT : salient features, application of VBT for the formation of - $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$, $[NiCl_4]^{2-}$, $[Ni(CN)_4]^{2-}$, magnetic properties – low spin and high spin complexes with examples, limitations of VBT.

CFT (crystal field theory): crystal field splitting-meaning, crystal field splitting in octahedral and tetrahedral coordination entities using energy level diagram and their comparison. Spectrochemical series, compare weak field ligand – strong field ligand with respect to d^4 ions in octahedral field ($\Delta_0 < P$, $\Delta_0 > P$). Explanation for colour of complexes using CFT, examples.

Isomerism: Structural – linkage, ionization, solvate, coordination – definition and examples. Stereoisomerism – geometrical and optical, examples, facial and meridional as geometrical isomers- example.

Importance of coordination compounds: In biological systems, qualitative analysis, extraction of metals, examples.

UNIT-X Haloalkanes and Haloarenes 7 hrs

Classification based on hybridization of carbon to which halogen is bonded-alkyl halides (haloalkane), allylic, benzylic, vinylic, aryl halides. Primary, secondary and tertiary alkyl halides, nomenclature, nature of C–X bond.

Preparation - From alcohols- using HCl / $ZnCl_2$, PX_3 (Cl, Br), PCl_5, $SOCl_2$ - general reactions and examples with R = CH_3, C_2H_5, Halogen exchange method- Finkelstein reaction – general equation and examples with R = CH_3, C_2H_5, X = Cl, Br, Swarts reaction – statement, example. Physical properties – density, melting point, boiling point, solubility.

Reactions of haloalkanes: Nucleophilic substitution reactions: with aqueous KOH / NaOH, alcoholic KCN, alcoholic AgCN, R′COOAg , general reactions, examples (R as CH_3 and C_2H_5).

Mechanisms - S_N1 and S_N2 - HO^- and CH_3Cl for S_N2, ^-OH and tertiary butyl bromide for S_N1 as examples. Trend in reactivity towards S_N1 and S_N2 - 1°, 2°, 3° haloalkanes and R–I, R–Br , R–Cl, with reasons. Optical isomerism - optical activity, d form (+) and *l* form (–) isomers,

chirality, enantiomers, racemic mixture, racemisation, examples. Reaction at a chiral carbon – inversion, retention, racemisation . Stereochemistry of 2-bromobutane and 2-bromooctane in S_N1 and S_N2 reaction, respectively.

Elimination reaction (β elimination)- dehydrohalogenation- general reaction, Zaitsev rule – statement, example taking 2-bromopentane. Reaction with metals – organo - metallic compounds - Grignard reagent,(RMgX) ,general reaction, its preparation fromCH_3Br and C_2H_5Br, importance of **dry** ether.

Haloarenes: Nucleophilic substitution reactions: reasons for haloarenes to be less reactive , replacement of Cl by hydroxyl group in chlorobenzene and nitro substituted chlorobenzenes to compare the reactivity when $–NO_2$ group/s are in *o*- and *p*- positions .

Electrophilic substitution reactions for chlorobenzene - chlorination, nitration, sulphonation, Friedel-Crafts reaction (alkylation, acetylation).

Reaction with metals - Wurtz-Fittig reaction – statement – general reaction, example (R= CH_3 and C_2H_5). Fittig reaction – statement, example – formation of biphenyl.

Uses and environmental effects of dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons and DDT.

UNIT – XI Alcohols, Phenols and Ethers 8 hrs

Classification: mono, di, tri ,allylic, and benzylic alcohols, mono, di and trihydric phenols and cresols. Ethers – simple and mixed, nomenclature of alcohols, phenols, ethers.

Preparation of alcohols: by acid catalysed hydration of alkene, general reaction and examples, by hydroboration-oxidation of propene, from carbonyl compounds: hydrogenation of aldehydes, ketones, reduction of carboxylic acids and using Grignard reagent- general reactions and examples (R as H, CH_3 and C_2H_5 wherever applicable.

Preparation of phenol: From i) benzene via sulphonation ii) diazonium salt iii) cumene.

Physical properties of **primary alcohols** and phenol: Boiling point and solubility.

Chemical properties of **primary alcohols** and phenol: discuss and compare acidic nature of alcohol and phenol ,with reasons. Effect of electron withdrawing groups(EWG) E.g.:$–NO_2$ and electron donating groups (EDG) E.g.; $–CH_3$, on acid strength of phenol, with reasons. Esterification and acylation of alcohols/phenols- general reactions, examples with R=CH_3, C_2H_5, conversion of salicylic acid into aspirin. Dehydration of alcohols, oxidation using PCC -general reactions, examples with R = CH_3, C_2H_5. Mechanism of dehydration of ethanol into ethene.

Identification of 1°, 2°, 3° alcohols: Lucas test–observation and inference, reaction in presence of heated copper, equations .Uses: methanol and ethanol

Reactions of phenol: 1) Electrophilic substitution: a) with dil. HNO_3 and conc. HNO_3 b) Br_2 in CS_2 (0°C) and Br_2 / water c) Kolbe's reaction d) Riemer-Tieman reaction 2) Reaction of phenol with zinc dust 3) Oxidation of phenol by air and by chromic acid.

Uses of phenols.

Ethers: Preparation - by dehydration of ethanol, Williamson's ether synthesis – general reaction - for aliphatic and phenolic ethers, examples- giving reason for proper choice of reactants wherever applicable.

Physical Properties: boiling points and solubility.

Chemical reactions: discuss the reaction of ethers with HX (reactivity of HX to be compared).

Electrophilic substitution reaction for anisole: bromination, nitration, acetylation, alkylation (methylation). Uses of ethers.

UNIT-XII Aldehydes, Ketones and Carboxylic acids 9 hrs

Aldehydes and ketones: nomenclature, nature of carbonyl group.

Methods of preparation: Aldehydes- Stephen reduction – general reaction and examples (R=CH_3 and C_2H_5). Preparation of benzaldehyde -Rosenmund reduction, Etard reaction and Gatterman Koch reaction. Ketones-from RCOCl with dialkyl cadmium, Friedel-Crafts reaction – general reactions and examples (R=CH_3 and C_2H_5).

Physical properties: boiling points and solubility.

Chemical properties: Nucleophilic addition reactions- HCN and $NaHSO_3$- general reaction, and examples, -mechanism of addition (HCN) .

Condensation reactions with derivatives of ammonia- NH_2OH, NH_2NH_2, $NH_2NHC_6H_5$, 2,4-DNPH, Clemmensen and Wolff-Kishner reductions -general equations and examples by taking HCHO, CH_3CHO, CH_3COCH_3, C_6H_5CHO. Tests to distinguish aldehydes from ketones - Tollens' reagent and Fehling's solution (equation not required). Addition of alcohol to aldehyde (to form an acetal) and ethylene glycol to ketone –general equations and examples.

For ketones: Haloform reaction for methyl ketones – general reaction, examples with $CH_3COC_6H_5$, CH_3COCH_3.

Reactions due to α-hydrogen:

1. Reason for acidic nature of α-hydrogen
2. Aldol reaction: addition and condensation for CH_3CHO, CH_3COCH_3
3. Crossed aldol condensation: between benzaldehyde and acetophenone

Cannizzaro's reaction (disproportionation reaction) for HCHO and C_6H_5–CHO.

Electrophilic substitution reaction: nitration of C_6H_5CHO. Uses of aldehydes and ketones.

Carboxylic acids:

Nomenclature, acidic nature of –COOH group (reaction with Na, NaOH, $NaHCO_3$)- with reasons, effect of EDG, e.g.: –CH_3 and EWG, e.g.: –Cl on acid strength, with reasons.

Compare acid strengths among: i) formic acid, acetic acid, propanoic acid
ii)formic acid, acetic acid, benzoic acid
iii)chloro, fluoro, bromoacetic acids
iv) acetic acid, mono, di, and trichloroacetic acids

Methods of preparation: oxidation of primary alcohols and toluene using alkaline $KMnO_4$/ H_3O^+, hydrolysis of nitriles, amides and esters and from Grignard reagent - general reactions and examples (R=CH_3, C_2H_5,C_6H_5).

Physical properties: boiling points and solubility.

Chemical properties: reaction with PCl_3, PCl_5, $SOCl_2$, with ammonia, decarboxylation, halogenation (X = Cl ,Br)– HVZ reaction- general reactions for all and examples with R=CH_3, C_2H_5, C_6H_5 (wherever applicable).Nitration and bromination of benzoic acid.

Uses of carboxylic acids.

UNIT-XIII Organic Compounds Containing Nitrogen 6 hrs

Amines:

Structure of amines, classification- 1°, 2°, 3° and aryl amines, nomenclature

Methods of preparation: Reduction of nitrobenzene, reduction of nitrile and amide - general reactions and examples (R=CH_3, C_2H_5), ammonolysis of alkyl halides -general reactions only – upto quaternary ammonium salt, Gabriel phthalimide synthesis -general reaction and example with R=CH_3**,** Hoffmann bromamide degradation reaction -general reaction and examples (R=CH_3, C_6H_5)

Physical properties:

1. Compare boiling point and solubility of 1°, 2°, 3° amines ,with reasons
2. Compare base strength of NH_3, CH_3NH_2 and $C_6H_5NH_2$ in aqueous medium,with reasons
3. Compare the trends in the base strength of methyl substituted amines in gaseous state and in aqueous medium ,with reasons

Chemical properties: Acylation – acetylation for 1° and 2° amine using CH_3COCl, Carbylamine reaction (test for 1° amine), and reaction with nitrous acid – general reaction and examples (R=CH_3, C_2H_5 ,C_6H_5)

Reaction with Hinsberg's reagent to identify/ distinguish 1°, 2°, 3° amines.

Electrophilic substitution reactions for aniline: bromination, nitration (significance of acetylation) and sulphonation.

Cyanides and isocyanides- will be mentioned at relevant places in context

Diazonium salts: General formula $ArN_2^+X^-$. Example: $C_6H_5N_2^+Cl^-$, $C_6H_5N_2^+HSO_4^-$ Preparation from aniline-diazotisation, chemical reactions: Sandmeyer's reaction -replacement of diazo group by Cl^-, Br^-, CN^- , replacement of diazo group by I^- and H^- (reduction using H_3PO_2).

Retention of diazo group: coupling reaction- formation of azo dyes, example - $C_6H_5N_2Cl$ with aniline and phenol. Importance in synthetic organic chemistry.

UNIT-XIV Biomolecules 7 hrs

Carbohydrates: classification-based on hydrolysis – mono, oligo and polysaccharides-examples, monosaccharides - aldoses and ketoses, examples, reducing and non-reducing sugars-examples.

Glucose: occurrence, some reactions of glucose- with HI, NH_2OH, acetic anhydride, Br_2/ water – their significance with respect to the structure of glucose. Open chain structure of glucose-compared with glyceraldehyde for D and L configuration. Haworth's (pyranose) structure of α and β-D (+) glucose. Fructose: occurrence, Haworth's (furanose) structure for α and β-forms.

Disaccharide: examples, glycosidic linkage - α and β.

Maltose, lactose and sucrose- monosaccharide units, type of glycosidic linkage, reducing property with reasons, Haworth's structures. Invert sugar – composition.

Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Importance of carbohydrate.

Proteins: α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Classification of α-amino acids: acidic, basic, neutral - examples, essential and non-essential-examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond and dipeptide, formation with equations. Number of peptide bonds in di, tri, tetra and pentapeptides. Polypeptides.

Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein – examples. Enzymes as biocatalysts – examples.

Hormones: definition, importance, types, functions, examples

Type	Example	Function
Polypeptide	Insulin, glucagon	Maintains blood sugar level
Amino acid derivatives	Epinephrine	Brings out response to stimuli
	Thyroxine (iodine containing hormone)	Growth and development
Steroids	Estrogen and androgens	Development of secondary sex characters

Vitamins: definition and importance.

Classification: water soluble and fat soluble-examples. Diseases due to deficiency of vitamin- A, D, C, and B_{12} to be mentioned.

Nucleic acids: polynucleotides, components of DNA and RNA, formation of nucleoside and nucleotide, formation of dinucleotide. (structures of these not included)

Poly nucleotides-RNA, DNA. Structure of DNA and RNA (diagram not required)

Biological functions of nucleic acids.

UNIT-XV Polymers 5 hrs

Definitions: Polymer, monomer, polymerization, macromolecule.

Classification: based on – source, structure, types (mode) of polymerization and molecular forces- examples for each type.

Methods of polymerization: Addition, condensation and copolymerization – an example for each with equation.

Name of monomer/s and partial structure for the polymers– polythene, polyamides – nylon 6, nylon-6,6 , polyesters-terylene (Dacron), bakelite .

Rubber: types – natural, synthetic -examples

Natural rubber: monomer, partial structure of natural rubber, Vulcanisation.

Preparation of synthetic rubbers: Neoprene, Buna-N.

Non-biodegradable polymers , biodegradable polymers (examples).

UNIT-XVI Chemistry in Everyday Life 5 hrs

1. Chemicals in medicines: drugs, chemotherapy - different classes of drugs- antacids, tranquilizers, analgesics, antihistamines, antimicrobials, antibiotics, antiseptics, disinfectants, anti-fertility drugs-examples for all.
2. Chemicals in food: artificial sweetening agents, preservatives, antioxidants (elementary idea) - examples for all.
3. Cleansing agents: soaps, process of saponification with equation, synthetic detergents-examples, cleansing action of soap and detergents, biodegradable detergent (soap) – elementary idea.

Guidelines for setting II PUC Chemistry question paper

1. The question paper has four parts: A, B, C and D. All the four parts are compulsory.
2. **Part A and B (I & II)**: Frame questions from all units as required.
   Part C (III): Frame questions from **Inorganic chemistry (Q.No.19 to 26)**.
   Part D (IV and V). Frame questions for part-IV from **Physical chemistry** (Q.No.27 to 31) and for part-V from **organic chemistry** (Q.No.32 to 37).
3. **Blue print:** The question paper must be prepared based on the individual blue print which is based on the weightage of marks for each unit.
   - ❖ A variation of ±1 mark in the unit weightage is allowed.
   - ❖ **A blank blue print model is provided for reference.**
4. All the questions framed must be well within the syllabus provided by PUE department

Weightage to objectives:

Objective	Weightage	Marks
Knowledge	40%	43/105
Understanding	30%	31/105
Application	20%	21/105
Skill	10%	10/105

Weightage to level of difficulty

Objective	Weightage	Marks
Easy	40%	43/105
Average	40%	42/105
Difficult	20%	20/105

5. **Intermixing of questions** of different units is not allowed.
   5 marks question may be framed as (3+2) as far as possible.
   Splitting of 3 marks question as 2 + 1 may be avoided.
6. **Questions based on numerical problems :** All the necessary data (i.e. like molecular mass, atomic mass, values of physical constants like **R, F, N_A etc.**,) should be given. **Final answer without appropriate unit carries zero mark.**
7. For part A and B try to follow the blue print as far as possible, so that due weightage for units can be maintained.
   In part C
   i) while framing 3 questions for the unit 7 (p-block elements), frame one question each from 15^{th}, 16^{th} and 17^{th} group elements. One mark question for 18^{th} group elements can be framed in Part-A. This division is done to make it easy for the students to learn and attempt these questions.
   ii) For d and f block elements, there are more concepts and learning aspects in d-block rather than f block elements. Hence frame two questions in part-C from d-block part. For f-block elements, frame a question of 2 marks in part-B.
8. **Numerical problems** worth of about **10 marks** should be given.
9. **Avoid questions from:**
   i) **Drawings** involving **3D diagrams**
   ii) **Boxed portions** of the units given in the text.
   iii) The **boxed materials with deep yellow bar** in the text book are to bring additional life to the topic and **are** non evaluative. (Please see the IV

paragraph of the **preface** in the part I of the text book). Questions should not be framed on it

iv) Questions on numerical data given in the form of **appendix, numbered tables** containing **experimental data and life history of scientists** given in the chapters should be avoided.

10. In **Organic chemistry R–, Ar–**, may be restricted to the groups as defined in the syllabus provided.
11. Frame the questions in such a way to strictly avoid **½ mark evaluation** (or value points for ½ mark.)
12. Questions framed should not be vague and ambiguous. Avoid framing questions for which answers/ printing in the text book is not well defined/ wrong.

Note :

a) 'Uses' for organic and inorganic compounds are now included in the syllabus. These topics are under the deep yellow bar in the text book. Hence avoid framing questions on these.

b) For part C and D to give weightage to the chapters, following guide lines may be used while framing the questions

i) Q No. 27: A question for 3 marks to calculate the packing efficiency or a problem on the equation for density or to calculate number of particles per unit cell for 2 marks.

ii) Q No. 28: A numerical problem of 3 marks.

iii) Q. No. 29: A numerical problem of 3 marks

iv) Q.No. 30: A numerical problem of 3 marks or a derivation.

v) Q. No 20 or 21 or 22: May have one question on manufacture or preparation for 3 marks on nitric acid, ammonia or sulphuric acid.

vi) Q.No 23: For general characteristics of d-block elements.

vii) Q.No. 24: Preparation/ manufacture/properties of $KMnO_4$ / $K_2Cr_2O_7$

viii) Q.No 25 & 26: On Co-ordination compounds, one question on VBT to account for the geometry & magnetic property of: $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[NiCl_4]^{2-}$, $[Ni(CN)_4]^{2-}$.

ix) Organic chemistry part in the question paper (part B & D (V) must include a mechanism [S_N1, S_N2, dehydration of alcohol to alkene, addition of HCN to aldehyde/ ketone] worth 3 marks and may have four named reactions of 2 marks each.

Time : 3 Hrs. 15min.

II PUC Chemistry (34)
Blue Print for Model Question Papers

Max. Marks: 70

Group	Unit	Title	Hours	Marks	Part-A I 10x1 mark	Part B II 8x2 mark	Part C III 8x3 mark	Part D IV & V 11x5 mark	Total
Group-I Physical	1	The Solid state	8	7		✓		✓	7
	2	Solution	9	8	✓✓			✓	7
	3	Electrochemistry	9	8	✓	✓		✓	8
	4	Chemical kinetics	9	8	✓	✓		✓	8
	5	Surface chemistry	6	5	✓			✓	6
		Total of Group-I	**41**	**36**					**36**
Group-II Inorganic	6	General principles and processes of isolation of elements	5	4	✓		✓		4
	7	The p-block elements	11	10	✓		✓✓✓		10
	8	The d and f-block elements	9	8		✓	✓✓		8
	9	Coordination compounds	7	6			✓✓		6
		Total of Group-II	**32**	**28**					**28**
Group-III Organic	10	Haloalkanes and haloarenes	7	6	✓			✓	6
	11	Alcohols, phenols and ethers	8	7		✓		✓	7
	12	Aldehydes, ketones and carboxylic acids	9	8	✓	✓		✓	8
	13	Amines	6	5				✓	5
	14	Biomolecules	7	6	✓			✓	6
	15	Polymers	5	5				✓	5
	16	Chemistry in everyday life	5	4		✓✓			4
		Total of Group-III	**47**	**41**					**41**
		TOTAL	**120**	**105**	**10**	**10**	**15**	**35**	**105**

Time : 3 Hrs. 15min.

II PUC Chemistry (34)
Blue Print for Model Question Paper

Max. Marks: 70

Group	Unit	Title	Hours	Marks	Part-A I 10x1 mark	Part B II 8x2 mark	Part C III 8x3 mark	Part D IV & V 11x5 mark	Total
Group-I Physical	1	The Solid state	8	7				27	
	2	Solution	9	8				28	
	3	Electrochemistry	9	8				29	
	4	Chemical kinetics	9	8				30	
	5	Surface chemistry	6	5				31	
		Total of Group-I	**41**	**36**					
Group-II Inorganic	6	General principles and processes of isolation of elements	5	4			19		
	7	The p-block elements	11	10			20, 21,22		
	8	The d and f-block elements	9	8			23,24		
	9	Coordination compounds	7	6			25,26		
		Total of Group-II	**32**	**28**					
Group-III Organic	10	Haloalkanes and haloarenes	7	6				32	
	11	Alcohols, phenols and ethers	8	7				33	
	12	Aldehydes, ketones and carboxylic acids	9	8				34	
	13	Amines	6	5				35	
	14	Biomolecules	7	6				36	
	15	Polymers	5	5				37	
	16	Chemistry in everyday life	5	4					
		Total of Group-III	**47**	**41**					
		TOTAL	**120**	**105**					

II PUC Chemistry (34)
Blank Blue Print for Question Paper

Time : 3 Hrs. 15min. Max. Marks: 70

Group	Unit	Title	Hours	Marks	Part-A I 10x1 mark	Part B II 8x2 mark	Part C III 8x3 mark	Part D IV & V 11x5 mark	Total
Group-I Physical	1	The Solid state	8	7					
	2	Solution	9	8					
	3	Electrochemistry	9	8					
	4	Chemical kinetics	9	8					
	5	Surface chemistry	6	5					
		Total of Group-I	**41**	**36**					
Group-II Inorganic	6	General principles and processes of isolation of elements	5	4					
	7	The p-block elements	11	10					
	8	The d and f-block elements	9	8					
	9	Coordination compounds	7	6					
		Total of Group-II	**32**	**28**					
Group-III Organic	10	Haloalkanes and haloarenes	7	6					
	11	Alcohols, phenols and ethers	8	7					
	12	Aldehydes, ketones and carboxylic acids	9	8					
	13	Amines	6	5					
	14	Biomolecules	7	6					
	15	Polymers	5	5					
	16	Chemistry in everyday life	5	4					
		Total of Group-III	**47**	**41**					
		TOTAL	**120**	**105**					

II PUC – CHEMISTRY (34)

MODEL QUESTION PAPER - 1

Time: 3hours 15 minutes Maximum marks: 70

***Instructions**:*

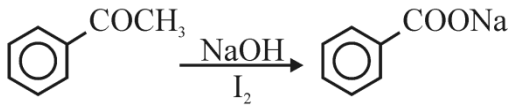
1. *The question paper has four parts: A, B, C and D. All parts are compulsory.*
2. *Write balanced chemical equations and draw labeled diagrams wherever required.*
3. *Use log tables and the simple calculator if necessary.*

(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 $t_{½}$ of zero order reaction increase if the initial concentration of the reactant is doubled?
5. What is heterogeneous catalysis?
6. Give the composition of 'copper matte'.
7. $XeF_6 + 3H_2O \longrightarrow P + 6HF$. What is P?
8. A racemic mixture is optically inactive. Why?
9.  + X. Give the IUPAC name of X.
10. Name a nitrogen base present both in DNA and in RNA.

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 1/3rd 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. Give one example each for i) antiseptic ii) synthetic detergent

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 oxoacid of phosphorous Y. What are X and Y? What is the basicity of the 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 maximum number of unpaired electrons in its ground state.
    ii) has zero spin only magnetic moment in its +2 oxidation state.
    iii) exhibits 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 above two reactions will the oxidation number of chromium remains unchanged? 3

25. Using VBT account for the geometry and magnetic property of $[Ni(CN)_4]^{2-}$.
    Given: outer electronic configuration of Ni^{2+} ; $3d^8$, $4s^0$. 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. 3

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

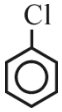
31. a) What is coagulation of a sol? Name two methods by which a lyophobic sol can be coagulated.

b) What is the change in enthalpy and entropy during adsorption of gas on 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) Explain with equations:

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

b) A carbonyl compound (P) with the formula C_2H_4O reacts with CH_3MgX followed by hydrolysis to form an alcohol (Q) .Name the alcohol Q. 4+1

34. a) Write equations for:

i) Gatterman-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 base strengths in the aqueous medium: $(CH_3)_3N$, 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) What is condensation polymerisation? Give an example with an equation.

b) With respect to natural rubber:

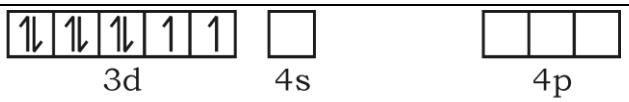
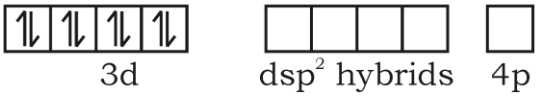
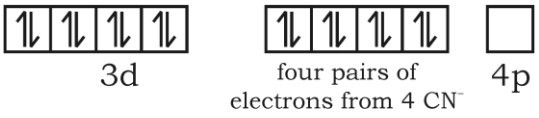
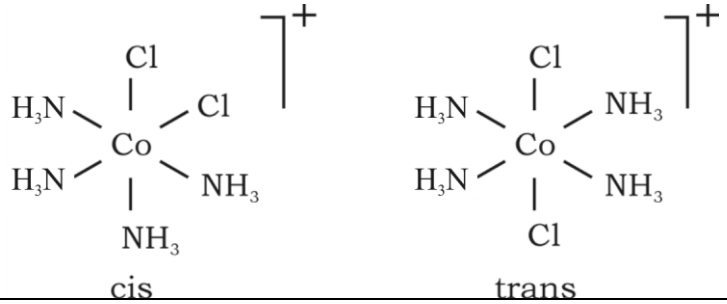
i) name its monomer

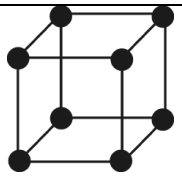
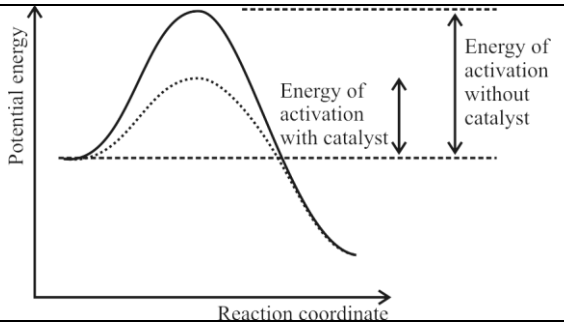
ii) name the element used for vulcanization. 3+2

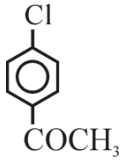
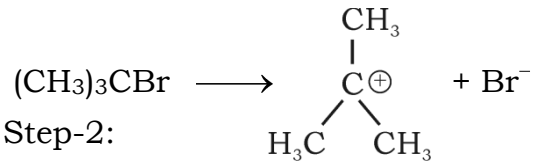
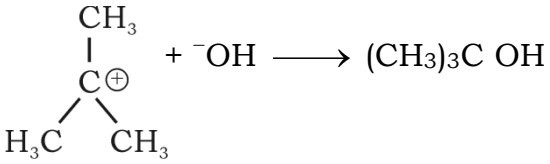
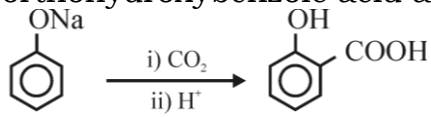
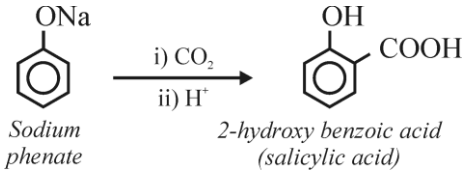
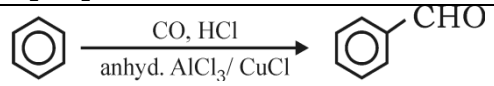
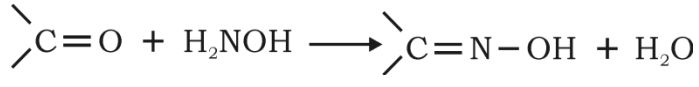
Scheme of valuation for model question paper-1

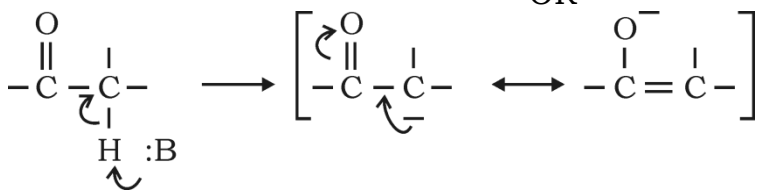
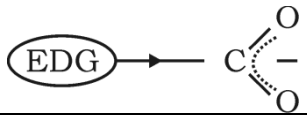
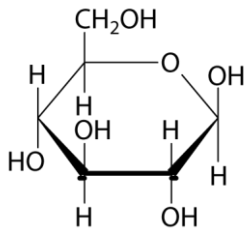
Note: Any other correct alternate answer can be honoured wherever applicable.

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	A catalytic process wherein reactants and catalyst are in different phases	1
6	Cu_2S + FeS	1
7	P is XeO_3	1
8	Rotation by an enantiomer is cancelled by the other	1
9	triiodomethane	1
10	Adenine or guanine or cytosine	1
II.	**PART-B**	
11	**Schottky defect** / **Frenkel defect** i. Density decreases / i. No change in density. ii. Observed when cations and anions have similar size. / ii. Observed when cations and anions differ in their size. iii. Equal number of cations and anions are missing from lattice points / 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	i) Dettol or soframicine ii) Sodium lauryl sulphate OR cetyltrimethylammonium bromide	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.	1

	ii) Aluminate solution is neutralised by passing CO_2. Hydrated Al_2O_3 is precipitated by seeding. iii) Hydrated Al_2O_3 is filtered, dried and heated to get pure Al_2O_3.	1 1
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) Chromium 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 Magnetic property: diamagnetic	1 1 1 1
26	tetraamminedichloridocobalt(III) chloride 	1 2
IV.	**PART-D**	
27	It is a percentage of total space filled by the particles in a crystal.	1

	 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 = $a^3 = 8r^3$ 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 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.	$E_{cell}^0 = \frac{0.059}{n} \log K_C$ $3.16 = \frac{0.059}{2} \log K_C$ $K_C = 1.314 \times 10^{107}$	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	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 ii)  or 4–chloroacetophenone iii) C_2H_5NC or ethylisocyanide or ethylisonitrile or ethylcarbylamine	1 1 1
b.	Step-1:  Step-2: 	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**  *Sodium phenate* *2-hydroxy benzoic acid (salicylic acid)* ii) Alkyl halide reacts with sodium alkoxide to form ether $R-X + Na-O-R \longrightarrow R-O-R + NaX$ **OR** R–X + Na–O–R ⟶ R–O–R + NaX Alkyl halide Sodium alkoxide ether	1 1 2 1 1 2
b.	Q is propan-2-ol	1
34a.	i)  ii)  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  ii) An electron donating group destabilises the carboxylate anion or the conjugate base. OR 	1 1
35a.	X is $C_6H_5NH_2$ Y is $C_6H_5N_2Cl$. Hoffmann's bromamide degradation reaction	1 1 1
b.	$(CH_3)_2$ NH > CH_3NH_2 > $(CH_3)_3$ N Inductive effect or solvation effect or steric hindrance	1 1
36a.	<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 kinkage. 3. Has only C_1–C_4 linkages. 4. It is a linear polymer.</td></tr></table> Any two 	2 1
b.	i) Aspartic acid **OR** glutamic acid. ii) Keratin **OR** myosin	1 1
37a.	It is a type of polymerisation which involves repeated condensation reaction between two different bifunctional monomeric units. E.g.: Nylon 6, 6 $nH_2N(CH_2)_6NH_2$ + nHOOC $(CH_2)_4$ COOH ⟶ $+NH(CH_2)_6NHCO(CH_2)_4CO+_n$ + nH_2O Any other suitable example with equation.	1 1 1
b.	i) Isoprene **OR** 2-methyl – 1, 3 –butadiene ii) Sulphur	1 1

II PUC – Chemistry (34)

MODEL QUESTION PAPER - 2

Time: 3 Hours 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 questions. 10 x 1= 10

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

1. State Henry's Law.
2. Name any one concentration term which is independent of temperature.
3. Give one use of primary batteries.
4. The unit of rate constant of a reaction is $mol^{-1}L\ s^{-1}$. What is the order of the reaction?
5. As_2S_3 sol is negatively charged. Between sodium nitrate and aluminium nitrate which one is needed in larger quantity to coagulate the above sol?
6. Metals having low melting point are refined by.....
7. How is $Xe^{+}PtF_6^{-}$ prepared ?
8. Why is boiling point of ethyl bromide higher than that of ethyl chloride?
9.  + $CH_3–CO–Cl \xrightarrow{\text{anhydrous } AlCl_3} X +$ HCl. Write the structure of X in the above reaction.
10. Name a vitamin that is stored in liver and adipose tissues.

PART-B

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

11. A compound A_xB_y crystallises in a FCC lattice in which A occupies each corner of a cube and B occupies the centre of each face of the cube. What is the formula of the compound?
12. Mention any two factors on which conductivity of an electrolytic solution depends.
13. Write any two differences between order and molecularity of a reaction.
14. What is lanthanoid contraction? Write any one consequence of lanthanoid contraction.
15. Name the organic compound formed when vapours of tertiary butyl alcohol is passed over heated copper at 573K. Write the equation.
16. How is propanenitrile converted into propanal? Write the equation.
17. What are tranquillizers? Give an example.
18. What is a broad spectrum antibiotic? Give an example.

PART - C

III. Answer any FIVE of the following. (Each question carries 3 marks)

5x 3 = 15

19. Draw a labeled diagram for the extraction of aluminium from purified alumina by Hall-Heroult process. Write the overall reaction taking place in the cell. What is the role of Na_3AlF_6 in the above process? 3

20. For the manufacture of ammonia by Haber's process,
    i) Draw the flow chart
    ii) Write the chemical equation for the reaction involved and
    iii) Name the catalyst used in the reaction. 3

21.a) Explain charring action of concentrated sulphuric acid on carbohydrate. Give the equation.

b) Complete the equation:
$2PbO_2\ (s) \xrightarrow{\Delta}$ _____ +_____ 2+1

22. Name the gas liberated when concentrated HCl is heated with MnO_2. Give the equation for the reaction. Name the reagent used to obtain bleaching powder from chlorine. 3

23.a) What are interstitial compounds? Write any one of their characteristics.

b) Out of the following elements, identify the element which does not exhibit variable oxidation state : Cr, Co, Zn. 2+1

24.a) What is the gas liberated when
    i) crystals of potassium permanganate is heated to 513K ?
    ii) acidified potassium permanganate is treated with oxalate ion at 333K?

b) Complete the following equation: $2MnO_4^- + 3Mn^{2+} + 2H_2O \longrightarrow$ ____ $+ 4H^+$. 2+1

25. Using Valence bond theory account for the geometry and magnetic property of complex ion $[CoF_6]^{3-}$ (Given: At. Number of Co = 27) 3

26.a) What is coordination isomerism? Give an example.

b) Write the IUPAC name of the complex: $[Ag(NH_3)_2]\ [Ag(CN)_2]$ 2+1

PART -D

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

27.a) Calculate the packing efficiency in hexagonal close packing arrangement.

b) Mention one consequence of metal excess defect 4+1

28.a) 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 boiling point is raised to 354.11 K. Calculate the molar mass of the solute. (K_b for benzene = 2.53 K kg mol^{-1})

b) What is reverse osmosis? Mention any one of its use? 3+2

29.a) Calculate EMF of the cell represented below.
Zn / Zn^{+2} (c = 0.1M) || Cu^{+2} (c = 1M) | Cu at 25°C.
Given: E^0_{Cu} = +0.34V and E^0_{Zn} = –0.76 V

b) Write the reactions taking place at anode and cathode during corrosion of iron. 3+2

30.a) Derive an integrated rate equation for the velocity constant of a zero order reaction.

b) A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of reaction? Give reason. 3+2

31.a) What is a) multimolecular colloid b) macromolecular colloid and c) associated colloid?

b) Write the equations for the two steps involved in enzyme catalysis. 3+2

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

32.a) How do you convert a aryl halide to diphenyl? Write the equation and name the reaction.

b) Write S_N2 mechanism for the conversion of methyl chloride to methyl alcohol. 3+2

33.a) Explain the mechanism of acid catalysed dehydration of ethanol into ethene.

b) How is phenol manufactured from cumene? 3+2

34.a) Write the chemical equation for the following conversions.

i) Ethanoic acid to ethanoic anhydride

ii) Ethanoic acid to acetamide

iii) Benzoic acid to m-nitrobenzoic acid

b) Explain Clemmensen's reduction with an example. 3+2

35.a) Complete the following equations.

i) $R–C \equiv N \xrightarrow{H_2/Ni}$ --------

ii) $R–NH_2 + CHCl_3 + 3KOH$ (alcoholic) $\xrightarrow{heat}$ ----- $+ 3KCl + 3H_2O$

iii) $C_6H_5NH_2 + 3Br_2 \xrightarrow{Br_2/water}$ ------- $+ 3HBr$

b) Explain diazotization reaction of aniline. 3+2

36.a) Name i) the sugar moiety present in DNA ii) Nitrogenous base present only in DNA, but not in RNA.

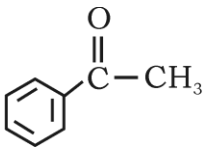
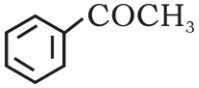
b) What is a peptide bond? How many peptide bonds are present in a pentapeptide?

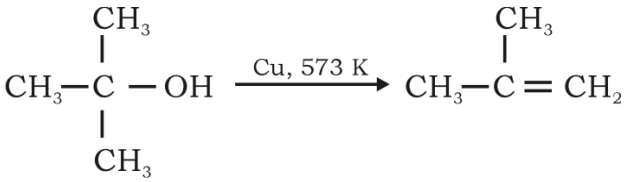
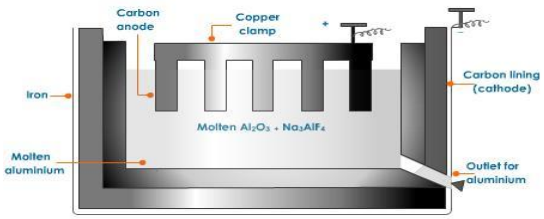
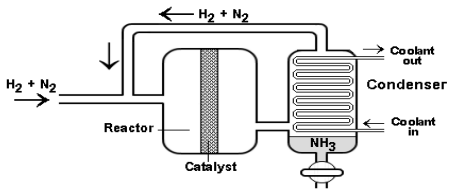
c) Name a hormone which regulates the blood sugar level in the body. 2+2+1

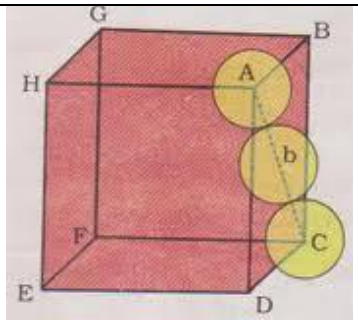
37.a) What is a thermoplastic? Name the monomer of nylon-6 and give the partial structure of nylon-6?

b) What is a biodegradable synthetic polymer? Give an example. 3+2

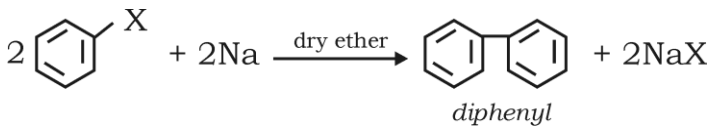
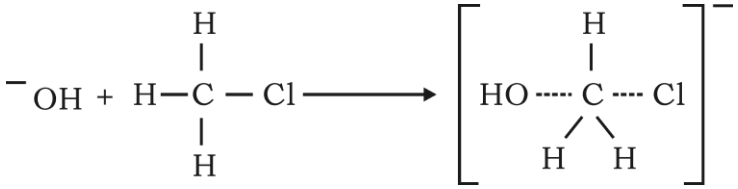
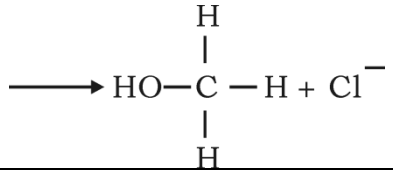
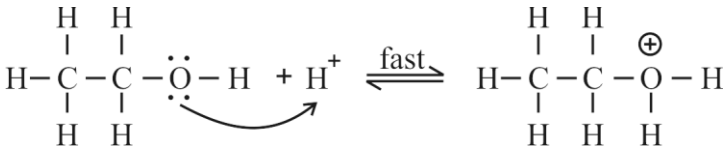
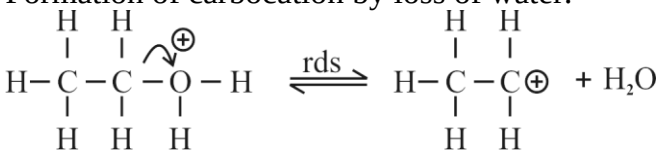
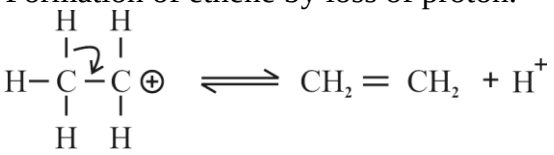
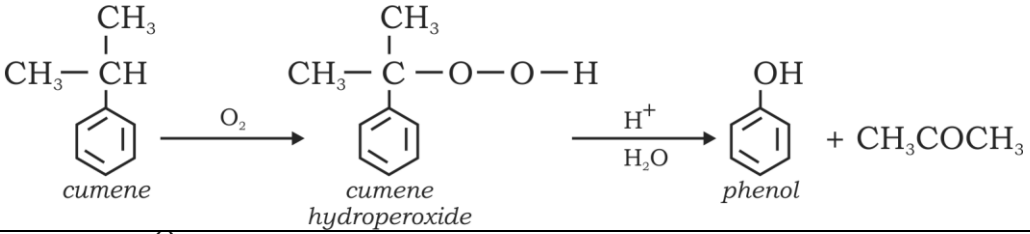
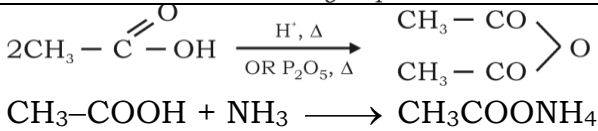
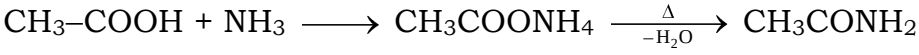
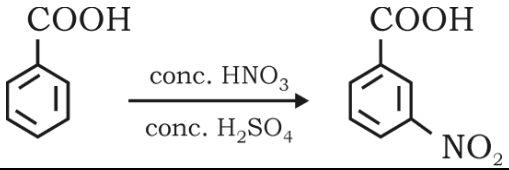
Scheme of valuation for Model question paper – 2

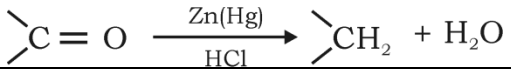
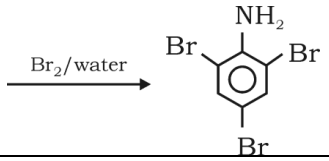
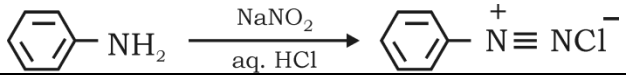
Q. No.	Value Point	Marks
I	**PART-A**	
1	The solubility of a gas in a liquid is directly proportional to the pressure of the gas at constant temperature.	1
2	Molality or mole fraction	1
3	Used in transistors	1
4	Second order or 2^{nd} order	1
5	Sodium nitrate	1
6	Liquation	1
7	By mixing PtF_6 and xenon	1
8	Ethyl bromide has higher magnitude of Van der Waals forces due to its larger size.	1
9	$C_6H_5COCH_3$ OR  OR 	1
10	Vitamin A, D, E or K - any one	1
II	**PART-B**	
11	$A_x B_Y$ $\frac{1}{8} \times 8 = 1 = x$ $\frac{1}{2} \times 6 = 3 = y$ A_1B_3	 1 1
12	i)the nature of the electrolyte added ii)concentration of the electrolyte OR temperature or nature of the solvent or size of the ions produced	1 1
13	**Order** / **Molecularity** Sum of powers of the concentration of the reactants in the rate law expression / The number of reacting species taking part in an elementary reaction It is an experimental quantity. It can be zero and even a fraction. / It is theoretical quantity. It cannot be zero or a non integer. Any two	1 1
14.	Steady decrease in the size of lanthanides with increase in atomic number is known as lanthanoid contraction. Radii of members of 3^{rd} transition series are very much similar to corresponding members of 2^{nd} series	1 1

15	2 – methyl propene  	1 1
16	Propanenitrile reduced to an imine with stannous chloride and HCl followed by hydrolysis forms propanal. $C_2H_5CN + SnCl_2 + HCl \longrightarrow C_2H_5CH{=}NH \xrightarrow{H_3O^+} C_2H_5CHO$	1 1
17	Tranquilizers are the drugs which are used to reduce the stress, mild and severe mental disease. Example: Chlorodiazepoxide or meprobamate or equanil or Valium or veronal any other correct example	1 1
18	Antibiotics which kill or inhibit a wide range of Gram – positive and Gram – negative bacteria Example: Chloramphenicol or Ampicillin or Amoxyllin or any other correct example	1 1
III	**PART-C**	
19	 $2\,Al_2O_3 + 3C \longrightarrow 4Al + 3CO_2(g)$ Lowers the melting point of the mix and brings conductivity	1 1 1
20	i) Haber's Process flow chart  ii) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ iii) Catalyst - Iron oxide	1 1 1
21a	Concentrated sulphuric acid is a strong dehydrating agent, it removes water from carbohydrates to form carbon. $C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4} 12C + 11H_2O$	1 1
b.	$2PbO_2(s) \rightarrow 2PbO(s) + O_2$	1
22	Chlorine $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$ Dry slaked lime	1 1 1

23a	Compounds which are formed when small atoms like H,C or N are trapped inside the crystal lattices of metals **Characteristics**: High M.P , higher than those of pure metals Very hard, Retain metallic conductivity and chemically inert. (Any one)	1 1
b	Zn	1
24a	i) Oxygen (O_2) ii) Carbon dioxide (CO_2)	1 1
b	$\longrightarrow 5MnO_2$	1
25	i) sp^3d^2 ii) Octahedral iii) Paramagnetic	1 1 1
26a	Coordination isomerism arises from the interchange of ligands between cationic and anionic entities of different metal ions present in a complex. Ex: $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are coordination isomers	1 1
b	Diamminesilver (I) dicyanoargentate (I)	1
IV	**PART-D**	
27a	 Packing Efficiency in hcp arrangement. In Δ ABC $AC^2 = b^2 = BC^2 + AB^2$ $b^2 = a^2 + a^2 = 2\,a^2$ or $b = \sqrt{2}\,a$ If r is the radius of the sphere, then $b = 4r = \sqrt{2}\,a$ or $a = 2\sqrt{2}\,r$ Each unit cell in hcp has effectively 4 spheres. Total volume of four sphere is equal to $4 \times (4/3)\,\pi\,r^3$ and volume of the cube is a^3 or $(2\sqrt{2}\,r)^3$ Packing efficiency $= \dfrac{\text{volume occupied by four spheres in the unit cell} \times 100}{\text{Total volume of the unit cell}}$ $= \dfrac{4 \times \frac{4}{3}\pi r^3 \times 100}{2\sqrt{2}r^3}\,\% = 74\,\%$	 1 1 1 1
b	It imparts colour to the crystal	1
28a	$\Delta T_b = 354.11\ K - 353.23\ K = 0.88\ K$	1 1

	$\Delta T_b = Kb \frac{W_2 \times 1000}{M_2 \times W_1}$ $M_2 = \frac{2.53 \text{ X } 1.8 \text{ X } 1000}{0.88 \text{ X } 90}$ $M_2 = 58$ g / mol	1
b	Flow of solvent out of the solution through semi permeable membrane, when the pressure larger than the osmotic pressure is applied to the solution side. Desalination of sea water	1 1
29a.	$E_{cell} = E^0_{cell} + \frac{0.059}{n} \log \frac{[Cu^{2+}]}{[Zn^{2+}]}$ $= \{ + 0.34 - (-0.76) \} + \frac{0.059}{2} \log \frac{1.0}{0.1}$ $= 1.1 + \frac{0.059}{2} \times 1 = 1.1295$ V	1 1 1
b.	Anode : $2 Fe_{(s)} \longrightarrow 2 Fe^{2+} + 4 e^-$ Cathode: $O_{2(g)} + 4 H^+_{(aq)} + 4 e^- \longrightarrow 2H_2O_{(l)}$	1 1
30a	Consider a zero order reaction $R \longrightarrow$ Product Rate $= -\frac{d R}{dt} = k [R]^0 = -\frac{d R}{dt} = k [1]$ $\quad d[R] = -k\, dt$ Integrating both sides, $[R] = -k t + I$ where I is integration constant At, t=0, $[R] = [R_0]$, therefore $I = [R_0]$, where $[R_0]$ is the initial concentration of the reactant. $[R] = -kt + [R_o]$	1 1 1
b	$t_{75\,\%} = 2 \text{ X } t_{½}$ Half life is independent of initial concentration Hence First order reaction	1 1
31 a	If large number of atoms and small molecules aggregate to form particles of colloidal size, then the colloid is multimolecular colloid. Macromolecules (polymer) which have colloidal dimension in a suitable medium disperse to form macro molecular colloid. Some substances (molecules) of intermediate size at higher concentration aggregate to form colloidal particles. This is associated colloid.	1 1 1
b.	Step-1: E + S $\longrightarrow$ ES* Enzyme substrate activated complex Step-2: ES* $\longrightarrow$ E + P Product	1 1

V	**PART-D**	
32a.	Aryl halide reacts with sodium metal in presence of dry ether to form diphenyl .  *diphenyl* Name : Fittig Reaction	1 1 1
b.	 	1 1
33a.	Step-1: Protonation of alcohol  Step-2: Formation of carbocation by loss of water.  Step-3: Formation of ethene by loss of proton. 	1 1 1
b.	Cumene is oxidised by oxygen to form cumene hydroperoxide, which on acid hydrolysis gives phenol.  *cumene* *cumene hydroperoxide* *phenol*	1 1
34a.	  	1 1 1

b.	**Clemmensen's reduction** The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc amalgam and conc. hydrochloric acid. 	1 1
35a.	$\longrightarrow R–CH_2–NH_2$ $\xrightarrow{heat} RNC$ 	1 1 1
b.	Reaction of aniline with nitrous acid at 273 – 278 K to form benzene diazonium chloride is known as diazotization. 	1 1
36a.	β –D- 2-deoxyribose Thymine	1 1
b.	Amide linkage or CO – NH bond formed between two α- amino acid molecules is called peptide bond. Four or 4	1 1
c.	Insulin or Glucagon	1
37a.	A polymer that can be repeatedly softened on heating and hardened on cooling. Monomer of nylon-6 is caprolactum Partial structure $–[–NH–(CH_2)_5–CO–]_n–$	 1 1 1
b.	The synthetic polymers which undergo bacterial degradation in the environment are known as biodegradable synthetic polymers. Ex.Poly β- hydroxybutyrate – co –β- hydroxyl valerate (PHBV)	1 1

II PUC CHEMISTRY (34)

MODEL QUESTION PAPER - 3

Time: 3hours 15 minutes Maximum marks: 70

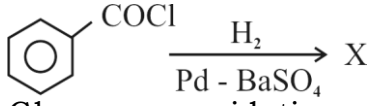
***Instructions**:*

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. What is the effect of increase in pressure on the solubility of a gas in a liquid?
2. Components of a non-ideal binary solution cannot be completely separated by fractional distillation. Why?
3. State Faraday's 1st law of electrolysis.
4. Unit of rate constant of a reaction is same as the unit of rate of reaction. What is the order of the reaction?
5. When is a solid a good adsorbent?
6. What is the role of limestone in the extraction of iron from the concentrated haematite ore?
7. Name the main commercial source of helium.
8. What are enantiomers?
9.  . What is X? (an organic compound)
10. Glucose on oxidation with Br_2/ water gives gluconic acid. What does this reaction indicate about the structure of glucose?

PART-B

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

11. Name any two crystal systems.
12. State Kohlrausch law of independent migration of ions.
13. What are two criteria for effective collision according to collision theory?
14. What is the formula of the products formed when a Lanthanoid (Ln) reacts with i) halogen (X) ii) nitrogen?
15. How is anisole converted into 2-methoxytoluene and 4-methoxy toluene? Give the equation.
16. Give the equation for the reaction between benzaldehyde and acetophenone in presence of dilute alkali. What type of condensation reaction is this?
17. Give an example for
    i) an antacid
    ii) an artificial sweetener
18. What are antioxidants? Give an example.

PART-C

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

19. a) Name the reducing agent used in the extraction of zinc from zinc oxide. Give the equation.
    b) What is the principle involved in zone refining of metals?
20. Which allotropic form of phosphorus has discrete tetrahydral P_4 molecules? How is phosphine prepared in the laboratory? Give the equation.
21. Complete the following equations:
    i) $2KClO_3 \xrightarrow{MnO_2\ heat}$
    ii) $SO_{2(g)} + Cl_{2(g)} \longrightarrow$
    iii) SO_3 + conc. $H_2SO_4 \longrightarrow$
22. Give two reasons for anamolous behaviour of fluorine.
    Give an example for one oxoacid of chlorine.
23. Give reason:
    i) Most of the transition metals have high melting point and boiling point.
    ii) 2^{nd} ionization enthalpy of Cu is exceptionally high
    iii) atomic size of 4d and 5d series elements are almost the same.
24. i) What happens when H_2S is passed into potassium dichromate in acidic medium? Give the equation.
    ii) What is the composition of chromite ore?
25. Give differences between $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ with respect to type hybridization, magnetic behaviour and geometry.
26. i) What is a heteroleptic complex?
    ii) Give the IUPAC name of $K_3[Cr(C_2O_4)_3]$.
    iii) When is linkage isomerism possible for a coordination compound?

PART-D

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

27. a) Sodium metal crystallizes in a BCC structure. Its unit cell edge length is 420pm. Calculate its density. (atomic mass of sodium = 23u, $N_A = 6.022\times10^{23}\ mol^{-1}$).
    b) What is Frenkel defect? How does it affect the density of a crystal? 3+2
28. a) Plot a graph of vapour pressure against mole fractions of the two volatile liquids forming an ideal solution. What is the change in enthalpy upon mixing the two components of an ideal solution?
    b) A 4% solution of a non-volatile solute is isotonic with 0.702% urea solution. Calculate the molar mass of the non-volatile solute. (Molar mass of urea $= 60 gmol^{-1}$) 3+2
29. a) Calculate standard free energy change for the reaction:
    $Zn_s + 2Ag^+_{aq} \rightleftharpoons Zn^{+2}_{aq} + 2Ag_s$; E^0_{cell} = 1.56 V. Given 1F=96500 $Cmol^{-1}$
    b) Write the reaction occurring at cathode and anode in H_2-O_2 fuel cell. 3+2
30. a) Rate constant of a first order reaction is 0.0693 min^{-1}. Calculate the percentage of the reactant remaining at the end of 60 minutes.

b) Show that half life period for a zero order reaction is directly proportional to initial concentration. 3+2

31. a) Describe electrophoresis with the help of a diagram.

b) What is meant by shape selective catalysis? Give an example of shape selective catalyst. 3+2

V. Answer any FOUR of the following. (Each question carries 5 marks)

4x5=20

32. a) Write the IUPAC name of the major product obtained when 2-bromopentane is heated with alcoholic KOH. Give equation. Name the reaction.

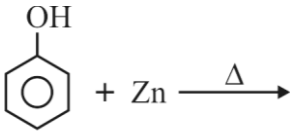
b) Aryl halides are less reactive towards nucleophilic substitution compared to alkyl halides. Give two reasons. 3+2

33. a) With equation, give an example for

i) Reimer Tiemann reaction

ii) Dehydration of a primary alcohol

b) Complete the following equation: 4+1



34. a) Explain the mechanism of addition of HCN to aldehydes in presence of a base.

b) What are Y and Z in the following reaction? 3+2

$R–Mg–X + Y \xrightarrow{\text{dry ether}} RCOOMgX \xrightarrow{H_3O^+} Z$ (an organic compound)

35. a) Give equations to synthesize methanamine by Gabriel phthalimide synthesis.

b) Explain the trend in base strengths of 1°, 2°, 3° methyl amines in gaseous phase. 3+2

36. a) What are reducing sugars? Is sucrose a reducing sugar ? Give reason.

b) i) write the Zwitter ion form of an α-amino acid 3+2

ii) Name the naturally occurring α-amino acid that is not optically active.

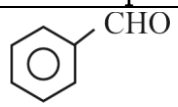
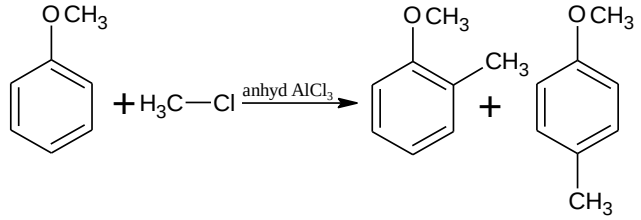
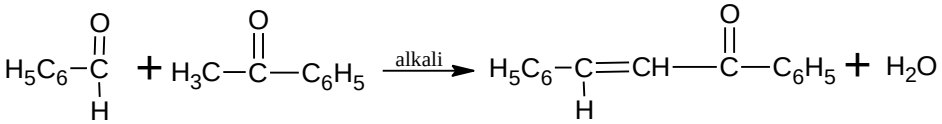
37. a) What is copolymerization? Give an example with equation.

b) Give an example for a 3+2

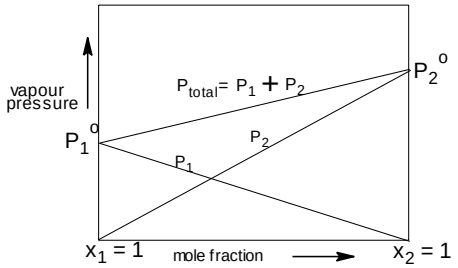
i) polyester fibre

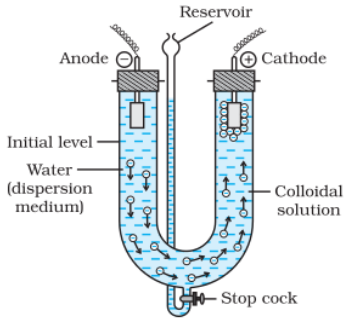
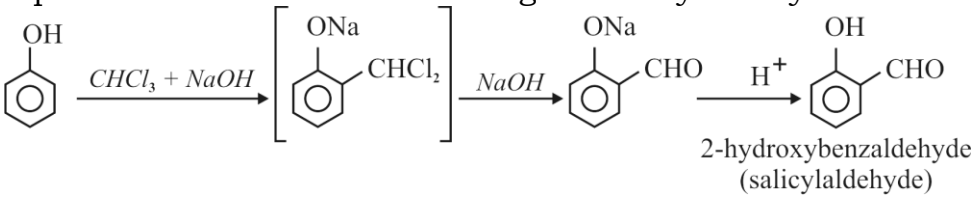
ii) thermosetting polymer

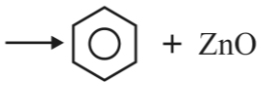
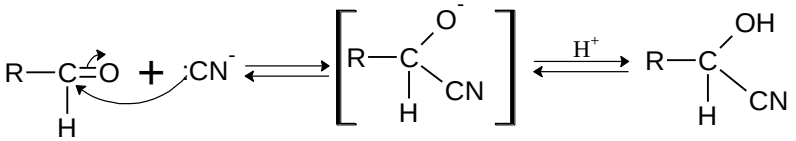
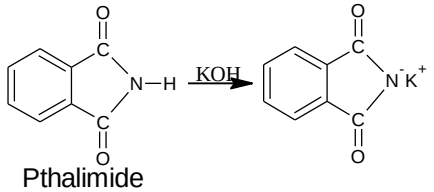
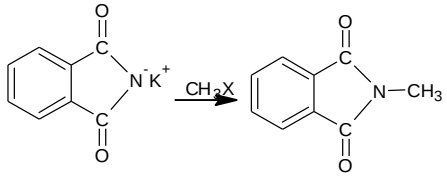
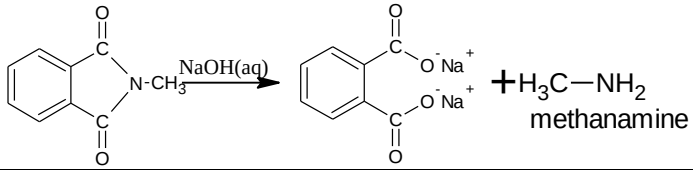
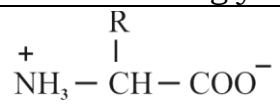
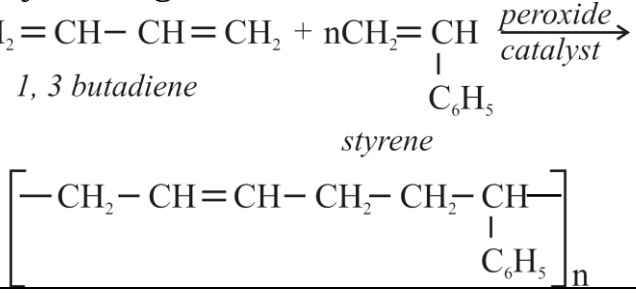
SCHEME OF VALUATION FOR MODEL QUESTION PAPER-3

Q.No	PART-A	Marks
1	Increase in pressure increases the solubility of a gas in a liquid.	1
2	It forms an azeotrope	1
3	Amount of chemical reaction that occurs at any electrode is directly proportional to the quantity of electricity passed through the electrolyte.	1
4	Zero order	1
5	When a solid is in finely divided state	1
6	Flux OR removes silica gangue as slag	1
7	Natural gas	1
8	Non-superimposable mirror image isomers	1
9		1
10	This indicates that the carbonyl group in glucose is aldehydic.	1
	PART-B	
11.	i) cubic ii) orthorhombic (or any two out of seven)	1 1
12.	Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and the cation of the electrolyte	2
13.	Molecule should have i) proper orientation and ii) Threshold energy or activation energy	 1 1
14.	i) Ln X_3 ii) LnN	1 1
15.	Anisole reacts with methyl chloride in presence of anhydrous $AlCl_3$ to give 2-methoxytoluene and 4-methoxytoluene  OR Self explanatory equation	1 1 2
16.	 Crossed aldol condensation	1 1
17.	i) Ranitidine OR Cimetidine ii) Aspartame	1 1

18.	These help to preserve food by decreasing the action of oxygen on food. E.g.: BHT (butylated hydroxyl toluene)	1 1
	PART-C	
19.	a) Coke (carbon) $ZnO + C \longrightarrow Zn + CO$ ii) The impurities are more soluble in the melt than in the solid state of the metal.	1 1 1
20.	White phosphorus By heating white phosphorous with conc. NaOH in inert atmosphere of CO_2. $P_4 + 3NaOH + 3H_2O \longrightarrow PH_3 + 3NaH_2PO_2$	1 1 1
21.	$\longrightarrow 2KCl + 3O_2$ $\longrightarrow SO_2\ Cl_2$ $\longrightarrow H_2S_2O_7$	1 1 1
22.	i) Small size ii) Highest electronegativity iii) Low F-F bond dissociation enthalpy iv) Non-availability of d orbitals in valence shell (any two) $HClO, HClO_2, HClO_3, HClO_4$ (any one)	 2 1
23.	i) Electrons of (n – 1) d orbitals along with ns electrons are also involved in metallic bonding. ii) There is loss of exchange energy, due to disruption of d^{10} configuration of Cu^+ ion. iii) Due to Lanthanoid contraction.	1 1 1
24.	i)H_2S gets oxidized to sulphur $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{+3} + 7H_2O$ $3H_2S \longrightarrow 6H^+ + 3S + 6e^-$ ii) $FeCr_2O_4$.	1 1 1
25.	<table><tr><th>Features</th><th>$[NiCl_4]^{2-}$</th><th>$[Ni(CN)_4]^{2-}$</th></tr><tr><td>Hybidisation</td><td>sp^3</td><td>dsp^2</td></tr><tr><td>Magnetic behavior</td><td>Paramagnetic</td><td>Diamagnetic</td></tr><tr><td>Geometry</td><td>Tetrahedral</td><td>Square planar</td></tr></table>	 1 1 1
26.	i) Complex in which metal ion/ atom is bound to more than one kind of donor groups. ii) Potassium trioxalatochromate (III) iii) When a coordination compound contains an ambidentate ligand.	 1 1 1

PART-D : IV		
27a.	Density = $\frac{z \cdot M}{a^3 N_A}$	1
	$= \frac{2 \times 23 \times 10^{-3}}{420 \times 10^{-12}{}^{3} \times 6.022 \times 10^{23}}$	1
	$= 3.73\ kgm^{-3}$	1
b.	This is a defect caused by the dislocation of a smaller ion from its normal site to an interstitial site	1
	Density does not change	1
28a.		2
	$\Delta H_{mix} = 0$	1
b.	For isotonic solutions $\frac{w_1}{M_1} = \frac{w_2}{M_2}$	1
	$M_2 = \frac{40 \times 60}{7.02} = 341.8$	1
29a.	$\Delta G^0 = -nF\ E^0$	1
	$\Delta G^0 = -2 \times 96500 \times 1.56$	1
	$= -301.08\ kJ$	1
b.	At anode: $2H_{2(g)} + 4^-OH \longrightarrow 4H_2O_{(l)} + 4e^-$	1
	At cathode: $O_{2(g)} + 2H_2O_{(l)} + 4e^- \longrightarrow 4^-OH_{(aq)}$	1
30.a.	$k = \frac{2.303}{t} \log \frac{R_0}{R}$	1
	$0.0693 = \frac{2.303}{60} \log \frac{100}{R}$	1
	$R = 1.56\%$	1
	OR Alternate method	
	Half life = $\frac{0.693}{0.0693} = 10$	1
	60 mins means 6 half lives	1
	Reactant remaining at the end of 60 mins = $100\left(\frac{1}{2^6}\right) = 1.56\%$	1
b.	$k = \frac{R_0 - R}{t}$ for a zero order reaction	1
	At $t = t_{½}$; $[R] = \frac{1}{2}[R_0]$	

	$k = \frac{R_0 - \frac{1}{2} R_0}{t_{\frac{1}{2}}}$ $\therefore t_{½} = \frac{R_0}{2k}$ or $t_{½} \alpha [R_0]$	1
31a.	 Explanation: movement of colloidal particles towards their oppositely charged electrode indicates that they are charged.	2 1
b.	The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape selective catalysis Ex. Zeolites	1 1
	PART-D : V	
32a.	Pent-2-ene $CH_3–CH_2–CH_2–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3 \xrightarrow{^-OH} CH_3–CH_2–CH = CH–CH_3$ Elimination	1 1 1
b.	i) Resonance effect: haloarenes are resonance stabilized with halogen carbon- double bond. ii) Hybridization: Carbon in haloarene is sp^2 hybridised which has more s-character and can hold the electron pair of C-X more tightly than sp^3 carbon in haloalkanes. iii) instability of phenyl cation: Phenyl cation is not resonance stabilized. iv) Possible repulsion between electron rich nucleophile and electron rich arenes. **Any two of the above factors**	2
33a.	i) Phenol reacts with chloroform in presence of NaOH to form a product which on acidification gives salicylaldehyde.  2-hydroxybenzaldehyde (salicylaldehyde) ii) Ethyl alcohol when heated with concentrated sulphuric acid, dehydrates to form ethanal. $CH_3CH_2OH \xrightarrow{conc.H_2SO_4, \Delta} CH_3CHO$	1 1 1 1

b.	 + ZnO	1
34a.	i) $HCN + OH^- \rightarrow :CN^- + H_2O$ 	1 2
b.	Y = CO_2 Z = R–COOH	1+1
35a.	 Pthalimide  N-methylpthalimide  methanamine	1 1 1
b.	The trend is 3° > 2° > 1° for the base strengths of amines. This is due to increase in +I effect of alkyl groups which makes lone pair of electron on nitrogen more available for a proton and also increases the stability of ammonium ion formed.	1 1
36a.	Sugar that reduces Tollen's reagent or Fehling's solution. Sucrose is not a reducing sugar. Both the reducing groups of glucose and fructose in sucrose are involved in glycoside bond formation.	1 1 1
b.	 i) ii) Glycine	1+1
37a.	It is a polymerization reaction in which a mixture of more than one type of monomer is polymerized to form a copolymer. E.g.: Formation of Buna- S  1, 3 butadiene styrene	1 1 1
b.	i) Terylene or dacron ii) Bakelite or urea-formaldehyde resin	1 1

II PUC – CHEMISTRY (34)

MODEL QUESTION PAPER - 4

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 the following: (Each question carries 1 mark) 10x1=10

(Answer each question in one word or one sentence)

1. What are isotonic solutions?
2. What is the van't Hoff factor for potassium sulphate in very dilute aqueous solution?
3. Write the equation for the reaction occurring at the anode in the lead acid battery when it is in use.
4. What is collision frequency?
5. State Hardy – Schulze rule.
6. Which type of ore is concentrated by froth floatation?
7. Noble gases have very low boiling point. Why?
8. Give the IUPAC name of CH_2=CHCl.
9. What is the oxidizing agent used in Etard's reaction?
10. Give an example for α-amino acid which is basic.

PART-B

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

11. How many tetrahedral and octahedral voids are possible if the number of close packed spheres in two layers is N?
12. Calculate the mass of aluminium deposited at cathode when 193 C of current is passed through molten electrolyte containing dissolved alumina. Given molar mass of Al = 27 g mol^{-1},1F=96500 $Cmol^{-1}$
13. Write Arrhenius equation. What is E_a in the equation called?
14. Give reasons:
    i) Element cerium (Ce) exhibits +4 oxidation state.
    ii) Actinoid contraction is greater from element to element than lanthanoid contraction.
15. How do you convert propene into propan–2–ol?
16. $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!\diagdown\!\!\diagup C=O \xrightarrow[-H_2O]{NH_2\text{-}NH_2} P \xrightarrow[\text{heat}]{KOH/glycol} Q + N_2$. What are P and Q?
17. What are analgesics? Give an example.
18. What are anti-fertility drugs? Give an example.

PART- C

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

19. Explain with equations Van–Arkel method of refining of Zirconium. 3

20. Describe with equations the manufacture of nitric acid by Ostwald's process. 3

21. Mention three anomalous behaviour of oxygen. 3

22. a) Complete the following equation:

$$6NaOH + 3Cl_2 \longrightarrow \_\_\_\_\_ + \_\_\_\_\_ + 3H_2O$$

Hot & concentrated

b) Interhalogen compounds are more reactive than halogens. Why? 2+1

23.a) Transition metals and their compounds are used as catalysts. Give two reasons

b) Write the outer electronic configuration of chromium (atomic no. = 24) 2+1

24. How is potassium permanganate prepared? Give equations. 3

25. a) Mention any two applications of coordination compounds.

b) What is crystal field splitting? 3

26. For $[Co(en)_3]Cl_3$:

i) Give the IUPAC name,

ii) Give the coordination number of the central metal ion,

iii) What type of stereoisomerism does it exhibit? 3

PART-D

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

27.a) Calculate the number of atoms per unit cell of FCC.

b) What is ferromagnetism? Give an example for ferromagnetic substance.

c) Give an example for molecular solid. 2+2+1

28.a) The vapour pressure of pure benzene at a certain temperature is 0.850 bar. When 0.5g of a non–volatile solute is added to 39.0g of benzene [molar mass of benzene 78g mol^{-1}], vapour pressure of the solution is 0.845 bar. What is the molar mass of a non–volatile solute?

b) State Raoult's law for a solution of 2 volatile liquids. Give an example for liquid mixture that shows negative deviation from Raoult's law. 3+2

29.a) The resistance of solution of a salt occupying a volume between two platinum electrodes 1.8cm apart and 5.4 cm^2 in area was found to be 32 ohms. Calculate the conductivity of the solution.

b) Write the symbolic representation of standard hydrogen electrode and give its standard potential value. 3+2

30.a) Derive an integrated rate equation for the velocity constant for a first order reaction.

b) Draw a graph of concentration of R versus time for a zero order reaction: $R \longrightarrow$ products. What is the intercept of the line? 3+2

31.a) Give any three differences between physical adsorption and chemical adsorption.

b) What is i) Tyndall effect ii) Peptisation? 3+2

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

32.a) Explain i) Wurtz-Fittig reaction. ii) Swarts reaction with an example for each.

b) Which one of the following is more reactive towards S_N2 reaction?
CH_3Br, $(CH_3)_2$ CHBr, $(CH_3)_3$ CBr 4+1

33.a) Explain the mechanism of dehydration of ethanol to ethene.

b) How is salicylic acid converted into aspirin? Give equation. 3+2

34.a) Benzaldehyde is treated with concentrated NaOH. Write the equation for the reaction. Name the reaction and name any one product formed.

b) Complete the following equations:

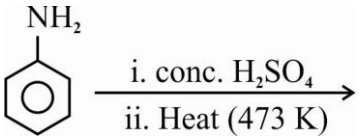
i) $RCOONa \xrightarrow[heat]{NaOH+CaO} \_\_\_\_\_ + Na_2CO_3$

ii) $CH_3–COOH \xrightarrow[ii)\ H_2O]{i)\ Cl_2\ /\ Red\ P} \_\_\_\_\_ + HCl$ 3+2

35.a) What is Hinsberg's reagent? How is it used to distinguish primary amine from a secondary amine?

b) Identify the major product in the following:

i) $C_2H_5NH_2 + CH_3COCl \longrightarrow$

ii) 

3+2

36.a) Write the Haworth's structure of lactose.

b) Mention any two importance of nucleic acids.

c) Name the hormone that contains iodine. 2+2+1

37.a) How are polymers classified based on source?

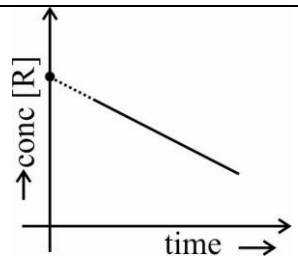
b) Explain with equation, preparation of neoprene.

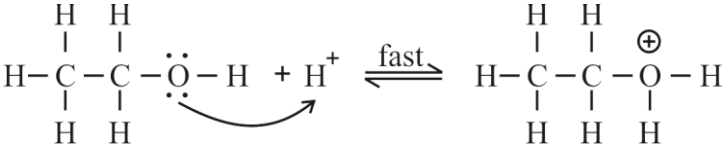
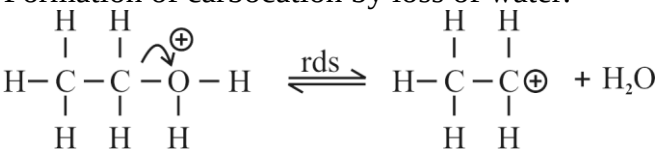
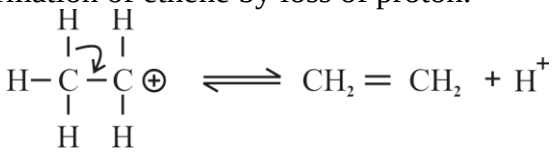
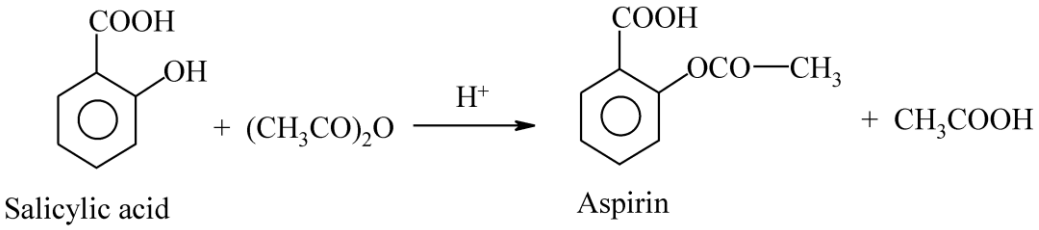
c) Name the dicarboxylic acid used as one of the monomer in the manufacture of terylene. 2+2+1

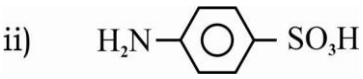
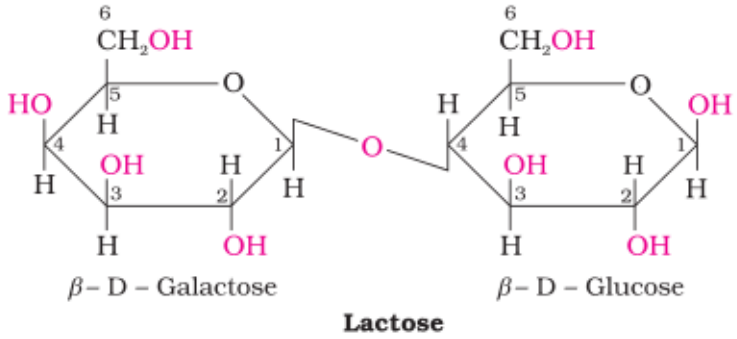
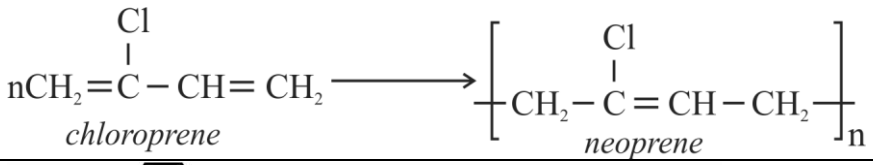
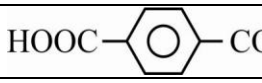
SCHEME OF VALUATION FOR MODEL QUESTION PAPER-4

QNo	PART-A	Marks
1	Solutions having same osmotic pressure at a given temperature	1
2	3	1
3	$Pb + SO_4^{2-} \longrightarrow PbSO_4 + 2e^-$	1
4	It is the number of collisions per second per unit volume of the reaction mixture	1
5	Higher the valency of the active ion, more will be its precipitating power	1
6	Sulphide ores	1
7	Due to weak dispersion forces between their atoms	1
8	Chloroethene	1
9	Chromyl chloride OR CrO_2Cl_2.	1
10	Lysine (any other)	1
	PART-B	
11	2N N	1 1
12	3×96500 C can deposit 1 mole of Al atoms i.e. 27 grams $\therefore$ 193 C ------ $\frac{193 \times 27}{96500 \times 3}$ = 0.018 g of Al	1 1
13	$k = Ae^{-Ea/RT}$ E_a = Energy of activation	1 1
14	i) It has noble gas configuration in +4 oxidation state ii) Due to poor shielding by 5f electrons	1 1
15	Propene reacts with water in presence of acid catalyst (dil. H_2SO_4) to form propan–2–ol. $CH_3-CH=CH_2 + H_2O \xrightarrow{H^+} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$	1 1
16	P = $(CH_3)_2C=N-NH_2$ Q = $CH_3–CH_2–CH_3$	1 1
17	These are drugs that reduce pain. E.g.: aspirin or morphine	1+1
18	These are drugs used to control the population OR birth control drugs. E.g.: norethindrone or novestrol	1 1

	PART-C	
19	The crude metal is heated in an evacuated vessel with iodine. The metal iodide being more covalent, volatizes. $Zr + 2I_2 \longrightarrow ZrI_4$ The metal iodide is decomposed on a tungsten filament, electrically heated to about 1800K. The pure metal is thus deposited on the filament. $ZrI_4 \longrightarrow Zr + 2I_2$	2 1
20	This method is based upon catalytic oxidation of NH_3 by atmospheric oxygen. $4NH_{3(g)} + 5O_{2(g)} \xrightarrow[500K,\ 9\ bar]{Pt/Rh\ gauze\ catalyst} 4NO_{(g)} + 6H_2O_{(g)}$ Nitric oxide thus formed combines with oxygen giving NO_2. $2NO_{(g)} + O_{2\ (g)} \longrightarrow 2NO_{2\ (g)}$ Nitrogen dioxide so formed, dissolves in water to give HNO_3. $3NO_{2\ (g)} + H_2O_{(l)} \longrightarrow 2HNO_{3\ (aq)} + NO_{(g)}$ NO thus formed is recycled and the aqueous HNO_3 can be concentrated by distillation.	1 1 1
21.	i. Oxygen is diatomic gas while other elements of this group are solids ii. Oxygen forms hydrogen bonds while other elements do not. iii. Oxygen has a maximum covalency of four while other elements can show a maximum of six.	1 1 1
22	a) $\longrightarrow 5NaCl + NaClO_3$ b) The bond between atoms in interhalogens (X–X′) is weaker than the bond in halogens (X–X).	2 1
23	a) i) They have an ability to adopt multiple oxidation states ii) They can form complexes. b) ---- $3d^5\ 4s^1$	2 1
24	Potassium permanganate is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent like KNO_3. This produces the dark green K_2MnO_4 which disproportionates in a neutral or acidic solution to give permanganate. $2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$ $3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$	1 1 1
25	a) i) Coordination compounds are used as catalysts for many industrial processes. ii) The pigment responsible for photosynthesis, chlorophyll, is a coordination compound of magnesium. iii) Haemoglobin, the red pigment of blood which acts as oxygen carrier is a coordination compound of iron. **(any two)** b) The splitting of degenerate levels of the central metal ion/ atom under the influence of ligands approaching it in definite geometry.	2 1
26	i) tris (ethane-1, 2-diamine)cobalt (III) chloride ii) 6 iii) Optical isomerism	1 1 1

	PART-D : IV	
27a.	8 corner atoms $\times\frac{1}{8}$ atom + 6 face centered atoms $\times\frac{1}{2}$ atom	1
	= 4	1
b.	Substances which are strongly attracted by magnetic field.	1
	Iron or Cobalt or Nickel or CrO_2 or any other	1
c	I_2 or any suitable example.	1
28a.	$\frac{P_1^0 - P_1}{P_1^0} = \frac{w_2 M_1}{M_2 w_1}$	1
	$\frac{0\cdot85 - 0\cdot845}{0\cdot85} = \frac{0\cdot5\times78}{M_2\times39}$	1
	M_2 = 170 g mol^{-1}	1
b.	Partial vapour pressure of each volatile component in the solution is directly proportional to its mole fraction.	1
	Acetone + chloroform OR nitric acid + water	1
29a.	Conductivity = cell constant $\times$ conductance OR $\frac{\ell}{A}\times\frac{1}{R}$	1
	k = $\frac{1.8}{5.4}\times\frac{1}{32}$	1
	= 0.01042 S cm^{-1}	1
b.	$Pt_{(s)}\|H_{2(g,\,1bar)}\|H^+_{(aq,1M)}$ OR $Pt_{(s)}\|H_{2(g)}\|H^+_{(aq)}$	1
	0.00 V	1
30a.	Consider $A \longrightarrow P$	
	$Rate = -\frac{d[R]}{dt} = k[R]$ or $\frac{d[R]}{[R]} = -kdt$	1
	Integrating the equation, we get $\ln[R] = -kt + I$ --- (1)	
	When t = 0, R = $[R]_0$ $\ln[R]_0 = I$ --- (2)	1
	Substitute (2) in (1)	
	$\ln[R] = -kt + \ln[R]_0$ $k = \frac{1}{t}\ln\frac{[R]_0}{[R]}$ or $k = \frac{2\cdot303}{t}\log\frac{[R]_0}{[R]}$	1
b.		1
	$[R_0]$ or initial concentration	1

31a.	**Physisorption**	**Chemisorption**
	It arises due to van der Waal's forces	It arises due to chemical bond formation
	It is not specific in nature.	It is highly specific
	It is reversible.	It is irreversible.
	Energy of adsorption is low.	Energy of adsorption is high
	Any three differences	3
b.	i) Scattering of light by colloidal particles	1
	ii) Conversion of freshly prepared precipitate into a colloid by adding a suitable electrolyte.	1
	PART-D : V	
32a.	i) Aryl halide reacts with alkyl halide in presence of sodium in dry ether to form alkyl benzene.	1
	$C_2H_5Br + C_6H_5Br + Na \xrightarrow{ether} C_2H_5C_6H_5 + NaBr$	1
	OR	
	$C_2H_5Br + C_6H_5Br + Na \xrightarrow{ether} C_2H_5C_6H_5 + NaBr$ Bromoethane bromobenzene ethylbenzene	2
	ii) An alkyl fluoride is obtained by heating an alkyl chloride or bromide in presence of silver fluoride.	1
	$CH_3Br + AgF \longrightarrow CH_3F + AgBr$	1
b.	CH_3Br	1
33a.	Step-1: Protonation of alcohol 	1
	Step-2: Formation of carbocation by loss of water. 	1
	Step-3: Formation of ethene by loss of proton. 	1
b.	 Salicylic acid Aspirin	2
34a.	$C_6H_5CHO + NaOH \longrightarrow C_6H_5COONa + C_6H_5CH_2OH$	1
	Cannizzaro's reaction	1
	Benzyl alcohol or sodium benzoate	1
b.	i) R–H	1
	ii) $ClCH_2$–COOH	1

35a.	It is benzene sulphonyl chloride or $C_6H_5SO_2Cl$. Primary amine reacts with Hinsberg reagent to form a product soluble in an alkali. Secondary amine reacts with Hinsberg reagent to form a product insoluble in an alkali.	1 1 1
b.	i) $\longrightarrow C_2H_5NHCOCH_3$ ii) 	1 1
36a.	 β– D – Galactose β– D – Glucose **Lactose**	2
b.	i) DNA is the chemical basis of heredity. ii) It is the reserve of genetic information of different species. iii) They are involved in the protein synthesis. (any Two)	2
c.	Thyroxine	1
37a.	They are classified as: i) natural ii) synthetic	2
b.	Neoprene is formed by the free radical polymerization of chloroprene  *chloroprene* *neoprene*	1 1
c	 OR terephthalic acid	1

Government of Karnataka

Commissionerate of Pre-University Education

II PUC Chemistry Practicals

EXPERIMENTS FOR CHEMISTRY PRACTICAL EXAMINATION

Time: 2 Hrs. Total Marks: 30

Q-I	**Salt analysis** Analyse the given simple inorganic salt systematically and report one **acid radical** and one **basic radical.**	10 marks
Q-II	**Titration (Volumetric Analysis)** Estimate the Molarity of **$KMnO_4$** solution using given standard (0.1M) **FAS** solution. (procedure of the titration should be given).	10 marks
Q-III	**Viva on tests for functional groups in organic compounds:**	4 marks
IV	Submission of the duly completed and certified **record**	6 marks
	TOTAL	**30 marks**

SCHEME OF VALUATION

Time: 2 Hrs. Total Marks: 30

Q-I	**Salt analysis (10 Marks)** **i) Preliminary tests** (any two correct) 1 mark **ii) Detection of Acid radical (4 Marks)** Group detection (correct group identification – 1 mark correct radical identification – 1 mark) 2 marks Confirmatory test 2 marks **iii) Detection of Basic radical (4 Marks)** Group detection (correct group identification – 1 mark correct radical identification – 1 mark) 2 marks Confirmatory test 2 marks For writing systematic procedure with absence of previous groups 1 mark	10
Q-II	**Titration (10 Marks)** i) For performing the experiment 3 marks For recording the readings in the tabular column 1 mark ii) For **accuracy** of the **Titre value** 3 marks up to ± 0.3 mL error 3 marks ± 0.4 mL error 2 marks ± 0.5 mL 1 mark ≥ 0.6 mL & above 0 mark iii) **Calculations of Molarity (2 marks)** a. Formula 1 mark b. Substitution and answer (1+1) 2 mark	10 marks

<table>
<tr><td>Q-III</td><td>Viva on functional group in organic compound (2 marks)
Four questions, two each on
any two functional groups (1x4)</td><td>4
marks</td></tr>
<tr><td>IV</td><td>Record
Submission of the duly completed and certified record</td><td>6
marks</td></tr>
<tr><td></td><td>
<table>
<tr><th>Sl.No</th><th>% of experiments performed and recorded</th><th>Maximum marks to be awarded</th></tr>
<tr><td>1</td><td>> 90%</td><td>6</td></tr>
<tr><td>2</td><td>81% to 90%</td><td>5</td></tr>
<tr><td>3</td><td>71% to 80%</td><td>4</td></tr>
<tr><td></td><td>41% to 70%</td><td>3</td></tr>
<tr><td>4</td><td>≤ 40%</td><td>0</td></tr>
<tr><td colspan="3">TOTAL</td></tr>
</table>
</td><td>30
marks</td></tr>
</table>

Note:

a) The **following salts** are suggested to be given for analysis for practical examination: **NH_4Br, NH_4Cl, $Al_2(SO_4)_3$, $MnSO_4$, $ZnSO_4$/ $ZnCO_3$, $CaCO_3$, $BaCl_2$/ $Ba(NO_3)_2$, $Sr(NO_3)_2$/ $SrCl_2$, $MgSO_4$/ $MgCO_3$.**

b) For viva:

Functional group	**Tests**
Alcohol	Ceric ammonium nitrate test and Lucas test
Phenol	Neutral ferric chloride, phthalein test
Aldehydes and ketones	2, 4 – DNPH and Tollen's reagent test
Carboxylic acid	Litmus test, sodium bicarbonate test, esterification
Primary amine	Carbylamine test, azo dye test

c) **Inorganic salts** and test for **organic compounds** other than the mentioned above but given in the prescribed manual can be given to students in regular practical class for practice.

d) All experiments as mentioned in the II PUC practical manual are to be conducted and recorded.