Veer Narmad South Gujarat University

Second Year B. Sc.

Chemistry

Paper – III (Inorganic Chemistry)

(Effective from July 2002 – Revised in B O S dated 23/10/2002)

42 Marks (External) Total 60 Hrs

18 Marks(Internal) Time 3 Hrs.

(Uni. Exam)

UNIT – I

Topic –1: Chemistry of elements of first transition series 10 Hrs

Characteristic properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, Coordination number and geometry.

Topic –2: Electronic configuration of atom L-S coupling 2 Hrs

Introduction, L-S coupling, Term Symbol, Determination of microstate Term Symbol of C, N, O, Ni, Ni^{2+}, Fe, Fe^{2+}, Fe^{3+}, Cr, Cr^{3+}, and Co^{2+}.

UNIT – II

Topic –1: Coordination compounds 8 Hrs

Werner's Coordination theory. Chelates;, isomerism in Coordination compounds, valence bond theory of transition metal compounds.

Crystal field theory -Basic assumption of crystal field theory, Shapes of d-orbitals , Splitting of d-orbitals in octahedral (Oh) , Tetrahedral (Td) and square planar (Sp) complexes.

Topic –2: Molecular Geometry: 4 Hrs

Gillespie theory stereo chemical rules for non transition elements and their explanation with suitable examples, molecular geometry of NH_3, IF_5, $[ICl_4]$, BH_3 and SF_6.

UNIT – III

Topic –1: Quantum Mechanics 4 Hrs

(A) – Derivation of the time independent Schrodinger equation , -- Probability and -- Complex numbers

(B) Particle in one – dimensional box and its importance.

(C) Operators (definition and derivation) , Linear Operators, Commutator Operators, Vector Operators, Laplacian Operators, Hamiltonian Operators, Hermition Operators and Unitary Operators

Derivation of Hamiltonian equation, Hamiltonian Operators for H-atom H_2^+, He_2^+ and Li.

Topic –2: Electron absorption Spectroscopy 4 Hrs

- Principle of electronic spectroscopy (Frank – Condon Principle)
- Instruments and their working of visible spectrometer.
- Spectra of some complex compounds Ti^{+3}, $Cu^{+3.}$
- Selection rule (without deviation)

Topic –3: Ion-exchange chromatography 4 Hrs

- Synthesis and Characterization of ion exchanger, Mechanism of ion exchange
- Ion exchange equilibria, Technique of ion exchange, Application of ion exchange for Separation.
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UNIT – IV

Topic –1: Chemistry of Lanthanide and Actinide Elements 6 Hrs

- Lanthanide and Actinide Elements, Electronic configuration, Sources
- Occurrence, Extraction by solvent and ion exchange, Properties (Spectral and Magnetic)
- Lanthanide contraction, Use of Lanthanide compounds as Lanthanide shift reagents
- Industrial use Uranium and Plutonium, Lanthanide Misch metal

Topic –2: Non – aqueous solvents 5 Hrs

Physical properties of solvents, types of solvents and their general characteristics, reaction in non – aqueous solvents with reference to liquid NH_3 and liquid SO_2

UNIT – V

Topic –1: Acids and Bases 6 Hrs

Arrhenious, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases

Topic –2: Bio-Inorganic: Role of metal complexes in Biological systems 3 Hrs

- Introduction, Role of metal ion in different biological processes., Essential, benificial and toxic metals, Metallo – Porphyrins, Hemoglobin – as Carrier of O_2 and as Carrier of CO_2
- Myglobin, Chlorophyll, Vitamin B-12

Topic –3: Fertilizers 4 Hrs.

. Difinition and classification of fertilizer, Direct and indirect fertilizer, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, P, K

- Industrial preparation of
  - (i) Urea from natural gas
  - (ii) Single and triple super –phosphate of lime
  - (iii) Ammonium Sulphate
- Hazardous effect of use of fertilizers and its preventive measures.

Mixd Fertilizer, Complex Fertilizer , Fertilizer Grade, Fertilizer ratio, Fertilizer conditioner , Fertilizer Filler.

Reference Books:

(1) Introductory Quantum Chemistry by A. K. Chandra Tata Mc. Graw Hill Delhi.
(2) Atomic Structure and chemical bond by Manos Chandra Tata Mc. Graw Hill Pub. Co. Ltd.
(3) Inorganic chemistry A modern introduction , by T. Moeller Wiley interscience pub. John Wiley & Sons Ny.
(4) Theoretical inorganic chemistry by M. C. Day & J. Selbin Affilated East west pubs. Pvt. Ltd.
(5) Inorganic chemistry by R. B. Hes lop and P. L. Robinson , Elsevier pub. Co. Ny.
(6) Coordination compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
(7) Inorganic chemistry by (Principles of structure and reactivity) James E. Huhely, Harper international (Ny)
(8) Inorganic chemistry by R. B. Heslop and P. L. Robinson Elsevier pub. Co. Ny.
(9) Physical methods Inorganic chemistry by R. S. Drago , W.B.S. Saunders Co. Landon, Reinhold pub. Co. Ny.
(10) Basic concepts of Analytical Chemistry by S. M. Khopkar , Wiely Estern ltd. New Delhi.
(11) Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
(12) Instrumental method of Analysis B. K. Sharma, Krishna Pub. House, Merrute.
(13) Principles of Inorganic Chemistry (Puri, Sharma, Kalia.
(14) Environmental Chemistry, by S. K. Banerji pretic Hall India pvt. Ltd.
(15) Progressive Inorganic chemistry , Suratkar , Thatle, Pndit , Ideal book Servica, Poona.
(16) Advanced Inorganic chemistry Vol. I & II by Gurudeepraj, Goel pub. House , Merrut.
(17) Quantum Chemistry Ira. N. Levine , Prentice Hall.
(18) Advanced Inorganic chemistry by Cotton & Wilkinson John Wihn Wiely.

Veer Narmad South Gujarat University

Second Year B. Sc.

Chemistry

Paper – IV (Organic Chemistry)

(Effective from July 2002 – Revised in B O S dated 23/10/2002)

42 Marks (External) Total 60 Hrs
18 Marks(Internal) Time 3 Hrs.
(Uni. Exam)

UNIT – I

Topic –1: Alcohol and phenols: 4 Hrs

(a) Alcohols :-Nomenclature and classification, methods of formation and chemical reactions.

(b) Phenols:Nomenclature method of formation and chemical reactions , electrophilic aromatic substitution.

Topic –2: Heterocyclic compounds 3 Hrs

Classification and nomenclature.

(a) Benzopylrrole (Indole):- Occurrence, synthesis (Fischer indole synthesis, Madeling synthesis , Reissert synthesis , Electrophilic substitution (nitration , sulfonation, halogenation , reactions.) Gattermann reaction Riemer Tiemann reaction, Mannich reaction, synthesis of Indigo.

(b) Benzofuran (Coumarone): occurrence , synthesis, substitution reactions (nitration , sulfonation, halogenation ,acylation reduction , reactions with ozone and sodium.

(c) Benzothiophene (thionaphthene) occurrence , synthesis , substitution reactions (nitration , sulfonation, bromination acylation , chloromethylation), reactions with phenyl lithium, carbon dioxide diazodiacetate , sodium and other sulfur, Raneynickel.

(d) Quinoline : Synthesis (Skraups synthesis , Frieldander method) reduction and oxidation of Quinoline , electrophilic substitution reactions , nitration sulfonation, halogenation , Friedel Crafft's reaction and nucleophilic substitution reactions.

(e) Isoquinoline: Synthesis (by heating Oxime of cinnamaldehyde with P_2O_5 and Bichler-Naieralsky reaction)electrophilic and nucleophilic reactions, oxidation and reduction reactions of isoquinoline.

Topic –3: Polycyclic Aromatic hydrocarbons: 3 Hrs

Classification and nomenclature .

(a) linear othofused polycyclic hydrocarbons :Occurrence , synthesis of tetracene , pentancene, and hexacene.

(b) Nonlinear orthofused polycyclic hydrocarbons Occurrence synthesis of 1,2-benzanthrancene , 1, 2, 5, 6- dibenzanthracere, 1, 2- benzphenanthrence.

(c) ortho and perifused polycyclic hydrocarbons Occurrence and synthesis of pyrene, perylene and coronene.

(d) carcinogenic properties of polyclic hydrocarbons.

Topic –4: Elimination reactions: 2 Hrs

Beta-elimination , E_2 mechanism , E_1 mechanism stereo chemistry of elimination reactions , elimination VS substitution.

Alpha elimination: Generation of carbenes and ketenes.

UNIT – II

Topic –1: Aldehydes and ketones: 4 Hrs

Nomenclature, method of formation and chemical reactions, mechanism of nucleophilic addition to carbonyl group. Benzoin, Wittig reaction , Mannich reaction . Woulf-Kishner reaction.

Topic –2: Carbohydrates: 4 Hrs

(a) Determination of configuration of D (+) glucose D (-) fructose – method of ascending and descending sugar series .

(b)objections against open chain structure of D (+) glucose & D (-) fructose –ring structure of them , determination of size of the ring of glucose and fructose .

(c) Method of methylating sugars.

(d) Structure of sucrose.

Topic –3: Uses of reagents: 4 Hrs

(a) Anhydrous aluminium chloride, (b) Grignard reagents, (c) Aluminium isoproxide

(d) Diborane, (e) NBS , (f) Selenium dioxide, (g)Lithium aluminiumhydride

UNIT – III

Topic –1: Carboxylic acid: 3 Hrs

Nomenclature, method of formation, physical properties and chemical reactions of mono carboxylic (saturated and unsaturated), hydroxy acids and dicarboxylic acids.

Topic –2: Carboxylic acid derivatives: 2 Hrs

Structure & nomenclature of acid chloride , ester , amides, and acid anhydrides; method of formation carboxylic acid derivatives and chemical reactions.

Topic –3: Vitamins and Harmones: 3 Hrs

Their definitions , classification , analytical and synthetic evidences to prove the structure of Ascorbic acid and Adrenaline.

Topic –4: Compunds containing reactive methylene group: 4 Hrs

(a) Malonic ester: preparation and its synthetic applications.

(b) Acetoacetic ester (ethylacetoacetate) preparation and synthetic applications.

(c) Keto-enol tautomerism : factors affecting Keto-enol tautomerism and its mechanism.

UNIT – IV

Topic –1: Organic Nitrogen compounds: 4 Hrs

(a) Preparation , physical properties and chemical reactions of nitroalkanes , nitroarenes, nitriles, isonitriles, cyanates, isocyanates , carbamates, semicarbazides, guanidine, and their application in synthetic organic chemistry.

(b) Structure and nomenclature of amines, preparation of alkyl and aryl amines , physical properties and chemical reactions . Gabriel-phthalimide reaction, Hofmann Bromamide reaction.

Topic –2: Diazonium salts: 3 Hrs

(a) Mechanism of dizotisation , reagents for checking completion of diazotisation.

(b) Nomenclature of Diazonium salts

(c) Reactions of Diazonium salts , replacement reactions in which nitrogen is eliminated , its application in the synthesis of aromatic compounds , reaction in which nitrogen atom are retained.

(d) Laws of coupling coupling agents , synthesis of diazomino and aminozo compounds.

(e) Benzidine rearrangment.

Topic –3: Purines: Definition 2 Hrs

(a) Structure of Uricacid and its synthesis (Baeyr's synthesis & Traube's synthesis)

(b) Synthesis of Purine Adermine Xanthine- Guanine , Caffeine-Theobromine and Theophylline.

Topic –4: Proteins and polypeptides 3 Hrs

(a) Classification and hydrolysis of proteins .

(b) Alpha amino acid: preparation (Gabriel's phthalimide synthesis Strecker synthesis Erlenmeyer azlactone synthesis) and properties.

(c) Peptides : Definition and preparation using various protective groups. Mixed anhydride method.

UNIT – V

Topic –1: Organic Sulfur compounds: 4 Hrs

(a) Aliphatic sulfur compounds: nomenclature, general methods of preparation and reaction of mercaptans , thioethers, sulfinic and sulfonic acid.

(b) Aromatic sulfonic acid : nomenclature , preparation , reactions and uses of sulfonic acids of benzene, toluene , naphthalene.

Topic –2:Electromagnetic spectrum: 8 Hrs

UV and visible spectroscopy , ultraviolet absorption spectroscopy, absorption laws (Beer-Lambert law) terminology used in UV and visible spectra , molar absorptivity, types of electronic transitions , effect of conjugation , concept of Chromophore and Auxochroue and Hypschromic shifts UV spectra of conjugated enes and enones , effect of solvent substitution on electronic transition . calculation of λ max for conjugated dienes and β-unsaturated carbonyl compounds and substituted Benzene derivatives using relevant rule , Problems.

Reference Books:

(1) Organic chemistry by R. T. Morison and R. N. Boyd, Prentice Hall India.
(2) Organic chemistry Vol. I & II by I. L. Finar.
(3) Organic chemistry Vol I & II by B. K. Sharma & S. K. Sharma Goel pub. House , Merrut.
(4) Reaction and Reagents in organic synthesis, by O. P. Agarwal Goel pub. House , Merrut.
(5) Organic chemistry, by S. H. Pine
(6) Reaction mechanism in organic chemistry S. M. Mukharji & S. P. Singh.
(7) Organic chemistry by L. G. Wade Jr. Prentic hall.
(8) Fundamentals of organic chemistry by Solomon , John Wiley

Veer Narmad South Gujarat University, Surat

Second Year B. Sc.

Chemistry

Paper – V [Physical Chemistry]

(Effective from July 2002 – Revised in B O S dated 23/10/2002)

42 Marks (External) Total 60 Hrs

18 Marks(Internal) Time 3 Hrs.

(Uni. Exam)

Unit – I 12 [hours]

THERMODYNAMICS

Entropy changes in ideal gas. Entropy changes at constant temperature, pressure & volume.

- [Entropy of mixing of ideal gases. Entropy change in physical transformations. Entropy change in chemical reactions. Physical significance of the entropy. Entropy and disorder. Entropy and probability. Maxwell's reactions. Thermodynamic derivation of law of massaction.]

  Free energy or work function (Gibbs free energy and Helmholtz free energy **A**) Dependence of free energy on temperature and pressure. Derivation of Gibbs Helmholtz equation by making use of work function and free energy function. Derivation of $G=G^{o} + RT \ln p$. Relation of G and equilibrium constant Kp. Vant Hoff isotherm isobar, isochore. Derivation of Clapeyron equation, Clapeyron - Clausius equation and its application in the derivation of molal elevation constant and molal depression constant.

  Numerical problems.

Unit – II 12 [hours]

ELECTROLYTES OR ELECTRO CHEMISTRY

- [Ions in solutions, formation of ions in solution, metalic conductance, Electrolytic, conductance, electrolysis, Electrical units (i.e. Coulomb, Ampere, ohm, mho, volt etc.) Faraday's Law of electrolysis, importance of first and second law.]

  Hittorf's rule, Transport number of ions and its determination by Hittorf's method & moving boundary method.

  Kohlraush law of ionic conductance. Application of Kohlraush's law to

  (a) Determination of degree of dissociation of weak electrolytes.
  (b) Determination of equivalent conductivity of weak electrolytes at infinite dilution.
  (c) Determination of solubility and solubility product of sparingly soluble salts.
  (d) Determination of ionic product of water.
  (e) Determination of ionic mobility, ionic conductance and transport number of ions

Conductometric titrations : Principle.

Types of Conductometric titrations

(a) Strong acid Vs Strong base.
(b) Strong acid Vs Weak base.
(c) Weak acid Vs Strong base.
(d) Weak acid Vs Weak base.
(e) Mixture of Strong acid and Weak base Vs Strong base.
(f) Precipitation titration of

→ (i) $Bacl_2$ $K2CrO_4$ → (ii) Nacl $AgNO_3$

Advantages of conductometric titrations over indicator method.

Numerical problems.

Unit – III 12 [hours]

IONIC EQUILIBRIA

Relation between degree of Hydrolysis, hydrolysis constant and $_pH$ of solution of

(a) Salts of weak acid and strong base.
(b) Salts of strong acid and weak base.
(c) Salt of weak acid and weak base.

Theories of acid-base indicators. Ostwald and Quinonoid theories, choice of indicator, Indicator exponent and useful range of pH of an indicator.

- Solubility Product. Application of solubility product principles.

Numerical problems.

PARTITION CO-EFFICIENT

Nernst distribution law, Conditions for the validity of distribution law, complications arising in distribution law :-

(a) Association of solute in one of the phases.
(b) Dissociation of solute in one of the phases.
(c) Dissociation of solute in both the phases.
(d) The solute gets polymerised in one of the phases.

Methods for the calculation of ' n '

(i) Hit and trial method & (ii) The Logarithmic Method.

Deriation of distribution law :

(a) From kinetic consideration
(b) Thermodynamic derivation.

Extraction of substances from solutions. Distribution law and Henary's law

Applications of distribution law to

(i) Determination of molecular weights in different solvents.
(ii) Distribution indicators.
(iii) Study of complexes.
(iv) Washing of precipitates in gravimetric analysis.
(v) Desilverisation of lead by Park's process.

(vi) Liquid-liquid chromatography (partition chromatography)

Limitations to distribution law : effect of temperature, concentration of solute. soluble impurities, mutual solubility of the two liquids.

ADSORPTION

Adsorption and Absorption, Heat of adsorption, characteristics of adsorption, Physical adsorption and chemical adsorption, Distinction between physical adsorption and chemical adsorption., Freundlich's adsorption isotherm, Langmuir's adsorption isotherm, Ion exchange adsorption cationic and anionic exchange, application of adsorption including ion exchange adsorption, Catalysis, General features of catalysis, Heterogeneous catalysis, Adsorption theory of catalysis.

Experimental methods of determining Gas adsorption (i.e. Volumetric and Gravimetric method.)

Unit – IV 12 [hours]

PHOTOCHEMISTRY

Introduction to photochemistry, Basics of Electromagnetic radiations, photons, Thermal and photochemical reactions, Difference between thermal and photochemical reaction.

Photochemical Laws :

(1) Grothus Droper's law
(2) Lambert Beer's law
(3) Einstein's law of photochemical equivalent. Quantum yield or efficiency. Experimental determination of Quantum yields. Reasons of Low and high quantum yield. Primary and secondary photo chemical reactions. Factors affecting quantum yield (i.e. temperature, wave length, light intensity and inert gases.)

Isomeric changes, Polymerisation, Double decomposition, Dissociation, Photo sensitisation photophysical processes. [Fluorescence, Phosphorescence] Chemiluminiscence . Factors affecting Fluorescence, Phosphorescence. Relation between fluorescence intensity and concentration, Relation between Phosphorescence intensity and concentration. Application of Fluorescence and Phosphorescence, Laser technique , Numerical problems.

CHEMICAL KINETICS

Experimental methods of Chemical kinetics : Conductometric, potentiometric, Optical methods, polarimetry and spectrophotometer Factors affecting reaction rate, Kinetics of 2^{nd} order reactions.

Dilutometric and Titrimetric methods measuring reaction rates (temperature coefficient),

Arhenius theory, Collision theory, Transition state theory, Energy of activation including determination, Effect of catalysis on energy of activation, Numerical problems.

Unit – V 12 [hours]

MOLECULAR STRUCTURE AND SPECTROSCOPY

Various types of spectra given by molecular species (brief summary) [i.e. there region, energy changes occurs]

(i) NMR and NQR
(ii) ESR or EPR
(iii) Pure rotational (micro wave) Spectra
(iv) Vibrational andVibrational rotational (Infra red) Spectra.
(v) Raman Spectra
(vi) Electronic Spectra

Electromagnetic radiation with wavelength and energy. (X-ray region, UV visible IR, Micro wave and radio frequency region.)

Absorption spectroscopy, Rotational spectra, calculation of bond length in simple diatomic molecules, Vibration rotational spectra Hook's law, Vibrational energy level, force constant, Electronic spectra.

Light scattering and Raman spectroscopy with applications, NMR spectra, Nuclear Spins, NMR techique, chemical shift, ESR spectroscopy.

Principle and work of a simple beam spectrophotometer.

References:

(i) Physical Chemistry by Gurudeep Raj
(ii) Text book of Physical chemistry by P.L.Soni - O.P.Dharmaraj.
(iii) Physical Chemistry by B.K.Sharma.
(iv) Essential of Physical Chemistry by Bahl, Tuli & Bahl.
(v) Physical Chemistry by Gorden M. Barrow 3rd Edition 1973.
(vi) Element of Physical Chemistry by Glasston and Lewis 2nd edition 1971 Memilan
(vii) Physical Chemistry by S. R. Patil.
(viii) Text book of Physical Chemistry by K.K.Sharma and L.K.Sharma, Vikas publishan house, New Delhi

Veer Narmad South Gujarat University

Second Year B. Sc.

Chemistry

Industrial Chemicals

(Effective from July 2002 – Revised in B O S dated 23/10/2002)

35 Marks (External) Total 30 Hrs
15 Marks(Internal) Time 3 Hrs.
(Uni. Exam)

UNIT – I

(A) Synthetic fibers: 3 Hrs
(i) Coprolactam, Nylon-6 (ii) HMDA, Adipic acid, Nylon-66
(iii) DMT Ethylene qlycol, Terylene (iv) Tetrafluoroethylene, Teflon.

(B) Synthetic Rubber: 3 Hrs
(i) Butadiene , Styrene, Buna-S (ii) Acrylonitrille, Buna-N
(iii) Chloroprene Neoprene, (iv) Isoprene, Poly isoprene

(C) Plastics and Resins: 2 Hrs
(i) Ureaformaldehyde resin, Bakelite (ii) Vinyl Chloride , pvc
(iii) Vinyl alcohol, Polyvinyl alcohol (iv) Melamine and Melamine resins.

(D) Synthetic drugs: 3 Hrs
(i) Novacaine (ii) Novalgin (iii) Paludrine (iv) Paracetamol (v) Sulphathiazole

UNIT – II

(A) Insecticides: 3 Hrs
(i) D. D. T. (ii) B. H. C. (iii) 2,4,D (iv)2,4,5,-T (v) Aldrin
(vi) Malathion (vii) MCPA

(B) Detergents: 1 Hrs
(i) Propyleneteramer (ii) ABS (iii) LAS

(C) Explisive: 1 Hrs
(i) RDX (ii) Nitrocellulose (iii) Glyceryl trinitrate

(D) Synthetic Perfumes: 2 Hrs
(i) Coumarin (ii) Vanillin (iii) Muskxylene (iv) Muskketone

(E) Phenol: 3 Hrs
(i) Rashig process (ii) Cumene process (iii) Dow – Toluene air oxidation process.

Acetylene:
(i) Wulff Process (ii) Sachsse Process

UNIT – III

(A) Inorganic chemicals: 2 Hrs

(i)Red Phosphorus (ii) Sodium hexa metaphosphate (iii) PCl_5.
(iv) Phosphoric acid

(B) Lime, Cement and Refracories 3 Hrs

(C) Glass 2 Hrs

(D) Nonferrous Alloys: 2 Hrs

Monel Metal , Duralumin , Wood Metal, Babit Metal, Phosphorus Bronze.

Veer Narmad South Gujarat University, Surat

Second Year B. Sc.

Chemistry Practical

(Effective from July 2002 – Revised in B O S dated 23/10/2002)

Prin. 84 Marks (External)
36 Marks(Internal)
Time 14 Hrs. (Uni. Exam)

Sub. 56 Marks (External)
24 Marks(Internal)
Time 7 Hrs. (Uni. Exam)

Only Paper V : 28 Marks Exernal
12 Marks Internal
Time 7 Hrs (Uni. Exam.)

INORGANIC QUALITATIVE ANALYSIS

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS

CHLORIDES- Bi^{+3}, Cu^{+2}, Cd^{+2}, Fe^{+3}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}.

BROMIDES- Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}

IODIDE – K^{+1}

NITRITE – Na^{+1}, K^{+1}

NITRATE – Pb^{+2}, Bi^{+3}, Co^{+2}, Ni^{+2}, Ba^{+2}, Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}

SULPHITE – Na^{+1}

SULPHIDE – Zn^{+2}, Sb^{+3}

SULPHATE – Cu^{+2}, Cd^{+2}, Al^{+3}, Fe^{+2}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}

CARBONATE – Pb^{+2}, Bi^{+3}, Cu^{+2}, Cd^{+2}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}

PHOSPHATE - Cu^{+2}, Al^{+3}, Fe^{+3}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}

OXIDE – As^{+3}, Sb^{+3}

Inorganic qualitative analysis of mixture containing four radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid excluding Arsenite, Arsenate, Chromate and Borate.

N. B. Candidate should perform the analysis of at least 10 mixtures.

The following exercises should not be asked in the university examination

1. Calibration of Burette 50 ml., Pipette 5 & 25 ml., Measuring Flasks 100 ml. & 250 ml.

VOLUMETRIC EXERCISE

To determine the amount of Nickel by E D T A

To determine the amount of Copper by E D T A

To determine the amount of Zinc by E D T A

To determine the amount of H_2O_2 Iodometrically.

GRAVIMETRIC ESTIMATIONS

Gravimetric Estimation of Fe^{+2} as Fe_2O_3 Given solution Fe-NH_4-SO_4 + Conc.H_2SO_4 .

Ba^{+2}	$BaSO_4$	$BaCl_2$
Mn^{+2}	$Mn_2P_2O_7$	$MnCl_2$ + Conc. HCl
Cu^{+2}	CuO	$CuCl_2$ + Conc. HCl
Ni^{+2}	Ni (D M G)$_2$	$NiCl_2$ + Conc. HCl

ORGANIC SPOTTING

Organic spotting & preparation of derivative only.

ACID – Salicylic acid, Cinnamic acid, Phenyl acetic acid, Anthranilic acid, Sulphanilic acid, Hippuric acid

BASE – o – Nitroaniline, m – Nitroaniline, p – Nitroaniline, p – Chloroaniline Dimethylaniline, Diethylaniline, Diphenylamine

PHENOL – Alpha naphthol, Beta naphthol, o – Nitro phenol.

NEUTRAL –
ALDEHYDE – Glucose, Benzaldehyde

KETONE – Methyl Ethyl ketone, Acetophenone,

ESTER – Ethylacetate, Butylacetate

ALCOHOL – Ethanol, Butanol

HYDROCARBON – Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON – m – Dinitro benzene

HALOGENATED HYDROCARBON – Carbon tetrachloride, Chlorobenzene, Bromobenzene,

p – Dichlorobenzene

AMIDE – Benzamide, Thiourea

ANILIDE - Acetanilide

QUINONE – Anthraquinone

N. B. Candidate should perform the analysis of at least 12 substances.

ORGANIC ESTIMATIONS

To determine the amount of Acetamide in the given solution

To determine the amount of Glucose in the given solution

To determine the amount of Aniline in the given solution

To determine the amount of Phenol in the given solution

PHYSICAL PRACTICALS

1. **Adsorption**
   To study the adsorption of given organic acid (acetic acid / oxalic acid) on animal charcoal.
2. **Partition Coefficient**
   To determine the molecular condition of Benzoic acid in its solution in kerosene/ benzene by the method of partition coefficient.

3. **Viscosity**

   To determine the viscosity of the given liquids and the % of unknown mixture C.

4. **Heat Of Solution**

   To determine the Heat of solution of organic acid(benzoic acid, phthalic acid) by finding the solubility of the acid at two different temp.

Conductometric Titration

5. To determine the normality of the given HCl solution by the conductometric titration with the given Std..NaOH solution

6. To determine the normality of the given mixture HAc solution by the conductometric titration with the given Std. NaOH solution

Solubility Product

7. To determine the solubility of $PbSO_4$ / MgC_2O_4 / SrC_2O_4 conductometrically

pH Metry

8. To determine the normality of weak acid pH metrically using strong base.

9.. To determine the normality of given acid in mixture of HCl + HAc PHmetrically using strong base.

Chemical Kinetics- Esterhydrolysis

10. To study the monomolecular reaction in the hydrolysis of methyl acetate in N/2 HCl at different initial concentrations.

Relative Strengh

11. To determine the relative strength of H_2SO_4 and HCl acids

Saponification

12 .To investigate the reaction in saponification of Ethylacetate by NaOH